VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

B.E Civil Engineering

Program Outcomes (POs)

At the end of the B.E program, students are expected to have developed the following outcomes.

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse 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 modelling 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 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:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B.E Civil Engineering program, the students are expected to have developed the following program specific outcomes.

PSO1

The graduates will have the ability to plan, analyse, design, execute and maintain cost effective civil engineering structures without overexploitation of natural resources.

PSO2

The graduates of civil engineering program will have the ability to take up employment, entrepreneurship, research and development for sustainable civil society.

PSO3

The graduates will be able to persue opportunities for personal and professional growth, higher studies, demonstrate leadership skills and engage in lifelong learning by active participation in the civil engineering profession.

PSO4

The graduates will be able to demonstrate professional integrity and an appreciation of ethical, environmental, regulatory and issues related to civil engineering projects.

General Notes:

1. Question Paper Pattern for Theory Courses (2017 Scheme):

- The question paper will have TEN questions.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

2. The teaching learning process should be as per the Choice Based Credit System
3. All Civil Engineering Departments should have a "CIVIL ENGINEERING MUSEUM" with collections related to civil engineering like models, charts, material samples, fixtures and fittings etc. which assist effective teaching learning process.
4. The teaching learning process may be planned to develop capabilities, competencies and skills required for career development based on course beginning and course end surveys.
5. Course objectives, course outcomes and RBT levels given under each course in the syllabus are broad and indicative/suggestive. The faculty can set them appropriately according to their lesson/ course plan.
6. The course coordinators/teachers/instructors are informed to deliberate in the faculty meeting with module coordinator, program coordinator along with the stake holders to develop the respective lesson/ course plans.
7. The department advisory board may make suitable changes to the course objectives, course outcomes and program objectives according to their finalized course plans.
8. The faculty should complement the teaching with case studies and field visits wherever required.
9. One faculty development program to be conducted to compliment teaching learning process by the department in a year

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

III SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics –III*	Maths	04		03	60	40	100	4
2	17CV32	Strength of Materials	Civil Engg.	04		03	60	40	100	4
3	17CV33	Fluid Mechanics	Civil Engg.	04		03	60	40	100	4
4	17CV34	Basic Surveying	Civil Engg.	04		03	60	40	100	4
5	17CV35	Engineering Geology	Civil Engg.	04		03	60	40	100	3
6	17CV36	Building Materials and Construction	Civil Engg.	03		03	60	40	100	4
7	17CVL37	Building Materials Testing Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL38	Basic Surveying Practice	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				**Theory: 24hours Practical: 06 hours**		**25**	**510**	**340**	**850**	**28**

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:
(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

1	17MATDIP31	Additional Mathematics –I	Maths	03		03	60	--	60	--

(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

IV SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics –IV*	Maths	04		03	60	40	100	4
2	17CV42	Analysis of Determinate Structures	Civil Engg.	04		03	60	40	100	3
3	17CV43	Applied Hydraulics	Civil Engg.	04		03	60	40	100	4
4	17CV44	Concrete Technology	Civil Engg.	04		03	60	40	100	4
5	17CV45	Basic Geotechnical Engineering	Civil Engg.	04		03	60	40	100	4
6	17CV46	Advanced Surveying	Civil Engg.	03		03	60	40	100	4
7	17CVL47	Fluid Mechanics Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL48	Engineering Geology Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
			TOTAL	**Theory: 24hours Practical: 06 hours**		**25**	**510**	**340**	**850**	**28**

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2.Audit Course:
(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – II, which is 03 contact hours per week.

1	17MATDIP41	Additional Mathematics –II	Maths	03		03	60	--	60	--

(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

V SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CV51	Design of RC Structural Elements	Civil Engg.	04		03	60	40	100	4
2	17CV52	Analysis of Indeterminate Structures	Civil Engg.	04		03	60	40	100	4
3	17CV53	Applied Geotechnical Engineering	Civil Engg.	04		03	60	40	100	4
4	17CV54	Computer Aided Building Planning and Drawing	Civil Engg.	04		03	60	40	100	4
5	17CV55X	Professional Elective-1	Civil Engg.	03		03	60	40	100	3
6	17CV56X	Open Elective-1	Civil Engg.	03		03	60	40	100	3
7	17CVL57	Geotechnical Engineering Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL58	Concrete and Highway Materials Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				**Theory: 22hours Practical: 06 hours**		**24**	**480**	**320**	**800**	**26**

Professional Elective-1			**Open Elective – 1*** (List offered by Civil Engg Board only)**	
17CV551	Air pollution and Control		17CV561	Traffic Engineering
17CV552	Railways, Harbours, tunneling and Airports		17CV562	Sustainability Concepts in Engineering
17CV553	Masonry Structures		17CV563	Remote Sensing and GIS
17CV554	Theory of Elasticity		17CV563	Occupational Health and Safety
			17CV563	NCC

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).
Selection of an open elective is not allowed, if:
· The candidate has no pre – requisite knowledge.
· The candidate has studied similar content course during previous semesters.
· The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s).
Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

VI SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CV61	Construction Management and Entrepreneurship	Civil Engg.	04		03	60	40	100	4
2	17CV62	Design of Steel Structural Elements	Civil Engg.	04		03	60	40	100	4
3	17CV63	Highway Engineering	Civil Engg.	04		03	60	40	100	4
4	17CV64	Water Supply and Treatment Engineering	Civil Engg.	04		03	60	40	100	4
5	17CV65X	Professional Elective-2	Civil Engg.	03		03	60	40	100	3
6	17CV66X	Open Elective-2	Civil Engg.	03		03	60	40	100	3
7	17CVL67	Software Application Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVL68	Extensive Survey Project /Camp	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
			TOTAL	**Theory:22hours Practical: 06 hours**		**24**	**480**	**320**	**800**	**26**

Professional Elective-2			**Open Elective – 2*** (List offered by Civil Engg Board only)**	
17CV651	Solid Waste Management		17CV661	Water Resource Management
17CV652	Matrix Method of Structural Analysis		17CV662	Environmental Protection and Management
17CV653	Alternative Building Materials		17CV663	Numerical Methods and Applications
17CV654	Ground Improvement Techniques		17CV664	Finite Element Analysis

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).
Selection of an open elective is not allowed, if:
· The candidate has no pre – requisite knowledge.
· The candidate has studied similar content course during previous semesters.
· The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s).
Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

VII SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CV71	Municipal and Industrial Waste Water Engineering	Civil Engg.	04		03	60	40	100	4
2	17CV72	Design of RCC and Steel Structures	Civil Engg.	04		03	60	40	100	4
3	17CV73	Hydrology and Irrigation Engineering	Civil Engg.	04		03	60	40	100	4
4	17CV74X	Professional Elective-3	Civil Engg.	03		03	60	40	100	3
5	17CV75X	Professional Elective-4	Civil Engg.	03		03	60	40	100	3
6	17CVL76	Environmental Engineering Laboratory	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17CVL77	Computer Aided Detailing of Structures	Civil Engg.	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CVP78	Project Work Phase–I + Project work Seminar	Civil Engg.		03	--	--	100	100	2
TOTAL				**Theory:18 hours Practical and Project: 09 hours**		**21**	**420**	**380**	**800**	**24**

Professional Elective-3		**Professional Elective-4**	
17CV741	Design of Bridges	17CV751	Urban Transportation and Planning
17CV742	Ground Water & Hydraulics	17CV752	Prefabricated Structures
17CV743	Design Concept of Building Services	17CV753	Rehabilitation and Retrofitting of Structures
17CV744	Structural Dynamics	17CV754	Reinforced Earth Structures

1. **Project Phase – I and Project Seminar:** Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and Seminar presentation skill.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION **2017-2018**

B.E: CIVIL ENGINEERING

VIII SEMESTER

Sl. No.	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CV81	Quantity Surveying and Contracts Management	Civil Engg.	4	-	3	60	40	100	4
2	17CV82	Design of Pre Stressed Concrete Elements	Civil Engg.	4	-	3	60	40	100	4
3	17CV83X	Professional Elective-5	Civil Engg.	3	-	3	60	40	100	3
4	17CV84	Internship/ Professional Practice	Civil Engg.	Industry Oriented		3	50	50	100	2
5	17CVP85	Project Work-II	Civil Engg.	-	6	3	100	100	200	6
6	17CVS86	Seminar on current trends in Engineering and Technology	Civil Engg.	-	4	-	-	100	100	1
TOTAL				**Theory: 11 hours Project and Seminar: 10 hours**		**15**	**330**	**370**	**700**	**20**

Professional Elective -5	
17CV831	Earthquake Engineering
17CV832	Hydraulic Structures
17CV833	Pavement Design
17CV834	Advanced Foundation Design

1. Internship/ Professional Practice: 4 Weeks internship to be completed between the (VI and VII semester vacation) and/or (VII and VIII semester vacation) period

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: STRENGTH OF MATERIALS B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV32**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students;

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.
5. To evaluate the behavior of torsional members, columns and struts.

Module-1

Simple Stresses and Strain:

Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

L1, L2

Module-2

Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

L2,L4

Module-3
Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations. L2,L4
Module-4
Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion. **Theories of Failure:** Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory). L2 ,L4
Module-5
Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre(only concept) **Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns. L1,L2,L4
Course outcomes: After studying this course, students will be able; 1. To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion. 2. To suggest suitable material from among the available in the field of construction and manufacturing. 3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts 4. To understand the basic concept of analysis and design of members subjected to torsion. 5. To understand the basic concept of analysis and design of structural elements such as columns and struts.
Text Books: 1. B.S. Basavarajaiah, P.Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010 2. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko " Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
3. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

TITLE OF THE COURSE: FLUIDS MECHANICS
B.E., III Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV33**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to practical problem solving
3. Principles of Kinematics and Hydro-Dynamics for practical applications
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements

Module-1

Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices**.**

L2,L3

Module-2

Hydrostatic forces on Surfaces: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane

surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

Fundamentals of fluid flow (Kinematics): Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irroational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

L2,L4

Module-3

Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses).

Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends.

Applications: Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems

L2,L4

Module-4

Orifice and Mouthpiece: Introduction, classification, flow through orifice, hydraulic coefficients, Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).

Notches and Weirs: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.

L1,L2,L4

Module-5

Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method, Numerical problems.

Surge Analysis in Pipes: Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems

L2 ,L4

Course outcomes: After successful completion of the course, the student will be able to:

1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
2. Compute and solve problems on hydrostatics, including practical applications
3. Apply principles of mathematics to represent kinematic concepts related to fluid flow
4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
5. Compute the discharge through pipes and over notches and weirs

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi

Reference Books:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics",

Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)
2. K Subramanya, “Fluid Mechanics and Hydraulic Machines”, Tata McGraw Hill Publishing Co. Ltd.
3. K Subramanya, “Fluid Mechanics and Hydraulic Machines-problems and solutions”, Tata McGraw Hill Publishing Co. Ltd.
4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, “Fluid Mechanics”, Pearson, Fifth Edition
5. 5. Mohd.Kaleem Khan, “Fluid Mechanics and Machinery”, Oxford University Press

TITLE OF THE COURSE: BASIC SURVEYING
B.E., III Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV34**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students to;

1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

Measurement of Horizontal Distances: Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.

L1, L2

Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite

L2,L3

Module-3

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems

Tacheometry: basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems

L1, L2

Module-4

Leveling: Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling, trigonometric leveling (heights and distances-single plane and double plane methods.)

L3,L4

Module-5

Areas and Volumes: Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- rapezoidal and prismoidal formula.

Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.

L2,L3

Course outcomes: After a successful completion of the course, the student will be able to:

1. Posses a sound knowledge of fundamental principles Geodetics
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Text Books:

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi – 2009.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988

Reference Books:

1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009.
2. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. – 2010
3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi
4. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., New Delhi

TITLE OF THE COURSE: ENGINEERING GEOLOGY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV35**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students;

1. To understand the internal structure and composition of the earth.
2. To comprehend the properties, occurrence and uses of minerals in various industries.
3. To learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects.
4. To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways.
5. To learn the application of Topographic maps, remote sensing and GIS in Civil engineering practices and natural resource management.

Module-1

Introduction: Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition.

Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chromite (Alloy); Bauxite (aluminum); Chalcopyrite (copper)

L1,L2

Module-2

Petrology: Formation, Classification and Engineering Properties. Rock as construction material, concrete aggregate, railway ballast, roofing, flooring, cladding and foundation. Deformation of rocks, Development of Joints, Folds, Faults and Unconformities. Their impact in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges, Rock Quality Determination (RQD), Rock Structure Rating (RSR),: Igneous Rocks - Granite, Gabbro, Dolerite, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite,Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite

L2,L3.

Module-3

Geomorphology and Seismology: Landforms – Classification, Rock weathering, types and its effects on Civil Engineering Projects. Study of Geo-morphological

aspects in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges. Watershed management, Floods and their control,River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations.

Earthquake - Causes and Effects,, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones-World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control

L2, L3, L5.

Module-4

Hydrogeology: Hydrological cycle, Occurrence of Groundwater in different terrains -Weathered, Hard and Stratified rocks; Determination of Quality aspects - SAR, RSC and TH of Groundwater. Groundwater Pollution, Groundwater Exploration-Electrical Resistivity and Seismic methods, Resistivity curves, Water Bearing Formations, Aquifer types and parameters - Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Springs and Artesian Wells, Artificial Recharging of Groundwater, Sea water intrusion and remedies.

L4,L5

Module-5

Geodesy: Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) – Concept and their use resource mapping. LANDSAT Imagery–Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation.

L2,L3, L5

Course outcomes: After a successful completion of the course, the student will be able to:

1. Students will able to apply the knowledge of geology and its role in Civil Engineering
2. Students will effectively utilize earth's materials such as mineral, rocks and water in civil engineering practices.
3. Analyze the natural disasters and their mitigation.
4. Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.
5. Apply and asses use of building materials in construction and asses their properties

Text Books:

1. P.K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd. Kolkatta.
2. Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K.Kataria and Sons, New Dehli

Reference Books:

1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
2. Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and

Geotechnics", CBS Publishers and Distributors, New Delhi.
3. K V G K Gokhale, "Principles of Engineering Geology", BS Publications,Hyderabad.
4. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
5. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
6. K. Todd, "Groundwater Hydrology", Tata Mac Grow Hill, New Delhi.
7. D. Venkata Reddy, "Engineering Geology", New Age International Publications, New Delhi.
8. S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGraw Hill Education (India) Pvt, Ltd. New Delhi.
9. M.P Billings, "Structural Geology", CBS Publishers and Distributors, New Delhi.
10. K. S. Valdiya, " Environmental Geology",, Tata Mc Grew Hills.
11. M. B. Ramachandra Rao, "Outlines of Geophysical Prospecting- A Manual for Geologists", Prasaranga, University of Mysore, Mysore

TITLE OF THE COURSE: Building Materials and Construction B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV36**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will develop a student;

1. In recognizing the good materials to be used for the construction work
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures
3. In supervision of different types of masonry
4. In selection of materials, design and supervision of suitable type of floor and roof.
5. To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures.

Module-1

Building Materials: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Stabilized Mud Blocks, Sizes, requirement of good blocks.

Mortar: types and requirements. Timber as construction material

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

L1 L2

Module-2

Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls

L1,L2

Module-3

Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.

Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material, Laying of Concrete, Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roof;-Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

L3

Module-4

Doors, Windows and Ventilators: Location of doors and windows, technical terms, Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Paneled and glazed Window, Bay Window, French window. Ventilators. Sizes as per IS recommendations

Stairs: Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.

Formwork: Introduction to form work, scaffolding, shoring, under pinning.

L2 L3 L5

Module-5

Plastering and Pointing : purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering **Damp proofing**-causes, effects and methods.

Paints- Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

L4 L5

Course outcomes: After a successful completion of the course, the student will be able to:

1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Adopt suitable repair and maintenance work to enhance durability of buildings.

Text Books:

1. Sushil Kumar “Building Materials and construction”, 20th edition, reprint 2015,Standard Publishers
2. Dr. B.C.Punmia, Ashok kumar Jain, Arun Kumar Jain, “Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. “Engineering Materials”, Charter Publishing House, Anand, India.

Reference Books:

1. S.K.Duggal, “Building Materials”, (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, “Buliding Materials”, PHI Learning Pvt. Ltd
3. Building Materials and Components, CBRI, 1990, India
4. Jagadish.K.S, “Alternative Building Materials Technology”, New Age International, 2007.
5. M. S. Shetty, “Concrete Technology”, S. Chand & Co. New Delhi.

TITLE OF THE COURSE: BUILDING MATERIALS T ESTING LABORATORY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CVL37**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
RBT Levels	**L1, L2, L3**	**Exam Hours**	**03**

Credits – 02

Course Objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel- single and double shear
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's
8. Tests on Bricks and Tiles
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course outcomes: After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:

- Group experiments - Tension test, compression test, torsion test and

bending test.

- Individual Experiments - Remaining tests.
- Two questions are to be set - One from group experiments and the other as individual experiment.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education(India)Pvt. Ltd., 2014
3. Fenner, " Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd.New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual",Standard Publishers & Distributors 1996.
7. Relevant **latest IS Codes**

TITLE OF THE COURSE: BASIC SURVEYING PRACTICE B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CVL38**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3, L4**		

Credits – 02

Course Objectives: The objectives of this course is to make students to:

1. Apply the basic principles of engineering surveying and measurements
2. Follow effectively field procedures required for a professional surveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Experiments:

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
   b) Setting out perpendiculars. Use of cross staff, optical square
2. Obstacles in chaining and ranging – Chaining but not ranging, ranging but not chaining, both ranging and chaining.
3. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
4. Measurement of bearings of sides of a closed traverse and adjustment of closing error by Bowditch method.
5. Determination of distance between two inaccessible points using compass and accessories
6. Determination of reduced levels of points using dumpy level/auto level (simple leveling)
7. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)
8. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error
9. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale
10. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.
11. Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single plane and double plane method.
12. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
13. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule.
14. Demonstration of Minor instruments Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter, nautical sextant and Pentagraph

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying for linear and angular measurements.
2. Comprehend effectively field procedures required for a professional surveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Question paper pattern:

- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. B.C. Punmia, **"Surveying Vol.1"**, Laxmi Publications pvt. Ltd., New Delhi 2009.
2. Kanetkar T P and S V Kulkarni , **Surveying and Levelling Part I**, Pune VidyarthiGrihaPrakashan, 1988
3. S.K. Duggal, **"Surveying Vol.1"**, Tata McGraw Hill Publishing Co. Ltd. New Delhi.-2009.
4. K.R. Arora, **"Surveying Vol. 1"** Standard Book House, New Delhi. – 2010 & Distributors 1996.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: Analysis of Determinate Structures B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV42**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope and deflections
2. Identify, formulate and solve engineering problems
3. Analyse structural systems and interpret data
4. Engage in lifelong learning with the advances in Structural Engineering

Module-1

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

L2,L4,L5

Module-2

Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts.

Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.

L2,L4,L5

Module-3

Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the

point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit

load method.

