SYLLABUS FOR B.TECH. PROGRAMME IN CIVIL ENGINEERING (3rd to 8th Semester)

UNIVERSITY OF KASHMIR
SRINAGAR

10th November 2021

(Batch 2020 & onwards)

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

B.TECH IN CIVIL ENGINEERING
UNDER THE CHOICE BASE CREDIT SYSTEM (CBCS)

Code	Nomenclature
ESC	Engineering Science Courses
BSC	Basic Science Courses
PCC	Professional Core Course
PEC	Professional Elective Course
OEC	Open Elective Course
ISE	Internal Semester Evaluation
MSE	Mid Semester Evaluation (35 Marks)
ESE	End Semester Evaluation

Code	Nomenclature
HSM	Humanities and Social Sciences including Management
PSI	Project work, Seminar and Internship
L	Lecture
T	Tutorial
P	Practical
IA	Internal Assessment (Assignment + Quiz/ Viva Voce (10 Marks) + Attendence (5 Marks)
ESE	End Semester Evaluation (50 Marks)

Semester-3 (Three)						Examination Scheme (Distribution of Marks)			
						ISE			
Course Code	Course Title	L	T	P	Credits	MSE	IA	ESE	Total
CVL301	Structural Analysis I	2	1	0	3	35	15	50	100
CVL302	Surveying Measurements & Adjustments	2	1	0	3	35	15	50	100
CVL303	Fluid Mechanics I	2	1	0	3	35	15	50	100
CVL304	Building Materials & Construction	2	1	0	3	35	15	50	100
MTH301	Applied Mathematics for Engineers	2	1	0	3	35	15	50	100
XXXYYY	Open Elective Course I	*	*	*	X=2-4	35	15	50	100
XXXYYY	Professional Elective Course I	*	*	*	Y=2-4	35	15	50	100
CVP301	Structural Analysis I Lab	0	0	2	1	50		50	100
CVP302	Surveying Measurements & Adjustments Lab	0	0	2	1	50		50	100
CVP303	Fluid Mechanics Lab I	0	0	2	1	50		50	100
Total					18+X+Y				1000

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Semester-4 (Four)						Examination Scheme (Distribution of Marks)			
						ISE		ESE	Total
Course Code	Course Title	L	T	P	Credits	MSE	IA		
CVL401	Structural Analysis II	2	1	0	3	35	15	50	100
CVL402	Advanced Surveying Measurements	2	1	0	3	35	15	50	100
CVL403	Fluid Flow in Pipes and Channels	2	1	0	3	35	15	50	100
CVL404	Concrete Technology	2	1	0	3	35	15	50	100
CVL405	Computer Aided Civil Engineering Drawing	3	1	0	4	35	15	50	100
XXXYYY	Professional Elective II				X-2-4	35	15	50	100
CVP401	Structure Analysis II Lab	0	0	2	1	50		50	100
CVP402	Advanced Surveying MeasurementsLab	0	0	2	1	50		50	100
CVP403	Fluid Mechanics Lab II	0	0	2	1	50		50	100
CVP404	Concrete Technology Lab	0	0	2	1	50		50	100
CVP400	Local Area Survey	0	0	2	1	50		50	100
Total					21+X				1100

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Semester 5 (Five)						Examination Scheme (Distribution of Marks)			
Course Code	Course Title	L	T	P	Credits	ISE		ESE	Total
						MSE	IA		
CVL501	Design Of Concrete Structures	2	1	0	3	35	15	50	100
CVL502	Geo technical Engineering-I	2	1	0	3	35	15	50	100
CVL503	Water Supply Engineering	2	1	0	3	35	15	50	100
CVL504	Engineering Hydrology	2	1	0	3	35	15	50	100
CVL505	Structural Analysis III	2	1	0	3	35	15	50	100
XXXYYY	Professional Elective III				X=2-4	35	15	50	100
XXXYYY	Open Elective Course II				Y=2-4	35	15	50	100
CVP502	Geo technical Engineering Lab I	0	0	2	1	50		50	100
CVP503	Water Quality Lab	0	0	2	1	50		50	100
CVP505	Structural Analysis Lab III	0	0	2	1	50		50	100
Total					18+X+Y				1000

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Semester-6 (Six)						Examination Scheme (Distribution of Marks)			
						ISE			
Course Code	Course Title	L	T	P	Credits	MSE	IA	ESE	Total
CVL601	Design of Advanced Concrete Structures	2	1	0	3	35	15	50	100
CVL602	Geotechnical Engineering-II	2	1	0	3	35	15	50	100
CVL603	Highway Engineering and Pavement Management System	2	1	0	3	35	15	50	100
CVL604	Quantity Survey & Cost Estimation	2	1	0	3	35	15	50	100
XXXYYY	Professional Elective IV				X=2-4	35	15	50	100
XXXYYY	Open Elective Course III				Y=2-4	35	15	50	100
CVP602	Geotechnical Lab II	0	0	2	1	50		50	100
CVP603	Highway Material Lab	0	0	2	1	50		50	100
CVP607	Industrial Training I	0	0	2	1	50		50	100
CVP608	Seminar	0	0	2	1	50		50	100
Total					16+X+Y				1000

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Semester-7 (Seven)						Examination Scheme (Distribution of Marks)			
						ISE			
Course Code	Course Title	L	T	P	Credits	MSE	IA	ESE	Total
CVL701	Design Of Steel Structures	2	1	0	3	35	15	50	100
CVL702	Irrigation & Hydraulic Structures	2	1	0	3	35	15	50	100
CVL703	Structural Dynamics	2	1	0	3	35	15	50	100
CVL704	Waste Management Technology	2	1	0	3	35	15	50	100
CVL705	Traffic Engineering and Road Facilities	2	1	0	3	35	15	50	100
XXXYYY	Professional Elective V				X=2-4	35	15	50	100
XXXYYY	Open Elective Course IV				Y=2-4	35	15	50	100
CVP703	Dynamics Lab	0	0	2	1	50		50	100
CVP705	Traffic Engineering Lab/ Field Study	0	0	2	1	50		50	100
CVD701	Pre Project	0	0	4	2	50		50	100
CVP708	Industrial Training II	0	0	2	1	50		50	100
Total					20+X+Y				1100

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Semester-8 (Eight)						Examination Scheme (Distribution of Marks)			
Course Code	Course Title	L	T	P	Credits	ISE		ESE	Total
						MSE	IA		
CVL801	Design Of Bridge Structures	2	1	0	3	35	15	50	100
CVL802	Earthquake Resistant Design	2	1	0	3	35	15	50	100
CVD803	Project	0	0	20	10	50		50	100
XXXYYY	Professional Elective Course VI				X=2-4	35	15	50	100
Total					16+X				400

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

1. **List of Professional Elective Courses:**

S.No.	Course Code		Course Name	Credits
1.	PEC-I	CVLP01	Introduction to Civil Engineering	3
2.		CVLP02	Mechanics of Composite Laminate	3
3.	PEC-II	CVLP03	Building Information Modelling	3
4.		CVLP04	Engineering Geology and Seismology	3
5.		CVLP05	Solid Waste Management	3
6.	PEC -III	CVLP06	Green Buildings	3
7.		CVLP07	Assessment and Repair of Structures	3
8.		CVLP08	Advanced Construction Technology	3
9.		CVLP09	Advanced Structural Analysis	3
10.		CVLP10	Disaster Preparedness & Planning Management	3
11.		CVLP11	Design Software (Advanced)	3
12.	PEC -IV	CVLP12	Operation Research & Optimization	3
13.		CVLP13	Quality Control	3
14.		CVLP14	Design of Masonry Structures	3
15.		CVLP15	Railway & Airport Engineering	3
16.	PEC- V	CVLP16	Hydropower Engineering	3
17.		CVLP17	Pre-stressed Concrete	3
18.		CVLP18	Environmental Impact Assessment and Audit	3
19.		CVLP19	Ground Improvement Techniques	3
20.	PEC- VI	CVLP20	Pre-Engineering and Pre-Fabricated Structures	3
21.		CVLP21	Water Shed Management	3
22.		CVLP22	Introduction to Finite Element Method	3

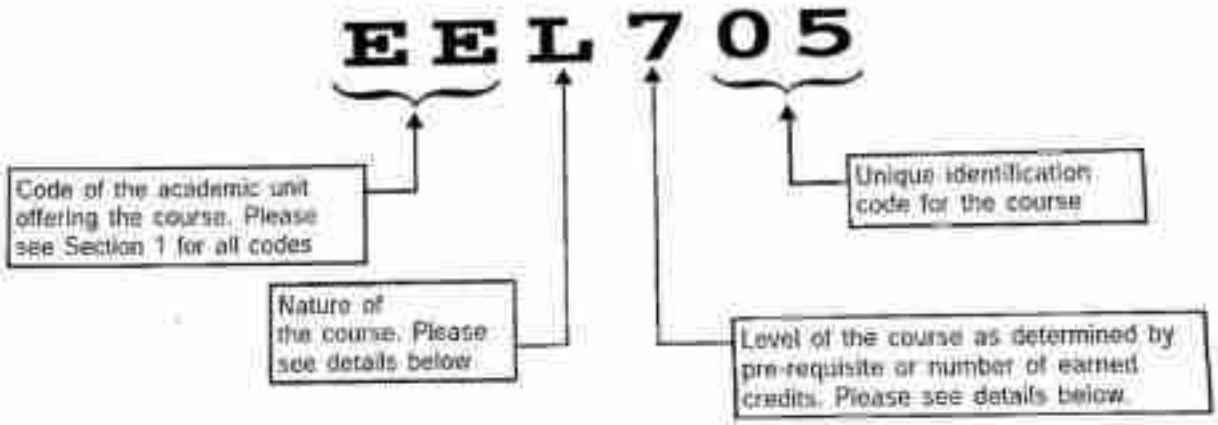
2. **List of Open Elective Courses (OEC)*:**

S. No	Course Code	Course Title	Hours Per Week			Credits
			L	T	P	
1.	CVLOE1	Civil Engineering Materials and Construction Techniques	2	1	0	3
2.	CVLOE2	Metro Systems and Engineering	2	1	0	3
3.	CVLOE3	Disaster Management	2	1	0	3
4.	CVLOE4	Advanced Solid Mechanics	2	1	0	3

* The students can opt for Open Elective Courses Floated by other Departments.

Course Numbering Scheme:

The course numbering scheme followed by the Department of Civil Engineering is as follows:



Code	Description
L	Lecture courses (other than lecture hours, these courses can have Tutorial and Practical hours, e.g. L-T-P structures 3-0-0, 3-1-2-, 3-0-2, 2-0-0, etc.)
P	Laboratory based courses (where performance is evaluated primarily based on practical or laboratory work with LTP structures like 0-0-3, 0-0-4, 1-0-3, 0-1-3, etc.)
D	Project based courses (e.g. Major, Minor, Mini Projects)
LP	Professional Elective Course
H	Lecture Hours

Course Outline for B. Tech. Civil Engineering, Batch 2020 Onwards

Course Code	Course Name	L	T	P	Credits
CVL301	Structural Analysis I	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To introduce the fundamentals of engineering mechanics (static)
- To understand the concept of the behavior and strength of materials in civil engineering.
- To understand the mechanics of materials under various loadings.

Syllabus:

UNIT I: BASIC CONCEPTS OF STRUCTURAL ANALYSIS [H 10]

Structure, structural engineering, Types of loads (point, uniformly distributed and varying), Types of supports and support reactions, free body diagrams, Equations of equilibrium, Principle of Superposition, Axial force, Bending moment, and Shear force in determinate beams (Simply supported beams, cantilever, and overhanging beams) and diagram of shear force and bending moment.

UNIT II: BENDING AND SHEAR STRESS IN BEAMS [H 8]

Theory of simple bending, Flexural formula; Bending Stress and Shear Stress Diagram for Homogeneous beam sections of various shapes, Composite sections and Applications to simpler problems, Shear center.

UNIT III: SLOPES AND DEFLECTIONS [H 10]

Slope and Deflection of determinate beams by Double Integration Method, Moment Area Method and conjugate beam method.

UNIT IV: COMPOUND STRESSES [H 8]

Normal and tangential stresses, Principal stresses and strains, Principal planes, Mohr's circle of stress, Evaluation by analytical and graphical method.

UNIT V: ANALYSIS OF COLUMNS [H 6]

Types of columns - Short and long columns, Stresses in columns; Buckling phenomenon; Euler's and Rankine's theory of Crippling loads, Stresses in eccentrically loaded columns.