L2,L4,L5

Module-4

Arches and Cable Structures: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

L2, L4, L5

Module-5

Influence Lines and Moving Loads: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses-Reactions, BM and SF in determinate beams using rolling loads concepts.

L2, L4, L6

Course outcomes: After studying this course, students will be able to:

1. Evaluate the forces i n determinate trusses by method of joints and sections.
2. Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.
4. Determine the stress resultants in arches and cables.
5. Understand the concept of influence lines and construct the ILD diagram for the moving loads.

Text Books:

1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi,2015.
3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002.

Reference Books:

1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014
2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2008.
3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd, 2007.

TITLE OF THE COURSE: Applied Hydraulics B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV43**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications.

Model analysis: Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems

L1, L2, L3, L4

Module-2

Open Channel Flow Hydraulics:

Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems

L3,L4

Module-3

Non-Uniform Flow: Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems, Control sections

L2,L3,L4

Module-4

Hydraulic Machines:

Introduction, Impulse-Momentum equation. Direct impact of ajet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems

Turbines – Impulse Turbines: Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems

L1, L2, L3,L4

Module-5

Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine-Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

L1,L2, L3,L4

Course outcomes:

After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechan ics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hy draulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechan ics and Fluid Machines", Tata McGraw Hill,New Delhi

1. K Subramanya, "Fluid Mechanics and Hydraulic Machin es", Tata McGraw Hill Publishing Co. Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *"Fluid Mechanics and Machinery"*, Oxford University Publication – 2010
4. J.B. Evett, and C. Liu, *"Fluid Mechanics and Hydraulics "*, McGraw-Hill Book Company.-2009.

TITLE OF THE COURSE: Concrete Technology B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV44**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course objectives: This course will enable students to:

1. Recognize the importance of material characteristics and their contributions to strength development in Concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

Concrete Ingredients

Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.

L1, L2, L3

Module-2

Fresh Concrete

Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

L1, L2, L3

Module-3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per

IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

L1, L2, L3

Module-4

Concrete Mix Proportioning

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262

L1, L2, L3, L4

Module-5

Special Concretes

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and aplications

L1, L2, L3 L4

Course outcomes:

After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behaviour based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

Text Books:

1. Neville A.M. “Properties of Concrete”-4th Ed., Long man.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro “Concrete-Mi crostructure, Property and Materials”, 4th Edition, McGraw Hill Education, 201 4
4. A.R. Santha Kumar, “Concrete Technology”, Oxford Un iversity Press, New Delhi (New Edition)

1. M L Gambir, “Concrete Technology”, McGraw Hill Educ ation, 2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, “Concrete Technology”, CENGAGE Learning , 2015
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete]Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House

TITLE OF THE COURSE: Basic Geotechnical Engineering B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV45**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students

1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.
2. To know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.
3. To determine the improvement in mechanical behaviour by densification of soil deposits using compaction.
4. To know how the properties of soils that can be measured in the lab

Module-1

Introduction:

Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties-Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis) Atterberg's Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.

L1, L2

Module-2

Soil Structure and Clay Mineralogy

Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and ontmorillonite and their application in Engineering

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control - compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

L1, L2

Module-3

Flow through Soils:

Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity,
superficial velocity and coefficient of percolation, Capillary Phenomena

Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles a nd below the dam section.

Unconfined flow, phreatic line (Casagrande's method –with and without toe filter), flow through dams, design of dam filters.

Effective Stress Analysis: Geostatic stresses, Effective stress concept-total stress, effective

stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena

L1, L2, L3

Module-4

Consolidation of Soil:

Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under

consolidated and over consolidated soils. Consolidation characteristics of soil (Cc, av, mv and Cv. Laboratory one dimensional consolidation test, characteristics of e-log(σ) curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

L1, L2, L3,

L4Module-5

Shear Strength of Soil:

Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion

Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Total and effective stress paths.

L2, L3

Course outcomes:

On the completion of this course students are expected to attain the following outcomes;

1. Will acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties
2. Will be able to determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures
3. Will be able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structure
4. Will be able to estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.
5. Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000), New Age International (P) Ltd., Newe Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering- (2012) , Laxmi Pulications.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; (2002), Fifth Edition, Thomson

Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, 1969.
2. Donold P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. (2009), "Tata Mc Graw Hill.
4. Narasimha Rao A. V. & Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.
5. Muni Budhu ,Soil Mechanics and Foundation Engg.- (2010), 3rd Edition, John Wiely & Sons

TITLE OF THE COURSE: Advanced Surveying B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV46**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students to:

1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

Module-1

Curve Surveying

Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics , numerical problems on Length of Transition curve, Vertical curves –Types – (theory).

L1,L3,L5

Module-2

Geodetic Surveying and Theory of Errors

Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

L1,L2, L3

Module-3

Introduction to Field Astronomy: Earth, celestial sphere, earth and celestial coordinate systems, spherical triangle, astronomical triangle, Napier's rule

L4,L5

Module-4
Aerial Photogrammetry Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax **L2,L3, L5**
Module-5
Modern Surveying Instruments Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning). **L2,L3, L5**
Course outcomes: After a successful completion of the course, the student will be able to: 1. Apply the knowledge of geometric principles to arrive at surveying problems 2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems. 3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments; 4. Design and implement the different types of curves for deviating type of alignments.
Text Books: 1. B.C. Punmia, “Surveying Vol.2”, Laxmi Publications pvt. Ltd., New Delhi. 2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi Griha Prakashan, 3. K.R. Arora, “Surveying Vol. 1” Standard Book House, New Delhi. 4. Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi **Reference Books:** 1. S.K. Duggal, “Surveying Vol.I & II”, Tata McGraw Hi ll Publishing Co. Ltd. New Delhi. 2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi. 3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers 4. B Bhatia, Remote Sensing and GIS , Oxford University Press, New Delhi. 5. T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India 6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication. 7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill Higher Education

TITLE OF THE COURSE: Fluid Mechanics and Hydraulic Machines Laboratory
B.E., IV Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CVL47**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3, L4**		

Credits – 02

Course Objectives: This course will enable students to;

1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:

1. Verification of Bernoulli's equation
2. Determination of Cd for Venturimeter and Orifice meter
3. Determination of hydraulic coefficients of small vertical orifice
4. Calibration of Rectangular and Triangular notch
5. Calibration of Ogee and Broad crested weir
6. Determination of Cd for Venturiflume
7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).
8. Experimental determination of operating characteristics of Pelton turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major and Minor Losses in Pipes
13. Demonstration Experiments:
    a. Reynold's experiment to understand laminar and turbulent flow
    b. Flow Visualization
    c. Calibration of Sutro-weir

Course outcomes: During the course of study students will develop understanding of:

1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Sarbjit Singh , *Experiments in Fluid Mechanics* - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi & D r S.M. Seth, Standard Book House- New Delhi. 2009 Edition

Title of the Course: Engineering Geology Laboratory

BE–IV SEMESTER Civil Engineering [AsperChoiceBasedCreditSystem (CBCS) scheme]

Subject Code		17CVL48	CIE Marks	40
Number of Hours/Week	Lecture	03(1hrtutorial+2hr laboratory)	SEE Marks	60
Total Number of Hours	Lecture	40 hr	Exam Hours	03
RBT Levels	L1, L2, L3, L4			
CREDITS–02				

Course objectives: This course will enablestudents

1. Toidentifythemineralsandrocksbasedontheirinherentpropertiesandusesincivil engineering
2. Tointerpretthegeologicalmapsrelatedtocivilengineeringprojects.
3. Tolearnthedipandstrike,boreholeproblems,thicknessofgeologicalformationrelated tofoundation,tunnels,reservoirsandmining.
4. Tounderstand subsurfacegeologicalconditionsthroughageophysical techniquesandwatershedmanagement.
5. Tovisitthecivilengineeringprojectslikedams,reservoirs,tunnels,quarrysitesetc.

Modules	Teaching Hours	RevisedBloom's Taxonomy (RBT Level)
1. Identification of minerals as mentioned in theory, their properties, uses and manufacturing of construction materials.	6 Hours	L1, L2,L3
2. Identification of rocks as mentioned in theory, their engineering properties and uses in construction and decorative purposes	6 Hours	L1,L2, L3
3. Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs) –graphical or any other method.	6 Hours	L3,L4
4. Bore hole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square	6 Hours	L3, L4
5. Calculation of Vertical, True thickness and width of the outcrops.	3 Hours	L3,L4
6. Interpretationof Electricalresistivitycurvestofind out subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone	4 Hours	L3, L4
7. Interpretation of Toposheets and geological maps related to Civil Engineering Projects	9 Hours	L2,L3, L4

Course outcomes:

Duringthiscourse,studentswilldevelopexpertisein;

1. Identifying the minerals and rocks and utilize them effectively in civil engineering practices
2. Understanding and interpreting the geological conditions of the area for the implementationofcivilengineeringprojects.
3. Interpreting subsurfaceinformationsuchasthickness ofsoil,weathered zone,depthof hardrockandsaturatedzone byusinggeophysicalmethods.
4. Thetechniquesofdrawingthecurvesofelectricalresistivitydataanditsinterpretationfor geotechnicalandaquiferboundaries

ProgramObjectives(asperNBA):

- oEngineeringKnowledge.
- oProblemAnalysis.
- oDesign/developmentofsolutions(partly).
- oInterpretationofdata.

Questionpaperpattern:**Questionpaper should be set for 100 marks**

Allareindividualexperiments

Instructions asprinted onthecoverpageofanswer scriptfor splitupofmarkstobe strictlyfollowed.

Allexercisesaretobeincludedfor practicalexamination.