Course Outcome:

CO1: To learn the basic concepts of structural analysis and various stresses.

CO2: Determine Shear force and bending moment in beams and understand the

concept of the theory of simple bending.

CO3: Calculate the deflection of beams by different methods and selection of method fordetermining slope or deflection

CO4: To understand the concepts of stress and strain, principal stresses, and principal planes.

CO5: To understand the buckling behavior of columns subjected to axial loads.

Text Books

1. Strength of Materials: Singer and Pytel
2. Strength of Materials: Ramamurtham

References:

1. Mechanics of materials: R C Hibbeler
2. Introduction to Structural Engineering John M.Biggs
3. Analysis of Structures: Thandavamoorthy
4. Determinate Structures: R.L.Jindal

Course Code	Course Name	L	T	P	Credits
CVL302	Surveying Measurements and Adjustments	2	1	0	3

Course Objectives:

- To impart practical knowledge in the field- Measuring distances, Directions, Angles and determining R.L.'s, Areas and Volumes
- To Find out or lay down the Elevations of the points.
- To traverse the area.
- To draw Plans and Maps
- To develop skills of setting and adjust the required instruments

Unit I: - Fundamentals and Compass Surveying. [H 8]

Fundamentals: Definition, Application, Primary Divisions, Classification, importance, types and principles of Surveying, Units of Measurements, Linear and Angular Measurements, Phases of Works in Surveying, Error and Types of Errors in Surveying, Sources of Errors.

Compass Surveying: Compass, its types and parts, Adjustments and errors in Compass Surveying, difference between Prismatic and Surveyor's Compass, Least Count, Basic Definitions, Bearing of a Line, Designation of Bearings, Conversion of Bearings from One System to other, Fore and Back Bearings with numerical, Declination with Numerical, Computations of Angles from Bearings, Computations of Bearings from Angles, Local Attraction, Sources of Local Attraction, Detection of Local At traction, Solution through Numerical, Traverse and its Types.

Unit II: -Chain Surveying: [H 8]

Approximate Methods of Distance Measurements, Measurement by chaining, Accessories used in Chain Surveying, Types of Chains, Types of Tapes, Testing and Adjustment of Chain, Principle of Chain Surveying, Operations in Chain Surveying their explanation and types, Errors in Chain Surveying, Chain and Tape Corrections with Numerical, Obstacles in Chain Surveying With Numerical, Traversing and plotting of Chain Survey, Setting Out of Right Angles by Tape and Chain Only, Setting out of Parallel Lines, Conventional Symbols and Colors.

Unit III: - Plane Table Surveying & Areas and Volumes. [H 8]

Plane Table Surveying: Plane table Surveying and its accessories, Temporary Adjustments of a Plane Table, Orientation and its types, Methods of plane table in viz Radiation, Intersection,

Traversing, Resection, Two point and Three-point problem with methods, errors in plane table surveying, Merits and Demerits of Plane Table Surveying.

Areas and Volumes: General methods of determining areas by dividing into number of triangles, by offset to base line viz Mid-ordinate rule, by average ordinate rule, by trapezoidal rule, by Simpson's one-third rule, by Graphical method, by Instrumental method using Planimeter, by determining volumes viz., Borrow – pits, Reducing and Enlarging the figure, Mass haul Diagram.

Unit IV: - Levelling. [H 9]

Levelling and its Principle, Terms and Definitions, Datum, Bench Mark and its types, Levels and its types, Construction and Parts of Dumpy level, Introduction of Tilting and Auto level, Leveling Staff and its types, Adjustments of level, Methods of Levelling, Booking and Reduction the levels by Line of Collimation Method and Rise and Fall Method with Numerical, Missing data Numerical, Field Book Recording, Difficulties in levelling and errors in Leveling, Curvature and Refraction. Longitudinal and Cross Section in levelling.

Trigonometrical levelling: Cases involved in trigonometrical levelling, bases of the Object being accessible and inaccessible, with derivations and necessary Numerical,

Unit V: - Levelling Applications, Contouring, Permanent Adjustments, Sensitivity [H 10]

Contour, Contouring, Contour Intervals, Horizontal Equivalent, Contour Gradient, Grade Contour, Ghat Tracer and its working, Land features and their forms, Characteristics of Contour lines, Methods of Contouring, Direct method, Indirect method, Interpolation 0f Contours, Drawing Contours, Uses of Contour Maps, Calculation of Reservoir Capacity. Permanent Adjustments of Dumpy Level, Object, Necessity, Test and Adjustment, with Numerical, Sensitivity, Sensitiveness of Bubble tube, Methods of Measuring Sensitiveness with Numerical.

Course Outcome:

Accomplish the abilities/skills for the following.

CO1: To understand the importance of Engineering Surveys, especially Land Surveying.

CO2: To know about the basic Principles and Types of Land Surveying.

CO3: To know the Theory, Working Principles, and Numerical aspects of various Surveying methods: Chain, Compass, Plane Table, and Leveling.

BOOKS RECOMMENDED

1.Surveying Vols. I, II& III by Dr. K.R.Arora

2.Duggal, S.K." Surveying" Vols. I & II, Tata McGraw Hill, New Delhi,2004.

REFERENCES:

1.Kanetkar,T.P. and Kulkarni, S.V."Surveying & Levelling" Vols. I & II PVG Prakashan, Pune.

2 Surveying by S.S Bhavikatti

3.Surveying & Levelling by P.B. Shahni

4.Punmia, B.C."Surveying" Vol. 1&2, Laxmi Publications Pvt. Ltd, New Delhi,2002.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL303	Fluid Mechanics-I	2	1	0	3

COURSE OBJECTIVES:

At the end of the course, students would be able:

- To develop the understanding of basic principles of mechanics of fluids at rest and in motion and their applications in solving the real engineering problems
- To imbibe basic laws and equations used for the analysis of static and dynamic fluids.
- To develop understanding of hydrostatic law, the principle of buoyancy and stability of a
- To teach the importance of fluid flow measurement and its applications in Industries.
- To be able to carry out dimensional analysis for various physical phenomenons occurring in nature.

SYLLABUS:

Unit I: Introduction [H 6]

Physical properties of Fluids: mass density, viscosity, compressibility, vapour pressure, surface tension, capillarity, etc. Ideal Fluids and Real Fluids; Newtonian and non-Newtonian fluids.

Unit II: Fluid Statics [H 8]

Pressure Intensity, Pascal's law; Pressure density-height relationships; manometers; pressure on plane and curved surfaces; centre of pressure; Buoyancy; stability of immersed andfloating bodies, Metacentric height and its determination.

Unit III: Fluid Kinematics [H 10]

Steady and unsteady; Uniform and non-uniform; laminar and turbulent flows; one, two and three dimensional flows; Streamlines, streak lines and path lines; Conservation of mass;

Velocity field and acceleration; continuity equation; rotation, circulation and vorticity; Elementary explanation of stream function and velocity potential; Graphical method of drawing flow nets.

Unit IV: Fluid Dynamics [H 12]

Euler's equation of motion along a streamline and its integration to yield Bernoulli's equation; flow measurement; flow through orifice-meter; Venturimeter; orifices, mouth-pieces, Pitot tube, various types of notches and weirs under free and submerged conditions, aeration of Nappe; momentum equation and its application to stationary and moving vanes.

Unit V: Dimensional Analysis and Hydraulic Similitude [H 6]

Dimensional homogenity, Buckingham's theorem; Important Dimensionless numbers and their significance, geometric, kinematic and dynamic similarity; Model Analysis and similitude

Course Outcome:

CO1: To analyze various Physical properties of fluids

CO2: Analyse and perform calculations on Pressure Intensity, force on a plane and curved surfaces, the center of pressure, and metacentric height

CO3: Perform calculations to determine Steady and unsteady, uniform and non-uniform, laminar and turbulent flows; one, two, and three-dimensional flows; Streamlines, Streak lines, and path lines.

CO4: Determine Euler's equation of motion along a streamline and its integration to yield Bernoulli's equation.

CO5: To carry out dimensional analysis for a physical phenomenon occurring in nature by using Buckingham's theorem

Text Books

1. Kumar, D.S. "Fluid Mechanics and Fluid Power Engineering". Seventh Ed. S.K. Kataria & Sons Publishers, New Delhi, 2008- 2009.

2. Garde R.J. "Engineering. Fluid Mechanics" 1988.

REFERENCES

1.Kumar, K.L. "Engg. Fluid Mechanics", Eurasia Publishing House (P) Ltd. New Delhi.

2.Streter, V.L., Wylie, E.B. and Bedford, K.W. "Fluid Mechanics" McGraw Hill, New York,

3.Asawa, GL., Fluid Flow in Pipes & Cannels 2008? CBS Publishers, new Delhi, 2000.

4.Som, S.K. and Biswas, G., "Fluid Mechanics and Fluid Mechanics", Tata McGraw Hill

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL304	Building Materials and Construction	2	1	0	3

Course Objectives:

- To aid practicing engineers in materials selection and design by understanding the interplay among structure, processing, properties, and performance.
- Introduction about basic building units and their suitability.
- To assess and evaluate the differences in material composition.
- To provides a broad overview of the field and serves.
- To know the pattern of lying of building units.

Syllabus:

Unit I: Introduction to building materials. **[H 10]**

Role of material in construction. Types of materials used in building construction.

Lime: classification/types and testing of lime.

Cement: classification/types and testing of cement.

Fly ash: classification and testing of fly ash.

Mortar: Classifications/types and their use.

Paints and varnish: classifications /types

Timber: classifications/types, seasoning of timber, defects in timber, testing of timber.

Steel: classifications and their tests

Introduction and advantages to advanced materials used in building construction with few case studies.

Unit-II: Stones, Bricks, and Concrete. [H 14]

Stone as building material: Criteria for selecting stones, Tests of stones, Deterioration and Preservation of stonework.

Bricks as building material: Classification of bricks, introduction to Manufacturing of bricks, Special and advanced bricks, defects in bricks Tests on bricks as Per Indian standard Concrete as building material: Classification /types of concrete, ingredients of concrete, tests of

HOD

Concrete, Concrete blocks types of concrete blocks advantages and disadvantages of concrete blocks.

Unit-III: Properties of building materials. [H 6]

Factors affecting properties of building materials, the importance of studying properties of building materials, introducing various properties of building materials e.g., structural properties, thermal, fire-related properties, and acoustic properties.

Unit-IV: Introduction of building and building elements. [H 6]

Building codes and their objectives. Load-bearing structures and framed structures its suitability and importance. Types of loads Introduction to building elements also discuss their types. Foundation, plinth, floors, DPC, walls, slab, stairs, columns, beams, lintel, roofs, plaster, doors, windows, and Ventilators.

Unit-V: Masonry Construction: [H 6]

Definition and terms used in masonry. Brick masonry, characteristics, and requirements of good brick masonry, Bonds in brickwork, Stonemasonry, Requirements of good stone masonry, Classification, of different stone masonry.

COURSE OUTCOME:

CO1: Learner should differentiate the basic materials used in building construction.

CO2: Learner should analyze the requirements of modern material, our traditional one.

CO3: Learner should know building elements and their construction.

TEXTBOOKS

1. Building materials by Parbin Singh.
2. Building materials and construction by Ragawala.

REFERENCES:

1. Building materials and construction by Gurcharan Singh.
2. Building construction by Sushil Kumar

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
MTH301	Applied Mathematics for Engineers	2	1	0	3

Course Objectives:

- To provide the student with different numerical techniques to find approximate numerical solutions to the numerical problems where exact solutions are not available.
- To develop the concepts of making and solving mathematical models of different engineering problems.
- To develop the concepts of writing computer programs for solving engineering problems

Syllabus:

Unit I (H 10):

Numerical solution of Nonlinear Equations, Regula-Falsi Method, Bolzano's Process or Bisection of Intervals. Newton-Raphson Method and its Geometrical significance. Convergence of iterative methods, solutions of systems of nonlinear equations by Newton Raphson method and method of successive approximations.

Unit-II (H 6):

Solution of system of linear equations, Jacobi and Gauss Siedel Method, Eigen value problem and power method.

Unit-III (H 8):

Interpolation and approximation, Finite differences and difference tables, Newton's methods of interpolation, Lagrange's Interpolation Formula, error propagation in difference and error estimation in interpolation. Gauss interpolation formula.

Unit-IV (H 6):

Curve fitting, method of least squares, Fitting a straight line, polynomial, geometric curve, hyperbola, exponential curve and trigonometric functions, multiple regression.