Question PaperPattern		
Qn.No.	EXPERIMENT	MARKS(100)
1	IdentificationofMinerals bygivingtheirphysical propertiesandcivilengineeringapplications(5 minerals)	25(5 x5)
2	Identificationofrocksbygivingtheirphysical properties,classificationandtheircivil engineeringapplications(5rocks)	25(5 x5)
3	Dipandstrikeproblems	7
4	Boreholeproblems(3pointmethod)	12
5	Thicknessofstrataproblemsincludingcalculation ofvertical,truethicknessanditswidthofout crop.	5
6	Electricalresistivitycurvesdrawingandits interpretationforGeotechnicalandAquifer investigations.	7
7	InterpretationofToposheets	6
8	Geologicalmaps,theircrosssectionsand description	15
9	Vivavoce	5

Note:

1)Questionnos.1,2,4,5.7,8&9arecompulsory.

2)**Amongquestionno. 3&6anyone shallbegiven**.

3)InternalAssessmentMarks=**40**:Byconducingatleastonetestfor**20marks**remaining

a)**10 marksforrecord**andb)**10 marks forfield visit report submission**(Engineering projects)

ReferenceBooks:

1. MPBillings,StructuralGeology,CBSPublishersandDistributors,NewDelhi
2. B.S.SatyanarayanaSwamy, Engineering Geology Laboratory Manual , DhanpatRai Sons,NewDelhi.
3. LRANarayan,Remotesensinganditsapplications,UniversityPress.
4. P.K.MUKERJEE,TextbookofGeology,WorldPressPvt.Ltd.,Kolkatta
5. JohnIPlattandJohnChallinor,SimpleGeologicalStructures,ThomasMurthy&Co,London

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

5th Semester

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: DESIGN OF RC STRUCTURAL ELEMENTS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV51**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course objectives: This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of RC elements for the success in competitive examinations.

Module-1

Introduction to Limit State Design and Serviceability: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

L1, L2

Module-2

Limit State Analysis of Beams:
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear

L2, L4

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456

L2, L4

Module-4

Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

L2, L4

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design

concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment

L2, L4

Course outcomes: After studying this course, students will be able to:

1. understand the design philosophy and principles
2. solve engineering problems of RC elements subjected to flexure, shear and torsion
3. demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings
4. owns professional and ethical responsibility

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper

Text Books:

1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books:

1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publisher s
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

TITLE OF THE COURSE: ANALYSIS OF INDETERMINATE STRUCTURES
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV52**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. communicate effectively in design of structural elements

Module-1

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3

L2, L4,L5

Module-2

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of 08 Hours orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3

L2, L4,L5

Module-3

Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway

L2, L4,L5

Module-4

Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3

L2, L4,L5

Module-5

Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3

L2, L4,L5

Course outcomes: After studying this course, students will be able to:

1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and frames using flexibility

method
5. Analyze the beams and indeterminate frames by system stiffness method.

Text Books:

1. Hibbeler R C, **" Structural Analysis",** Pearson Publication
2. L S Negi and R S Jangid, **"Structural Analysis",** Tata *McGraw-Hill* Publishing Company Ltd.
3. D S Prakash Rao, **"Structural Analysis: A Unified Approach"** , Universities Press
4. K.U. Muthu, H.Narendra etal, **"Indeterminate Structural Analysis",** IK International Publishing Pvt. Ltd.

Reference Books:

1. Reddy C S, **"Basic Structural Analysis",** *Tata McGraw-Hill* Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **"Theory of Structures"**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M M Ratwani, **"Analysis Of Structures** ", Vol. 2, Khanna Publishers
4. Wang C K, **"Intermediate Structural Analysis",** McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **"Computational Structural Mechanics",** PHI Learning Pvt. Ltd.,

TITLE OF THE COURSE: APPLIED GEOTECHNICAL ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV53**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course objectives: This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geotechnology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

L1,L2,L3

Module-2

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart Foundation Settlement - Approximate method for stress distribution on a horizontal plane, Types of settlements and importance, Computation of immediate and consolidation settlement

L2,L3,L4

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.

Stability of Slopes : Assumptions, infinite and finite slopes, factor of safety, use of Taylor's stability charts, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle

L2,L4,L5

Module-4

Bearing Capacity of Shallow Foundation: Types of foundations, **10 Hours** determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Effect of water table and eccentricity, field methods - plate load test and SPT Proportioning of shallow foundations- isolated and combined footings (only two columns)

L2,L4,L5,L6

Module-5

Pile Foundations: Types and classification of piles, single loaded pile capacity in

cohesionless and cohesive soils by static formula, efficiency of file group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation)

L1, L2, L3 L4

Course outcomes: On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications

TITLE OF THE COURSE: COMPUTER AIDED BUILDING PLANNING AND DRAWING

B.E., V Semester, Civil Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV54**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Credits – 04

Course Objectives: Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module-1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962
Simple engineering drawings with CAD drawing tools : Lines, Circle,Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

12 Hours L1,L2

Module-2

Drawings Related to Different Building Elements:
Following drawings are to be prepared for the data given using CAD Software

a. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
b. Different types of bonds in brick masonry
c. Different types of staircases – Dog legged, Open well
d. Lintel and chajja
e. RCC slabs and beams
f. Cross section of a pavement
g. Septic Tank and sedimentation Tank
h. Layout plan of Rainwater recharging and harvesting system
i. Cross sectional details of a road for a Residential area with provision for all services
j. Steel truss (connections Bolted)

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing

12 Hours L2,L3,L4,L5,L6

Module-3

Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services *using CAD software* for:

1. Single and Double story residential building
2. Hostel building
3. Hospital building
4. School building
5. Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:

- *Students should sketch to dimension the above in a sketch book before doing the computer drawing*
- *One compulsory field visit/exercise to be carried out.*
- *Single line diagrams to be given in the examination*

26 Hours L2,L3, L4, L5, L6

Course outcomes: After studying this course, students will be able to

1. Gain a broad understanding of planning and designing of buildings
2. Prepare, read and interpret the drawings in a professional set up.
3. Know the procedures of submission of drawings and Develop working and submission drawings for building
4. Plan and design a residential or public building as per the given requirements

Question paper pattern:

- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying ***thirty*** marks. Students have to answer one question.
- There will be two full questions from Module 3 with each full question carrying ***fifty*** marks. Students have to answer one question.
- The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. question papers should be given in batches

Text Books:

1. MG Shah, CM Kale, SY Patki, **"Building drawing with an integrated approach to Built Environment Drawing"** , Tata Mc Graw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, **"Building Construction",** Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, **"Civil Engineering Drawing"** , Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
3. **National Building Code**, BIS, New Delhi.

TITLE OF THE COURSE: AIR POLLUTION AND CONTROL
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV551**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

Module-1

Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

L1,L2

Module-2

Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model

L1,L2,L3

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

L2,L3,L4

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.

L3,L4

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards. Environmental issues, global episodes, laws, acts, protocols

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Text Books:

1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell, “Introduction t o Environmental Engineering” McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, “Air Pollution Control Engineering” , Waveland Pr Inc.
2. Anjaneyulu Y, “Text book of Air Pollution and Contr ol Technologies”, Allied Publishers

TITLE OF THE COURSE: RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV552**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
2. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction
3. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module-1

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

L1,L2

Module-2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

L1,L2,L3

Module-3

Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.

Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

L2,L3,L4

Module-4

Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

L3,L4

Module-5

Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

Text Books:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planni ng and Design", Nemchand and Brothers, Roorkee,
4. C Venkatramaiah, " Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi

Reference Books:

1. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co.,
2. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill
3. Srinivasan R. Harbour, "Dock and Tunnel Engineering ", 26th Edition 2013

TITLE OF THE COURSE: MASONRY STRUCTURES
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV553**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Module-1

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties o f mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

L1,L2,L3

Module-2

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

L1,L2,L3

Module-3

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

L1,L2,L3

Module-4

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

L2,L3,L4,L5

Module-5

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs.
In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

L2,L3,L4,L5

Course outcomes: After studying this course, students will be able to:

1. Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.
2. Summarize various formulae's for finding compressive strength of masonry units.
3. Explain permissible stresses and design criteria as per IS: 1905 and SP-20.
4. Design different types of masonry walls for different load considerations.

Text Books:

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd., 1990.
2. Dayaratnam P, "Brick and Reinforced Brick Structures", Oxford & IBH, 1987.
3. M. L. Gambhir, "Building and Construction Materials", Mc Graw Hill education Pvt. Ltd.

Reference Books:

1. IS 1905–1987 "Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.
2. SP 20 (S&T) – 1991, "Hand book on masonry design and construction (1^{st} revision) BIS, New Delhi.

TITLE OF THE COURSE: THEORY OF ELASTICITY
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV554**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials into more general, two and three-dimensional problems.
2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
3. Introduction to the stress – strain relationship, basic principles and mathematical expressions involved in continuum mechanics. also solution of problems in 2- dimensional linear elasticity

Module-1

Concepts of continuum, Stress at a point, Components of stress, Differential equations of equilibrium, Stress transformation, Principal stresses, Maximum shear stress, Stress invariants.
Strain at a point, Infinitesimal strain, Strain-displacement relations, Components of strain, Compatibility Equations, Strain transformation, Principal strains, Strain invariants, Measurement of surface strains, strain rosettes

L1,L2,L3

Module-2

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only).

L1,L2,L3

Module-3

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). equations of equilibrium, compatibility equation, stress function.