Unit-V (H 6):

Numerical differentiation and Integration, Differentiation of tabulated functions with equal and unequal intervals, Simpson's one-third and three-eight rules, Trapezoidal Rule. Double integrals and Improper integrals.

Unit-VI (H 8):

Numerical Solution of Ordinary and Partial Differential Equations, Numerical Solution of Ordinary Differential Equations, Taylor's Series Method, Runge-Kutta Methods, system of differential equations, classification of Partial differentiation equations, Finite Difference Method for solving partial differential equations.

Note: In each module and for each numerical technique the algorithms and MATLAB programs must be used to solve the problems.

Course Outcomes:

At the end of the course, the student will be able to:

- Write algorithms for solving mathematical problems using numerical techniques.
- Write programs in programming language (MATLAB) to solve mathematical problems using MATLAB.
- Solve the mathematical problems using numerical techniques.

Textbooks:

1. Introductory Methods of Numerical analysis by S.S.Sastry Prentice -Hall of India

References:

1. Numerical Methods using MATLAB by George Lindfield and John Penny, Academic Press
2. An introduction to MATLAB programming and Numerical Methods for Engineers by Timmy Siauw and Alexandre .M Bayen by Academic Press
3. Numerical Methods for Engineering & Scientists by Joe. D Hofmann CRC Press

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP301	Structural Analysis I Lab	0	0	2	1

LIST OF EXPERIMENTS:

1. **Tensile Test of Steel-** To determine yield strength, ultimate tensile strength, percentage elongation, and modulus of elasticity of structural steel (Plot, stress-strain curve)
2. **Tensile Test of Steel-** To determine yield strength, ultimate tensile strength, percentage elongation, and modulus of elasticity of round steel bars (Plot, stress-strain curve)
3. **Tensile & Compressive strength of Timber-** a) Parallel to grains, b) Perpendicular to grains.
4. **Torsion test of Steel:-** To measure the angle of twist, ultimate Torsional Strength Stress-strain curve.
5. **Shear test of steel/Timber-** To measure ultimate shear strength, shear modulus, and Plotshear stress-strain curve.
6. **Impact test of Steel-** To determine the impact strength of notched mild steel test piece using Charpy Test .
7. **Buckling load of columns with various end conditions-** To determine the crippling load of columns with different end conditions and compare theoretical values.
8. **Testing of Bricks and Stones as per IS specifications.**

Course Outcomes:

At the end of the course, students would be able to:

CO1: To determine the behavior of structural members/elements under loading.

CO2: To determine the crippling load of columns with different end conditions.

CO3: To measure the ultimate shear strength of various materials.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP302	Surveying Measurements and Adjustments Lab	0	0	2	1

List of Field Practical's: -

Chain Surveying:

1. Study of Chain and Accessories
2. Laying out the Chain.
3. Ranging a line by Direct Ranging.
4. Ranging a line by Reciprocal Ranging.
5. Chaining a line by Direct Chaining.
6. Chaining a line on slope (Stepping method).
7. Chaining a line by Indirect Chaining. (Using Instruments).
8. Setting-out Right Angles using Tape and Chain when the point is on the Chain.
9. Setting-out Right Angles using Tape and Chain when the point is outside the Chain.
10. Taking offsets and setting-out Right Angles using: -
    (i) Cross Staffs (ii) Optical Squares.
11. Finding out the area using field book method by offsetting.
12. Obstacles in Chain Survey when Chaining round the obstacle is possible
13. Obstacles in Chain Survey when Chaining round the obstacle is not possible.
14. Obstacles in Chain Survey when both Chaining & Ranging obstructed.
15. Testing and Adjustment of Chain.

Compass Surveying:

1. Study of Prismatic Compass
2. Setting out Compass.
3. To find out Fore & back Bearing of a Line.
4. Measurement of Angles between two lines meeting at a point.
5. Compass Traversing

(a) Closed Traverse for Pentagon, Hexagon, Rectangle etc.

(b) Open Traverse of Road, Canal, Railway line.

6. Least Count Of Compass

Plane Table Surveying:

1. Study of Equipment
2. Setting-up the plane table/ Temporary Adjustments.
3. Marking North Direction and Orientation by :
   (i) Magnetic Needle/Trough Compass
   (ii)Back- sighting.
4. Plotting a few points by Radiation Method.
5. Plotting a few points by Intersection Method.
6. Plotting a few points by Traversing Method
7. Finding Instrument Station (Resection) by
8. Resection after orientation by Compass
9. Resection after orientation by back sighting
10. Resection after orientation by Two-point Problem
11. Resection after orientation by Three-point Problem.
    i) Tracing Paper Method
    ii) Graphical Method
    iii) Trial and Error Method

Levelling:

1. Study of Equipment's and Levelling Staff.
2. Temporary Adjustments of Dumpy Level, Auto, & Tilting Level.
3. Fly levelling using Dumpy level.
4. Fly levelling using Tilting level.
5. Check levelling.
6. Field work using Levelling Instruments:-
   i. Taking Staff Readings from Single Instrument Station.
   ii. Taking Staff Readings from Multi Instrument Station.
7. Longitudinal Section of a Road/ Canal/ Dam/ Railway track.
8. Cross Section of a Road/ Canal/ Dam/ Railway track.

9. Taking Staff readings on different stations/ finding difference in level between them by
   i. Height of Instrument Method.
   ii. Rise and Fall Method.

Contouring, Permanent Adjustments, Sensitivity:

1. Contouring of a given area by Spot Leveling. (Squaring Method)
2. Interpolation of Contours by Arithmetical method.
3. To find out the Gradient of a road by Ceylon Ghat Tracer.
4. To lay out the Gradient of a road by Ceylon Gath Tracer.
5. Permanent adjustments of a dumpy level by two methods.
6. Sensitiveness of Bubble tube by two methods.

Course Outcome:

CO1: To accomplish the abilities/skills for the following.

CO2: To handle and use basic Surveying Equipment's.

CO3: To prepare layout plans

CO4: To measure Angles and Bearings

CO5: To prepare different traverses applying different methods of Surveying

CO6: To prepare L-sections, X sections, and contour Maps

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP303	Fluid Mechanics Lab-I	0	0	2	1

Course Objectives:

At the end of the course, students would be able:

- To develop understanding of hydrostatic law, the principle of buoyancy and stability of a floating body, and application of mass, momentum, and energy equation in fluid flow.
- To imbibe basic laws and equations used for the analysis of static and dynamic fluids.
- To teach the importance of fluid flow measurement and its applications in Industries
- To give fundamental knowledge of fluid, its properties, and behavior under various Conditions of internal and external flows.

Syllabus:

1. To determine the metacentric height of a ship model experimentally.
2. To verify Bernoulli's equation experimentally.
3. To determine the coefficient of discharge, coefficient of velocity, and coefficient of Contraction of an orifice or a mouthpiece of a given shape.
4. To calibrate an orifice meter and to study the variation of coefficient of discharge with Reynold's number.
5. To calibrate a Venturimeter and to study the variation of coefficient of discharge with Reynold's Number.
6. To calibrate sharp-crested rectangular and triangular weir.
7. To verify the momentum equation experimentally.

Course Outcome:

The ability to conduct experiments for a given purpose.

CO1: The ability to analyze experimental data and develop empirical equations.

CO2: Verification of basic principles and equations of fluid mechanics.

CO3: The ability to use computers for data analysis, empirical equations, and presentation.

CO4: The ability to work individually and as a team

CO5: The ability to communicate in written reports and oral presentation.

CO6: Demonstrate a practical understanding of the various equations of Bernoulli.

References:

1. "Fluid Mechanics with Laboratory Manual", Bireswar Majumdar, Prentice Hall India Learning Private Limited , January 2010.

2. "Fluid Mechanics & Machinery Laboratory Manual", Dr. N. Kumara Swamy, Charotar Books Dist.-Anand; 1st Edition, January 2014.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL401	Structural Analysis II	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To introduce the basic theory of structural analysis
- To understand the classical methods of structure analysis
- To determine the response of structures under various loadings.

Syllabus:

UNIT I: INTRODUCTION TO INDETERMINATE STRUCTURES [H 8]

Introduction to Indeterminate structure, Degree of Freedom, Kinematic and Static indeterminacy of structures (Statically indeterminate structures, Redundant Frames, degree of indeterminacy), Equilibrium and stability conditions.

UNIT II: ENERGY METHODS OF ANALYSIS OF STRUCTURES [H 12]

Strain Energy Method for analysis of Determinate and Indeterminate Structures; Strain Energy stored due to axial loading, bending, torsion; Principle of Virtual work, Unit load method, Betti-Maxwell's Reciprocal theorem, Castigliano's Ist and 2nd theorem of minimumenergy and its application to the analysis of Internally and Externally indeterminate Beams, Frames and trusses

UNIT III: FORCE METHODS OF ANALYSIS OF STRUCTURES [H 8]

Method of consistent deformation for analysis of indeterminate beams; Continuous beams; Analysis of fixed beams by integration and moment area method, Clepryon's Three- Moment equation.

UNIT IV: DISPLACEMENT METHODS OF ANALYSIS OF STRUCTURES BY SLOPE DEFLECTION METHOD [H 6]

Analysis of indeterminate Beams and Frames (with and without Sway) by Displacement methods using slope deflection method.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

UNIT V: DISPLACEMENT METHODS OF ANALYSIS OF STRUCTURES BY MOMENT DISTRIBUTION METHOD [H 8]

Distribution factors, analysis of indeterminate Beams and Frames (with and without Sway) by moment distribution method yield support.

Course Outcome:

CO1. To determine the static and kinematic indeterminacy of various types of structures

CO2. Determine the strain energy and compute the deflection of determinate beams, frames, and trusses using energy principles.

CO3 Analyze statically indeterminate structures by force methods

CO4. Analyze statically indeterminate structures by the displacement method

Text Books/

1. Indeterminate Structural Analysis by C.K.Wang

2. Indeterminate Structural Analysis by R.L.Jindal.

3. Theory of Structures by S.Ramamrutham R.Narayan

References:

1.Structural mechanics by Norris and Wilbur.

2. RC Hibbler- Analysis of Structures

3. Analysis of Structures: Thandavamoorthy

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL402	Advanced Surveying Measurements	2	1	0	3

Course Objectives:

- To impart a basic understanding of various aspects related to Geometrics and other physical measurements in Civil Engineering.
- To provide knowledge of Comparison between Theodolite, Total Station & Advanced Surveying Instruments.
- To develop skills of setting out Curves in the field using both Total Station and Theodolite.

Unit I: -Theodolite Surveying and Minor Instruments. [H 10]

Theodolite, Classification of Theodolite, Main parts, Technical definitions and terms, Fundamental axis of theodolite, Reading a theodolite, Adjustments of theodolite Fundamental lines and relation between the fundamental lines, Least Count, Vernier scales and its types, Methods of measuring of Horizontal , Vertical angles, and Bearing of a line, Laying of Horizontal and Vertical Angle, Least Count of theodolite, Methods of Prolongation of straight lines, theodolite Traversing and its methods, uses of theodolite, Good practice in theodolite Survey, traverse computations and numerical,, Errors in theodolite.

Minor Instruments. Hand level, Abney Level, Indian Pattern, Clinometer, Ceylon, Ghat Tracer, Planimeter, Pentagraph, Box Sextant.

Unit II: - Tachometry and Setting out of Works. [H 8]

Tachometry. Advantages of Tachometry, Instruments used in Tachometry, Different Systems of Tachometry Measurements, General Principles of Stadia Tachometry, Methods of determination of Stadia Constants of Tachometer, along with the Numerical, Errors in Tachometric Surveying, Degree of Accuracy, Method of holding Staff, Advantages of Holding the Staff Vertical and Normal, Method of Reading the Staff.

Setting out Works: Introduction, marking a control station, Horizontal and Vertical Control, marking building corner, marking a line, controls for setting out, reference grids, definitions viz. stake, post, batter board, cross head, sight rail, boning rod, travelling rod, setting out of Trenches of a Buildings, setting out of culvert, drain, setting out of tunnels and transferring level Under Ground.

Unit III: - Advance Topics in Surveying. [H 9]

Reconnaissance Surveying, Route Surveying. Route Surveying for Highways, Railways and Waterways, Curve, Classification of Curves, Simple Curve and its types, Compound curve, Reverse, Transition curve and its types, Combined Curve, Broken-back , Vertical curve and its types, Definitions, Elements of Simple curve, Designation of Curve, Numerical, Relation between Degree and Radius of Curve, Methods of setting out of Curve by offsets and angles, Necessities of Curves, Functions and Requirements of Curves, Sources of Errors and mistakes, Definitions and Notations, Sight distance, Numerical on Simple and Compound Curves. Hydrographic Survey and Tides.