L3,L4

Module-4

Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

L3,L4

Module-5

Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections

L3,L4

Course outcomes: After studying this course, students will be able to:

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum
2. Ability to formulate boundary value problems; and calculate stresses and strains
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints;
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

Text Books:

1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publish ers, 2012
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford & IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003

Reference Books:

1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York, 1953
2. G. W. Housner and T. Vreeland, Jr., "The Analysis o f Stress and Deformation", California Institute of Tech., CA, 2012. [Download as per user policy from http://resolver.caltech.edu/CaltechBOOK:1965.001]
3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", Prentice Hall, 2003.
4. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press,1998

TITLE OF THE COURSE: TAFFIC ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV561**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analysing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

L1,L2,L3

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.

L1,L2,L3,L4,L5

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks

L1,L2,L3,L4

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

L1,L2,L3

Module-5

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

L1,L2,L3,L4

Course outcomes: After studying this course, students will be able to:

1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Text Books:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning ", Khanna Publishers, Delhi, 2013
2. S K Khanna and CEG Justo and A Veeraragavan, "Highway Engineering", Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

Reference Books:

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005

TITLE OF THE COURSE: SUSTAINABILITY CONCEPTS IN ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17 CV562**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frameworks and their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Module-1

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act

L1,L2,L3

Module-2

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking

L1,L2,L3

Module-3

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

L1,L2,L3,L4

Module-4

Clean Technology and Energy: Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

L1,L2,L3

Module-5

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
5. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

Text Books:

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

Reference Books:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice
6. Daniel A. Vallero and Chris Brasier, " Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers

TITLE OF THE COURSE: REMOTE SENSING AND GIS
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV563**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic maps for various applications.

Module-1

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

L1,L2,L3

Module-2

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

L2,L3,L4

Module-3

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

L2,L3,L4

Module-4

Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.

L3,L4,L5

Module-5

Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based

Services And Its Applications.

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Collect data and delineate various elements from the satellite imagery using their spectral signature.
2. Analyze different features of ground information to create raster or vector data.
3. Perform digital classification and create different thematic maps for solving specific problems
4. Make decision based on the GIS analysis on thematic maps.

Text Books:

1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press 2011
3. Kang – Tsurg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited 2015.

   Lillesand, Kiefer, Chipman, "Remote Sensing and Image Interpretation", Wiley 2011.

Reference Books:

1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006
2. John R. Jensen, "Remote sensing of the environment", An earth resources perspective – 2nd edition – by Pearson Education 2007.
3. Anji Reddy M., "Remote sensing and Geograperhical information system", B.S. Publications 2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications 2004.
5. S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

TITLE OF THE COURSE: OCCUPATIONAL HEALTH AND SAFETY
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CV564**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

1. Gain an historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

L1,L2,L3

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations

L2,L3,L4,L5

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.
Electrical Safety, Product Safety: Technical Requirements of Product safety.

L2,L3,L4,L5

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and
advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

L2,L3,L4,L5

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Text Books:

1. Goetsch D.L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3. "Industrial Safety and Pollution Control Handbook

Reference Books:

1. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

TITLE OF THE COURSE: GEOTECHNICAL ENGINEERING LAB

B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CVL57**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**

RBT LEVEL L1,L2

Credits – 02

Course Objectives: This course will enable students to;

1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules

1. Visual soil classification. Water content determination by oven drying method and infrared moisture method. Specific gravity test (pycnometer and density bottle method).
2. Grain size analysis
   i. Sieve analysis
   ii. Hydrometer analysis
3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method
4. Consistency limits
   i. Liquid limit test (by Casagrande's and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test
5. Standard compaction test (light and heavy compaction)
6. Co-efficient of permeability test
   i. Constant head test
   ii. Variable head test
7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (undrained unconsolidated)
8. Consolidation test : Determination of compression index and co- efficient of consolidation
9. Laboratory vane shear test
10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics (SPT- Demonstration)

Question paper pattern:

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Punmia B C, Soil Mechanics and Foundation Engineering- (2017), 16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4. Bowles J.E., "Engineering Properties of Soil and Their Measurements",- McGraw Hill Book Co. New York.
5. Relevant BIS Codes of Practice: 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 1 0) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1 966, IS 2720 (Part-60) 1965.

TITLE OF THE COURSE: CONCRETE AND HIGHWAY MATERIALS LABORATORY
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17CVL58**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3,**		

Credits – 02

Course objectives: This course will enable students

1. To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

Modules

Part A: Concrete Lab

1. Tests on Cement:
   a. Normal Consistency
   b. setting time
   c. compressive strength
   d. fineness by air permeability test
   e. specific gravity

2. Tests on Concrete:
   a. Design of concrete mix as per IS-10262
   b. Tests on fresh concrete:
      i. slump,
      ii. compaction factor and
      iii. Vee Bee test
   c. Tests on hardened concrete:
      i. compressive strength test,
      ii. split tensile strength test,
      iii. flexural strength test
   d. NDT tests by rebound hammer and pulse velocity test.

3. Tests on Self Compacting Concrete:
   a. Design of self compacting concrete,
   b. slump flow test,
   c. V-funnel test,
   d. J-Ring test,
   e. U Box test and
   f. L Box test

Part B: High way materials Lab

1. Tests on Aggregates
   a. Aggregate Crushing value
   b. Los Angeles abrasion test
   c. Aggregate impact test
   d. Aggregate shape tests (combined index and angularity number)

2. Tests on Bituminous Materials
   a. Penetration test
   b. Ductility test
   c. Softening point test
   d. Specific gravity test
   e. Viscosity test by tar viscometer
   f. Bituminous Mix Design by Marshall Method (Demonstration only)

3. Tests on Soil
    a. Wet sieve analysis
    b. CBR test

Course outcomes: During this course, students will develop expertise in;

1. 1. Conduct appropriate laboratory experiments and interpret the results
2. Determine the quality and suitability of cement
3. Design appropriate concrete mix
4. Determine strength and quality of concrete
5. Test the road aggregates and bitumen for their suitability as road material.
6. Test the soil for its suitability as sub grade soil for pavements.

Question paper pattern:

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. 1. M.L.Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand & Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual ", Nem Chand Bros, Roorkee
7. L R Kadiyali, "Highway Engineering ", Khanna Publishers, New Delhi

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

6th Semester

Course Title: CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV61**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks - 100**	

Course Objectives: This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

Module -1

Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans

Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles

Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node.

L1,L2,L3

Module -2

Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance

Materials: material management functions, inventory management.

L1,L2,L3

Module -3

Construction Quality , safety and Human Values:

Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

L1,L2,L3

Module -4

Introduction to engineering economy :

Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.

Comparison of alternatives : Present worth, annual equivalent , capitalized and rate of return methods , Minimum Cost analysis and break even analysis

L1,L2,L3

Module -5

Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Understand the construction management process.
2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
3. Fulfill the professional obligations effectively with global outlook

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education
2. Chitkara, K.K, “Construction Project Management: Planning Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
4. Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works :

Reference Books:

1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
2. Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, New Delhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill Education
5. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pitsburgh
6. James L.Riggs , David D. Bedworth , Sabah U. Randhawa “ Engineerng Economics” 4 ed tata Mc Graw hill.
7. S.C Sharma –“Construction Equipments and its management” – Khanna publishers

Course Title: DESIGN OF STEEL STRUCTURAL ELEMENTS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV62**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks- 100**	

Course Objectives: This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module -1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

L1,L2,L3

Module -2

Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member,

Advantages and Disadvantages of Bolted and Welded Connections.

L1,L2,L3

Module -3

Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

L1,L2,L3

Module -4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

L1,L2,L3

Module -5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel
2. Understand the Concept of Bolted and Welded connections.

3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi

Reference Books:

1. Dayarathnam P, "Design of Steel Structures", S Chand and Company Ltd., New Delhi.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

Course Title: HIGHWAY ENGINEERING
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VI

Subject Code	**17CV63**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

Module -1

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute

Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.

L1,L2

Module -2

Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects

Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves

L2,L3,L4

Module -3

Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates-Desirable properties and tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material

Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples

L3,L4,L5

Module -4

Pavement Construction: Design of soil aggregate mixes by Rothfuch's method.

Uses and properties of bituminous mixes and cement concrete in pavement construction.

Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads

L2,L3,L4

Module -5

Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods-Examples, Highway financing-BOT-BOOT concepts

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S K Khanna and C E G Justo, " Highway Engineering", Nem Chand Bros, Roorkee
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K.P.subramanium, "Transportation Engineering", SciTech Publications, Chennai.

Reference Books:

1. Relevant IRC Codes
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

Course Title: WATER SUPPLY AND TREATMENT ENGINEERING
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV64**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.
Different methods of population forecasting -with merits and demerits. Numerical Problems.

L1,L2,L3

Module -2

Water Treatment: Objectives, Treatment flow chart – significance of each unit
Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques.
Water quality characteristics: Physical, Chemical and Microbiological.

L1,L2,L3

Module -3

Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers.
Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.
Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.

L1,L2,L3

Module -4

Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration.
Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.

L1,L2,L3

Module -5

Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures.
Pumps: Types of pumps with working principles. Numerical Problems.
Pipes: Design of the economical diameter for the rising main; Numerical Problems.
Pipe appurtenances, Valves, Fire hydrants
Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.
Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.

Visit to Intake structure, Water treatment plant and report working of each unit
Design of water treatment plant units and distribution system with population forecasting for the given city

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008.