Unit IV: -Total Station Surveying. [H 9]

Total Station, Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distance meter, Basic Principle, Parts of a Total Station, Accessories, Classification, Electro-optical system, Measuring Principle, Working, Infrared and Laser Total Station instruments, Microwave Total Station instruments, Comparison between Electro-optical and Microwave Total Station, Care and Maintenance of Total Station, Traversing with Total Station, Resection by Total Station, Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey.

Unit V: -Global Positioning Systems & Remote Sensing. [H 6]

Global Positioning Systems: - Basic Concepts, Segments, GPS measurements, Orbit determination and representation, Errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations. Satellite Configuration, Nature Of works.

Remote Sensing: Introduction, Principle of Remote sensing, Classification of satellite orbits, Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing, Advantages and disadvantages.

Course Outcome:

Accomplish the abilities/skills for the following.

CO1: To understand the importance of Engineering Surveys, especially Land Surveying.

CO2: To know about the basic Principles and types of Land Surveying.

CO3: To understand the mechanics concerned with the response of the rock to the force Field of its physical environments.

CO4: To know the theory, working principles, and numerical aspects of various surveying methods viz., Theodolite, Total station, Curves etc,

BOOKS RECOMMENDED:-

1. Surveying Vols. I, II& III by Dr. K.R.Arora

2. S.K." Surveying" Vols. I & II, Tata McGraw Hill, New Delhi,2004.

3. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

REFERENCES:-

1. Basak "Surveying & Levelling" Tata McGraw Hill, New Delhi

2. Kanetkar,T.P. and Kulkarni, S.V."Surveying & Levelling" Vols. I & II PVG Prakashan, Pune.

3. Surveying by S.S Bhavikatti

4. Surveying & Levelling by P.B. Shahni

5. Punmia, B.C."Surveying" Vol. 1&2, Laxmi Publications Pvt. Ltd, New Delhi,2002.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL403	Fluid Flow in Pipes and Channels	2	1	0	3

Course Objectives:

At the end of the course, students would be able:

- To develop an understanding of basic principles of fluid flow through pressure and gravity type conduit systems.
- To gain proficiency in applying the conservation equations to open channel flow problems.
- To develop and apply relationships for hydraulic jumps, surges, and critical, uniform, and gradually-varying flows.
- To determine the losses in a flow system, flow through pipes, boundary layer flow, and flow past immersed bodies.

Syllabus:

Unit I: Boundary Layer Analysis [H 6]

Boundary Layer Analysis-Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, Application of momentum equation, turbulent boundary layer, Laminar sub-layer, Hydrodynamically smooth and rough boundaries, local and average friction coefficients, separation of flow and its control.

Unit II: Flow in Open Channels [10]

Physical Uniform flow, critical depth, Normal depth, Specific energy, Resistance formulae, gradually varied flow equations, Classification of water surface profiles, Computation of water surface profiles, step by step method and graphical integration method. Hydraulic jump, Momentum Principle for open channels, Evaluation of the jump elements. Hydraulically efficient channel sections.

Unit III: Flow through Pipes, Water Hammer and Surge tanks [H 14]

Nature of turbulent flow in pipes, Hydraulic and energy grade lines. Equation for velocity

distribution over smooth and rough pipes, Resistance coefficient and its variation, Nikuradse experiments, Moody diagram, Flow in sudden expansion, Contraction, diffusers, Bends,

Valves and Siphons; Concept of equivalent length, branched pipes in series and parallels, Simple networks, Transmission of power. Sequence of events after sudden valve closure, pressure diagrams, Gradual closure or opening of the valve, Instantaneous closure of valve in a rigid pipe, Instantaneous closure of valve in an Elastic pipe and compressible fluid, Methods of Analysis; Surge tanks, Location of surge tank and types of surge tanks.

Unit IV: Fluid flow past Submerged bodies [H 6]

Drag and lift, Drag on a sphere, cylinder and disc: Lift, Magnus effect and Circulation.

Unit V: Hydraulic Machines [H 6]

Types of Turbines, Description and principles of impulse and reaction Turbines, Unit quantities and specific speed, Runaway speed, Turbine characteristics, Selection of Turbines, Cavitation; Draft tube, Draft tube dimensions, Types of Draft tubes; Centrifugal pumps,specific speed power requirements, Reciprocating pumps.

Course Outcome:

CO1: Analyze and perform calculations on open-channel flows, compute water surface profiles and hydraulic jump characteristics

CO2: Analyze and perform calculations on pipe flow problems involving turbulent flow, understand the concept of friction factor, head loss, and design of pipes, and analysis of pipe- networks.

CO3: Perform calculations for the determination of the drag and lift forces on submerged bodies.

CO4: Analyze the water hammer phenomenon in closed conduits and the concept of surge tanks.

CO5: Determine various hydraulic characteristics of turbines and pumps.

TEXTBOOKS

1.Kumar, D.S. "Fluid Mechanics and Fluid Power Engineering". Seventh Ed. S.K. Kataria & Sons Publishers, New Delhi, 2008- 2009.

2. K. Subramanaya "Open channel Flow" 3rd.Tata McGraw Hill Pub. Co. New Delhi,1999.

3. Garde R.J. "Engineering. Fluid Mechanics" 1988.

REFERENCES:

1.RangaRaju, K.G., "Flow-Through Open Channels," 2nd.Tata McGraw Hill Publishing Company Ltd., New Delhi,1986

2. Nigam "Handbook of Hydroelectric Engg.", 2001.

3. Deshmukh, M.M, "Water Power Engineering" Danpat Rai & Sons, Nai Sarak New Delhi,

4. Asawa, GL "Fluid Flow in Pipes and Channels" CBS Publishing.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL404	Concrete Technology	2	1	0	3

Course Objectives:

To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete, and special concretes.

Syllabus:

UNIT I: CONSTITUENT MATERIALS [H 14]

Cement, Different types , Chemical composition and Properties , Hydration of cement , Testson cement , IS Specifications , Aggregates , Classification ,Mechanical properties and tests asper BIS , Grading requirements , Water , Quality of water for use in concrete. Concrete, Mixing, Placing, and curing of concrete.