Reference Books:

1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
2. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Course Title: SOLID WASTE MANAGEMENT
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV651**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Module -1

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.
Collection: Collection of solid waste- services and systems, equipments,
Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

L1,L2,L3

Module -2

Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control,Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

L1,L2,L3

Module -3

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems.
Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems

L1,L2,L3

Module -4

Sources, collection, treatment and disposal of :-
Biomedical waste ,E-waste ,Hazardous waste and construction waste

L1,L2,L3

Module -5

Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolsis ,design criteria for incineration
Energy recovery technique from solid waste management

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste

Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd.,

Reference Books:

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

Course Title: MATRIX METHOD OF STRUCTURAL ANALYSIS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV652**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

Module -1

Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements

L2, L4,L5

Module -2

Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4,L5

Module -3

Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

L2, L4,L5

Module -4

Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

L2, L4,L5

Module -5

Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses

L2, L4,L5

Course Outcomes: After studying this course, students will be able to:

1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Weaver W and Gere J H, **"Matrix Analysis of Framed Structures"**, CBS publications, New Delhi.
2. Rajasekaran S, **"Computational Structural Mechanics"**, PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **"Matrix and Finite Element Analysis of Structures"**, Ane Books Pvt. Ltd.

Reference Books:

1. Godbole P N et.al, “Matrix Method of Structural Analysis”, PHI ltd, New Delhi.
2. Pundit and Gupta, “Theory of Structures Vol II”, TMH publications, New Delhi
3. A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee.
4. Manikaselvam, “Elements of Matrix Analysis and Stability of Structures”, Khanna Publishers, New Delhi.
5. H C Martin, “Introduction to Matrix Methods in Structural Analysis”, International textbook company, McGraw Hill.

Course Title: ALTERNATIVE BUILDING MATERIALS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV653**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course objectives: This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Module -1

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions

L1,L2,L3

Module -2

Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as
per BIS, characteristics and requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

L1,L2,L3

Module -3

Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes

L1,L2,L3

Module -4

Alternative Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications.

Top down construction, Mivan Construction Technique.

Alternative Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

L1,L2,L3

Module -5

Equipment for Production of Alternative Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. KS Jagadish, BV Venkatarama Reddy and KS Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers

Reference Books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

Course Title: GROUND IMPROVEMENT TECHNIQUES
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV654**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

Module -1

Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits;
Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.
Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

L1, L2 , L3

Module -2

Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.
Pre-compression and Vertical Drains: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading

L1, L2 , L3

Module -3

Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.
Chemical Modification-Ii: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

L2, L3 , L4

Module -4

Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibroflotation, sand compaction piles, stone columns, heavy tamping
GROUTING AND INJECTION: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting

L2 , L3, L5

Module -5

Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of
Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,
Miscellaneous Methods (Only Concepts & Uses): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.

L1 , L3, L5

Course Outcomes: After studying this course, students will be able to:

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", Mc Graw Hill Pub. Co.

Reference Books:

1. Manfred Hausmann , "Engineering principles of ground modification", Mc Graw Hill Pub. Co.,
2. Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London.
3. Nelson J.D. and Miller D.J, "Expansive soils", John Wiley and Sons.
4. Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths

Course Title: WATER RESOURCES MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV661**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS – 03	**Total Marks-100**	

Course objectives: This course will enable students to;

1. Judge surface and ground water resources.
2. Address the issues of water resources management.
3. Learn the principles of integrated water resources management.
4. Understand the legal framework of water policy.
5. Know the different methods of water harvesting.

Module -1

Surface and Ground water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium

L2, L3

Module -2

Water Resources Planning and Management: Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.

L2, L3

Module -3

Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.

L3, L4

Module -4

Water Governance and Water Policy: Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal Changes in Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India.

L2, L3

Module -5

Water Harvesting and Conservation: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area.

L2, L3

Course outcomes: After studying this course, students will be able to:

1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.

4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
3. Daniel P. Loucks and Eelco van Beek, "Water Resources Systems. Planning and Management", UNESCO Publication.
4. Mollinga, P. et al, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
5. Singh, Chhatrapati "Water Rights in India," Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi,1992.
6. 6) Dhruva Narayana, G. Sastry, V. S. Patnaik, "Watershed Management", CSWCTRI, Dehradun, ICAR Publications, 1997.

Reference Books:

1. Lal, Ruttan. " Integrated Watershed Management in the Global Ecosystem". CRC Press, New York.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.

Course Title: ENVIRONMENTAL PROTECTION AND MANAGEMENT
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV662**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to gain knowledge in Environmental protection and Management systems

Module -1 Environmental Management Standards

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

L1,L2,L3

Module -2 Environmental Management Objectives

Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies

L1,L2,L3

Module -3 Environmental Management System

EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

L1,L2,L3

Module -4 Environmental Audit

Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit

L1,L2,L3

Module -5 Applications

Applications of EMS , Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
2. Lead pollution prevention assessment team and implement waste minimization options
3. Develop, Implement, maintain and Audit Environmental Management systems for Organisations

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice", McGraw- Hill International, Boston,2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

Course Title: NUMERICAL METHODS AND APPLICATIONS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV663**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

Module -1

Solution of Equations and Eigen value Problems: Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method

L1,L2,L3

Module -2

Interpolation and Approximation: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

L1,L2,L3

Module -3

Numerical Differentiation and Integration: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

L1,L2,L3

Module -4

Initial Value Problems for Ordinary Differential Equations : Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

L1,L2,L3

Module -5

Boundary Value Problems in Ordinary and Partial Differential Equations:
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

L1,L2,L3

Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from
Industry, management and other engineering fields.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna
   Publishers, 9th Edition, New Delhi
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi

Reference Books:

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill,

New Delhi
2. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi

Course Title: FINITE ELEMENT METHOD
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CV664**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to;

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Module -1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions

L1,L2

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates , Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples

L1,L2

Module -3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisymmetric Element

L1,L2,L3

Module -4

Isoparametric concepts; isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems

L1,L2,L3

Module -5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.
Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

L1,L2,L3

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Krishnamoorthy C.S., “Finite Element analysis” -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al., “Concepts and applications of Finite Element analysis ”, John Wiley

Reference Books:

1. Daryl L Logan,“ A first course on Finite element Method ” , Cengage Learning
2. Bathe K J - “ Finite Element Procedures in Engineering analysis ”- Prentice Hall

Course Title: SOFTWARE APPLICATION LAB
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CVL67**	**IA Marks**	**40**
Number of Lecture Hours/Week	**1I+2P**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –02		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Use industry standard software in a professional set up.
2. understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design
3. Develop customized automation tools

Module -1

Use of civil engineering softwares:

Use of softwares for:

1. Analysis of plane trusses, continuous beams, portal frames
2. 3D analysis of multistoried frame structures

L1,L2,L3

Module -2

1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:**

a. Understanding basic features of Project management software
b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
c. Identification of Predecessor and Successor activities with constrain
d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats.
e. Study on various View options available
f. Basic understanding about Resource Creation and allocation
g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project

(9hrs)

1. GIS applications using open source software:

a. To create shape files for point, line and polygon features with a map as reference.
b. To create decision maps for specific purpose. (3hrs)

L1,L2,L3

Module -3

Use of EXCEL spread sheets:

Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- The question paper will have 3 modules comprising of 6 questions.
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- Module-1: 40 Marks, Module-2: 20 Marks, Module-3: 20 Marks

• The students shall answer three full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.
Reference Books: Training manuals and User manuals and Relevant course reference books

Course Title: EXTENSIVE SURVEY PROJECT /CAMP
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**17CVL68**	**IA Marks**	**40**
Number of Practice Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Practice Hours	**50**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. **NEW TANK PROJECTS:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.

2. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. Design of all elements and preparation of drawing with report.

3. **HIGHWAY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
   d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

4. **RESTORATION OF AN EXISTING TANK:** The work shall consist of;
    a. Reconnaissance survey for selection of site and conceptualization of project.
    b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
    c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
    d. Design of all elements and preparation of drawing with report.
5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;
    a. Reconnaissance survey for selection of site and conceptualization of project.
    b. Detailed survey required for project execution like contour surveys
    c. Preparation of layout plans as per regulations
    e. Centerline marking-transfer of centre lines from plan to ground
    f. Design of all elements and preparation of drawing with report as per regulations

Course outcomes: After studying this course, students will be able to:

1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:

Training manuals and User manuals
Relevant course reference books

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

7th Semester

Course Title: MUNICIPAL AND INDUSTRIAL WASTE WATER ENGINEERING

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV71**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to;

4. Understand sewerage network and influencing parameters.
5. Understand and design different unit operations involved in conventional and biological treatment process.
6. Apply the principles of Industrial effluent treatment process for different industrial wastes.
7. Evaluate self purification of streams depending on hydraulic and organic loading of sewage into receiving waters.

Module -1

Introduction, need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow, material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. low-cost waste treatment; oxidation pond, septic tank, Sewer appurtenances, manholes, catch basins, basic principles of house drainage, typical layout plan showing house drainage connections,

L1,L2

Module -2

Design of sewers, hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions, disposal of effluents by dilution, self purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation

L2,L3

Module -3

Waste water characteristics, sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water treatment, unit operations; screens, grit chambers, skimming tanks, equalization tanks

Suspended growth and fixed film bio process, design of trickling filters, activated sludge process, sequential batch reactors, moving bed bio reactors, sludge digesters,

L1,L2,L3

Module -4

Difference between domestic and industrial waste water, effect of effluent discharge on streams, methods of industrial waste water treatment; volume reduction, strength reduction, neutralization, equalisation and proportioning. Removal of organic, inorganic and colloidal solids, combined treatment methods; merits, demerits and feasibility, principles of discharge of raw, partially treated and completely treated wastes in to streams

L1,L2

Module -5

Process flow chart, sources and characteristics of industrial waste water, treatment methods, reuse and recovery and disposal; cotton and textile industry, tanning industry, cane sugar and distilleries, dairy industry, steel and cement industry, paper and pulp industry, pharmaceutical and food processing industry.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

4. Acquires capability to design sewer and Sewerage treatment plant.
5. Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
6. Identify waste streams and design the industrial waste water treatment plant.
7. Manage sewage and industrial effluent issues.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Metcalf and Eddy, "Wastewater Engineering - Collection, Treatment, Disposal and Reuse", McGraw Hill Pub.Co., 2009.
2. Nelson Leonard Nemerow, "Industrial Waste Treatment", Butterworth-Heinemann, 2007**.**
3. Patwardhan A.D, "Industrial Waste Water Treatment", PHI Learning Private Limited-New Delhi
4. Hammer, M.J. and Hammer, M.J., "Water and Wastewater Technology", 7th Ed., Prentice Hall of India

Reference Books:

1. Manual on Waste Water Treatment: CPHEEO, Ministry of Urban Development, New Delhi.
2. Fair, Geyer and Okun , "Water and Wastewater Engineering" Vol-II, John Willey Publishers, New York.

Course Title: DESIGN OF RCC AND STEEL STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV72**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to

6. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
7. Identify, formulate and solve engineering problems in RC and Steel Structures
8. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
9. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
10. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab type combined footing.

Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.

Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV)**

Design of portal frames with fixed and hinged based supports.

L1,L2,L3

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.

Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks

Gantry Girder: Design of gantry girder with all necessary checks

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

6. Students will acquire the basic knowledge in design of RCC and Steel Structures.
7. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 40 marks.

3. Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing
4. The above charts shall be provided during examinations

Text Books:

4. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
5. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
6. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:

6. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behaviour"**, Pearson Publications
7. Nether Cot, et.al, **"Behaviour and Design of Steel Structures to EC -III"**, CRC Press
8. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
9. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

Course Title: HYDROLOGY AND IRRIGATION ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV73**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
	CREDITS – 04	**Total Marks-100**	

Course Objectives: This course will enable students to;

1. Understand the concept of hydrology and components of hydrologic cycle such as pricipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Module -1

Hydrology: Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

L2, L3

Module -2

Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control

Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation,

Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

L2, L3

Module -3

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations

L2, L4

Module -4

Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.
Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

L2, L4

Module -5

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.
Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

L2, L4

Course outcomes: After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1) K. Subramanya, “Engineering Hydrology”, Tata McGraw Hill Publishers, New Delhi.

2) Jayarami Reddy, “A Text Book of Hydrology”, Lakshmi Publications, New Delhi.

3) Punmia and LalPandey, “Irrigation and Water Power Engineering” Lakshmi Publications, New Delhi.

Reference Books:

1. H.M. Raghunath, “Hydrology”, Wiley Eastern Publication, New Delhi.
2. Sharma R.K., “Irrigation Engineering and Hydraulics”, Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, “Applied Hydrology”, Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N “Water Resources and Water Power Engineering”-. Standard book house, Delhi.
5. Garg S.K, “Irrigation Engineering and Hydraulic Structures” Khanna publications,

New Delhi.

Course Title: DESIGN OF BRIDGES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV741**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Module -1

Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth

Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

L1,L2

Module -2

Design of Slab Bridges: Straight and skew slab bridges

L2,L3

Module -3

Design of T beam bridges(up to three girder only)

Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

L2,L3,L4

Module -4

Other Bridges:

Design of Box culvert (Single vent only)

Design of Pipe culverts

L2,L3,L4

Module -5

Substructures - Design of Piers and abutments,

Introduction to Bridge bearings, Hinges and Expansion joints.(No design)

L2,L3,L4

Course outcomes: After studying this course, students will be able to:

- Understand the load distribution and IRC standards.
- Design the slab and T beam bridges.
- Design Box culvert, pipe culvert
- Use bearings, hinges and expansion joints and
- Design Piers and abutments.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

Reference Books:

1. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2., Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. "Concrete Bridges", The Concrete Association of India

Course Title: GROUND WATER & HYDRAULICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV742**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS – 03	**Total Marks-100**	

Course objectives: This course will enable students

- To characterize the properties of ground water and aquifers.
- To quantify the ground water flow.
- To locate occurrence of ground water and augment ground water resources.
- To synthesize ground water development methods.

Module -1

Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

L1, L2

Module -2

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, unisotropic layered soils, steady one dimensional flow: cases with recharge.

L2, L3

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.

L2, L3, L4

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and

fluid logging.

L2, L3

Module -5

Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.

Ground Water Recharge: Artificial recharge, groundwater runoff

L2, L3

Course outcomes: After studying this course, students will be able to:

- Find the characteristics of aquifers.
- Estimate the quantity of ground water by various methods.
- Locate the zones of ground water resources.
- Select particular type of well and augment the ground water storage.

Program Objectives:

3. Engineering knowledge
4. Problem analysis
5. Interpretation of data

Text Books:

1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:

1. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

Course Title: DESIGN CONCEPT OF BUILDING SERVICES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV743**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course Objectives: This course will enable students to

1. learn the importance of sanitation, domestic water supply, plumbing and fire services
2. Understand the concepts of heat, ventilation and air conditioning
3. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply, Drainage and Solid Waste Disposal:

Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps – quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit

Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers

Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods

L1,L2

Module -2

Heat Ventilation and Air Conditioning (HVAC):

Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

L1,L2

Module -3

Electrical and Fire Fighting Services:

Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires,

Wiring systems and their choice , planning electrical wiring for building, Main and

distribution boards, Principles of illumination,

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc.

Provisions of NBC.

L1,L2,L3

Module -4

Plumbing and Fire Fighting Layout of Simple Buildings:

Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

L2,L3

Module -5

Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.
Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift

codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Reference Books:

- National Building Code
- Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
- Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
- Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
- M.David Egan, Concepts in Building Fire Safety.
- O.H.Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom
- V.K.Jain, Fire Safety In Building 2edition, New Age International Publishers
- E.G.Butcher, Smoke control in Fire-safety Design.
- E.R.Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York
- Handbook for Building Engineers in Metric systems, NBC, New Delhi

Course Title: STRUCTURAL DYNAMICS

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV744**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

1. Understand the behaviour of structure especially building to various dynamic loads: such as wind, earthquake, machine vibration and ambient vibration
2. Basic understanding of structural analysis and knowledge of engineering mathematics.
3. Understand response of a single degree of freedom system to dynamic excitation and Vibration Control Techniques.

Module -1

Introduction: Introduction to structural dynamics, brief history of vibration, Basic definitions, vibration of SDOF (Single Degree of Freedom) systems, undamped, Damped, Free vibrations, equivalent viscous damping, Logarithmic decrement

L1,L2

Module -2

Forced vibrations of SDOF system, Response of undamped and damped system subjected to harmonic loading, response to SDOF subject to harmonic base excitation, Duhamel's integral, response to general system of loading, dynamic load factor, response spectrum.

L1,L2,L3

Module -3

Free vibration of MDOF (Multi Degree Freedom System), Natural frequencies, Normal modes, Orthogonality of normal modes, Eigen Values Shear buildings modeled as MDOF systems. Free vibrations, Natural frequencies,

L1,L2,L3

Module -4

Forced vibrations, Motion of shear buildings, Model Superposition Method, Response to shear buildings, Base motion, Harmonic fixed excitation.

Damped motion of shear buildings, Equations for damped shear buildings, uncoupled damped equations, Conditions for damping uncoupled.

L1,L2,L3

Module -5

Dynamic analysis of base stuffiness matrices, Lumped mass and consistent mass formulation, Equations of motion.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.
2. Basic understanding of fundamental analysis methods for dynamic systems Interpret dynamic analysis results for design, analysis and research purposes
3. Apply structural dynamics theory to earthquake analysis, response, and design of structures

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

- Anil K Chopra, **"Structural Dynamics"**, PHI Publications
- Mukobadhyay, **"Vibrations, Structural Dynamics",** Oxford IBH Publications
- Vinod Husur, **"Earth Quake resistant design of building structures**", WILE EASTERN India Publications

Reference Books:

- V K Mac Subramanian, "Elementary structural dynamics", Danpatra Publications
- Mario Poz, "Structural Dynamics", CBS publications.
- Manik A Selvam, "Structural Dynamics", Danpatra publications

Course Title: URBAN TRANSPORTATION AND PLANNING

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV751**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

1. Understand and apply basic concepts and methods of urban transportation planning.
2. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
4. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

Module -1

Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

L1,L2,L3

Module -2

Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

L1,L2,L3

Module -3

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above**

L3,L4

Module -4

Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above**

L2,L3,L4,L5

Module -5

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Introduction to land use planning models, land use and transportation interaction.

L2,L3,L4,L5

Course outcomes: After studying this course, students will be able to:

1. Design, conduct and administer surveys to provide the data required for transportation planning.
2. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
3. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
4. Adopt the steps that are necessary to complete a long-term transportation plan.

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

- Kadiyali.L.R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
- Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
- Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
- Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

Reference Books:

- Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
- Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
- Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

Course Title: PREFABRICATED STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV752**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Understand modular construction, industrialised construction
2. Design prefabricated elements
3. Understand construction methods.

Module -1

Introduction: Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

L1,L2

Module -2

Prefabricated Components: Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels

–Columns–Shear walls

L1,L2

Module -3

Design Principles: Disuniting of structures-Design of cross section based on efficiency

of material used–Problems in design because of joint flexibility

–Allowance for joint deformation.

L2,L3

Module -4

Joint In Structural Members: Joints for different structural connections–Dimensions and detailing–Design of expansion joints

L1,L2,L3

Module -5

Design For Abnormal Loads: Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Use modular construction, industrialised construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

- CBRI, Building materials and components, India, 1990
- Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:

- Koncz T.,"Manual of precast concrete construction", Vol.I, II and III, Bauverlag, GMBH,1976.
- "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

Course Title: REHABILITATION AND RETROFITTING OF STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV753**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

- Investigate the cause of deterioration of concrete structures.
- Strategise different repair and rehabilitation of structures.
- Evaluate the performance of the materials for repair

Module -1

General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

L1,L2

Module -2

Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

L1,L2

Module -3

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

L1,L2,L3

Module -4

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

L1,L2,L3

Module -5

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Course Title: REINFORCED EARTH STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CV754**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics

Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

L1,L2,L3

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken

L1,L2,L3,L4

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

L2,L3,L4

Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes

L2,L3,L4

Module -5

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability (No Numerical Problems)

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)

L2,L3,L4

Course outcomes: After studying this course, students will be able to:

1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geosynthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geosynthetics in drainage requirements and landfill designs

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Koerner. R.M, “Design with Geosynthetics”, Prince Hall Publications
2. Koerner. R.M. & Wesh, J.P, “Construction and Geotechnical Engineering using synthetic fabrics”, Wiley Inter Science, New York,.
3. SivakumarBabu G. L., “An introduction to Soil Reinforcement and Geosynthetics”, Universities Press, Hyderabad
4. Swami Saran, “Reinforced Soil and its Engineering Applications”, I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, “Engineering with Geosynthetics”, Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books:

1. Jones, “Earth reinforcement and Soil structure”, CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, “Geotextile Hand Book”, Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, “Earth Reinforcement Practices”,Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, “Ground Engineer’s reference Book”, Butterworths, London
5. Ingold, T.S, “Reinforced Earth”, Thomas, Telford, London.
6. Sarsby R W- Editor, “Geosynthetics in Civil Engineering”, Woodhead Publishing Ltd & CRC Press, 2007

Course Title: ENVIRONMENTAL ENGINEERING LABORATORY

As per Choice Based Credit System (CBCS) scheme

SEMESTER:VII

Subject Code	**17CVL76**	**IA Marks**	**40**
Number of Lecture Hours/Week	**1I+2P**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students,

1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

Revised Bloom's Taxonomy (RBT) Level **L1,L2,L3**

1. Determination of pH, Acidity and Alkalinity
2. Determination of Calcium, Magnesium and Total Hardness.
3. Determination of Dissolved Oxygen.
4. Determination of BOD.
5. Determination of Chlorides
6. Determination of percentage of available chlorine in bleaching powder,
7. Determination of Residual Chlorine
8. Determination of Solids in Sewage:
   I) Total Solids,
   II) Suspended Solids,
   III) Dissolved Solids,
   IV) Volatile Solids, Fixed Solids,
   V) Settle able Solids.
9. Determination of Turbidity by Nephelometer
10. Determination of Optimum Dosage of Alum using Jar test apparatus.
11. Determination of sodium and potassium using flame photometer.
12. Determination Nitrates by spectrophotometer.
13. Determination of Iron & Manganese.
14. Determination of COD. (Demonstration)
15. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution) (Demonstration)
16. Determination of Sound by Sound level meter at different location(Demonstration)

Course Outcomes: After studying this course, students will be able to:

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.

3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

Program Objectives:

1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in 8th semester in the field of environmental engineering.

Question paper pattern:

1. Two experiments shall be asked from the above set
2. One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

1. Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal
2. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science" , McGraw-Hill Series in Civil and Environmental Engineering

Course Title: COMPUTER AIDED DETAILING OF STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**17CVL77**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03 (1I+2D)**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to

- Be aware of the Scale Factors, Sections of drawings,
- Draft the detailing of RC and Steel Structural member.

RBT LEVEL **L1,L2,L3**

Module -1 Detailing of RCC Structures

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Beams with Bolted and Welded
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:

4. Prepare detailed working drawings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 40 marks.

Text Books:

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
2. IS 13920:2016,Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

8th Semester

Course Title: QUANTITY SURVEYING AND CONTRACTS MANAGEMENT
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VIII

Subject Code	**17CV81**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
	CREDITS –04	**Total Marks- 100**	

Course objectives: This course will enable students to;

1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

Module -1

Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method.

Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.

L2,L3

Module -2

Estimate of Steel truss, manhole and septic tanks.

Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.

L1,L2,L3

Module -3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings,

Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost

Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

L1,L2,L3

Module-4

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).

Law of Contract as per Indian Contract act 1872 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting.

Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC

L1,L2,L3

Module -5

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration

Valuation: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation,

valuation for mortgage, valuation of land.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Prepare detailed and abstract estimates for roads and building.
2. Prepare valuation reports of buildings.
3. Interpret Contract document's of domestic and international construction works

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi
2. B.S. Patil, " Civil Engineering Contracts and Estimates", Universities Press
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi

Reference Books:

1. Kohli D.D and Kohli R.C, " Estimating and Costing",12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, " Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi
7. David Pratt , " Fundamentals of Construction Estimating" – 3ed ,
8. PWD Data Book ,CPWD Schedule of Rates (SoR). and NH SoR – Karnataka
9. FIDIC Contract forms
10. B.S. Ramaswamy " Contracts and their Management" 3ed , Lexis Nexis (a division of Reed Elsevier India Pvt Ltd)

Course Title: DESIGN OF PRE STRESSED CONCRETE ELEMENTS As per Choice Based Credit System (CBCS) scheme] SEMESTER:VIII			
Subject Code	**17CV82**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements

Module -1

Introduction and Analysis of Members: Concept of Prestressing - Types of Prestressing - Advantages - Limitations –Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.
Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point - Pressure line.

L1,L2

Module -2

Losses in Prestress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.
Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

L1,L2

Module -3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members

L1,L2,L3

Module -4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

L1,L2,L3

Module -5

Composite Sections: Types of composite construction - Analysis of composite sections - Deflection –Flexural and shear strength of composite sections.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

- Understand the requirement of PSC members for present scenario.
- Analyse the stresses encountered in PSC element during transfer and at working.
- Understand the effectiveness of the design of PSC after studying losses
- Capable of analyzing the PSC element and finding its efficiency.
- Design PSC beam for different requirements.

Course Title: EARTHQUAKE ENGINEERING
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**17CV831**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course Objectives: This course will enable students to learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake)

L1,L2,L3

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

L1,L2,L3

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

L1,L2,L3

Module -4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

L2,L3,L4

Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

L2,L3,L4

Course outcomes: After studying this course, students will be able to:

1. Acquire basic knowledge of engineering seismology
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry structures thorough exposure to different IS-codes of practices.

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

- Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
- S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
- Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
- T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

Reference Books:

1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

Course Title: HYDRAULIC STRUCTURES
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**17CV832**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS – 03		**Total Marks-100**	

Course objectives: This course will enable students to;

- Analyze and design gravity dams.
- Find the cross-section of earth dam and estimate the seepage loss.
- Design spillways and aprons for diversion works.
- Design CD works and chose appropriate canal regulation works.

Module -1

Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries.

L2, L3

Module -2

Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.

L2, L3

Module -3

Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices.

Diversion Head works: Design of aprons- Bligh's and Koshla's theory, Simple Problems

L2, L3, L4

Module -4

Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.

L2, L3

Module -5

Canal Regulation Works: Introduction, Function of a regulator.

Canal falls: Necessity and types.

Canal outlets: Necessity and types.

L2, L3

Course outcomes: After studying this course, students will be able to:

- Check the stability of gravity dams and design the dam.
- Estimate the quantity of seepage through earth dams.
- Design spillways and aprons for various diversion works.
- Select particular type of canal regulation work for canal network.

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. Punmia and PandeyLal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3. K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard

Publications, New Delhi.

Reference Books:

1. R. K. Sharma, “Text Book of Irrigation Engineering and Hydraulic Structures”, Oxford and IBH, New Delhi.
2. P. N. Modi, “Irrigation, Water Resources and Water Power”, Standard Book House, New Delhi.

Course Title: PAVEMENT DESIGN
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**17CV833**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course objectives: This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

Module -1

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above

L2, L3,L4

Module -2

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above

L5,L6

Module -3

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflectometer, GPR method. Design factors for runway pavements, Design methods for

Airfield pavement and problems on above

L4,L5

Module -4

Stresses in Rigid Pavement : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above

L4,L5,L6

Module -5

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints

L4,L5

Course outcomes: After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, burmister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky

Reference Books:

1. Yoder & wit zorac , "Principles of pavement design", John Wiley & Sons.
2. Subha Rao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design" , University Press.
4. Relevant recent IRC codes

Course Title: ADVANCED FOUNDATION DESIGN
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**17CV834**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks-**	**100**

Course objectives: This course will enable students to

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course (15CV53)
2. Develop profound understanding of shallow and deep foundation analyses
3. Develop understanding of choice of foundation design parameters
4. Learn about cause and effect of dynamic loads on foundation

Module -1

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

L1,L2

Module -2

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure

L2,L3

Module -3

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

L1,L2,L3

Module -4

Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.

Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

L1,L2,L3

Module -5

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

4. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
5. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles
6. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons
7. Understand basics of analysis and design principles of machine foundations

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., India
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

Reference Books:

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India
4. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

Course Title: INTERNSHIP /PROFESSIONAL PRACTICE As per Choice Based Credit System (CBCS) scheme] SEMESTER:VIII			
Subject Code	**17CV84**	**IA Marks**	**50**
Number of Lecture Hours/Week	**Industry Oriented**	**Exam Marks**	**50**
Total Number of Lecture Hours	**Industry Oriented**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to get the field exposure and experience

Note: Internship /Professional Practice:

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organisations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organisation should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.
6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.