UNIT II: CHEMICAL AND MINERAL ADMIXTURES [H 10]

Introduction of shrinkage, Creep, and Maturity of concrete, Shrinkage Accelerators , Retarders, Plasticizers , Superplasticizers, Waterproofers, Mineral Admixtures like Fly Ash,Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline , Effects on concrete properties.

UNIT III: FRESH AND HARDENED PROPERTIES OF CONCRETE [H 6]

Workability, Tests for the workability of concrete , Segregation and Bleeding , Determination of strength Properties of Hardened concrete , Compressive strength , split tensile strength, Flexural strength , Stress-strain curve for concrete , Modulus of elasticity , durability of concrete, water absorption , permeability , corrosion test , acid resistance.

UNIT IV: PROPORTIONING OF CONCRETE MIX [H 6]

Principles of Mix Proportioning, Properties of concrete related to Mix Design, Physical properties of materials required for Mix Design , Design Mix and Nominal Mix , BIS Method of Mix Design -Mix Design Examples

UNIT V: SPECIAL CONCRETES [H 6]

Lightweight concretes, foam concrete, self-compacting concrete , vacuum concrete , High strength concrete , Fiber-reinforced concrete , Ferro cement , Ready mix concrete, SIFCON - Shotcrete , Polymer concrete , High-performance concrete , Geopolymer Concrete.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy

CO2: Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete

CO3: Evaluate the effect of the environment on service life performance, properties, andfailure modes of structural concrete and demonstrate techniques of measuring the Non-Destructive Testing of concrete structure

CO4: Develop an awareness of the utilization of waste materials as a novel, innovative materials for use in concrete

CO5: Design a concrete mix that fulfills the required properties for fresh and hardened concrete

Text Books

1. Textbooks of Concrete technology by M.S Shetty and Neville, Pearson Education; Second edition.
2. Neville, Brooks, Concrete Technology, Addison – Wesley, England

References:

1. Neville A.M., Properties of Concrete, The English Language Book Society and India
2. Waddell, et.al: Concrete Construction Handbook, McGraw Hill Inc

Course Code	Course Name	L	T	P	Credits
CVL405	Computer Aided Civil Engineering Drawing	0	1	4	4

Course Objectives:

At the end of the course, students would be able to:

- To develop the skills and knowledge of 2D as well as 3D modelling in civil engineering drawing.

Syllabus:

Unit I: [H 6]
Basic principles of planning and design in buildings. Sub structure and super structure, Masonry, concrete elements. Building drawing - Plans, Elevations, Sections. Building components, Joinery, fixtures (Electrical & Plumbing), Fittings and Finishes

Unit II: [H 6]
2D Drawing- Introduction of CAD, working the basic commands & toolbars. Drawing of basic shapes and figures

Unit III: [H 10]
Computer aided drafting of single storey residential building with plan, section and elevation details, RCC frames structure, plots layout - locating roads, drainages and other amenities

Unit IV: [H 6]
3D Drawing- Introduction of Autodesk Revit, working with basic commands & toolbars, Modeling of various 3D figures

Unit V: [H 8]
Modeling the dimensional residential building – Creating layers, walls, floors, roofs, internal walls. Adding doors, windows, curtain walls, stairs, furniture. Modifying the elements. Developing multi sections and elevations

Unit VI: [H 6]
Modeling multi storey residential buildings, Adding and modifying families, adding rooms, tags, views, creating sheets and printing. Material takeoff.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Understanding the concepts of building plans and detailing of building elements and various other items

CO2: To inculcate the skills of 2D as well as 3D modeling of building drawings

CO3: To understand the effective utilization of modeling software for developing the building plans

CO4: To apply the skills on developing various required construction documents

Text Books/References:

1. Bhavikatti S.S & Chitawadagi M.V, Building Planning and Drawing, 2014
2. ShahM.G, Building Drawing,McGraw-Hill Inc.,US; 2nd Revised edition 1985.
3. Sharma and Koul, Textbook of Building Construction, S Chand & Co Ltd; 6th Revised edition, 1987.
4. Nevile, A. M., Properties of Concrete, Pearson Education India; 5 edition 2012.
5. Autodesk AutoCAD latest manuals
6. Autodesk REVIT latest manuals

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP404	Concrete Technology Lab	0	0	2	1

Course Objectives:

- To know the concept and procedure of different types of tests conducted on cement, aggregate, and finished concrete.
- To understand the procedure of designing the concrete mix of given specification of its ingredients and appropriate water-cement ratio and admixtures.

LIST OF EXPERIMENTS:

A) FINE AGGREGATES:-

1. Grading and zoning of fine aggregates.
2. Specific gravity of fine aggregates.

B) COARSE AGGREGATES:-

1. Grading and zoning of Coarse aggregates.
2. Determination of water absorption of coarse aggregates.

C) CEMENT:-

1. Determination of standard consistency of cement.
2. Determination of initial setting time and final setting time of cement.
3. Determination of fineness of cement.
4. Soundness test of concrete.

D) CONCRETE:-

1. Determination of consistency of fresh concrete by slump test.
2. Determination of workability of freshly mixed concrete by Compaction factor test.
3. Determination of cube strength of concrete for different mixes and different W/C ratio
4. Determination of tensile strength of concrete by cylinder splitting test.
5. Determination of flexural strength of concrete beam.

On completion of this course, the students will be able to

Course Outcome

CO1 : Perform different tests conducted on cement, aggregate, and concrete at the site.

CO 2: Perform a non-destructive test on concrete.

CO3: Design the concrete mix as per the site conditions and specification of materials available there.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP403	Fluid Mechanics Lab-II	0	0	2	1

At the end of the course, students would be able:

Course Objectives:

- To compare the results of analytical models introduced in a lecture to the actual behavior of real fluid flows
- To discuss and practice standard measurement techniques of fluid mechanics and their applications
- To learn and practice writing technical reports;
- To work on small design projects.

Syllabus:

1. To find friction factors for pipes of different materials.
2. To determine the minor head loss coefficient for different pipe fittings.
3. To determine the surface profile and total head distribution of a vortex.
4. To determine the elements of a hydraulic jump in a rectangular channel.
5. To determine the Manning's rugosity coefficient of a laboratory flume.
6. To obtain the velocity distribution for an open channel and to determine the values of α, β and n.

Course Outcome:

CO1: Utilize basic measurement techniques of fluid mechanics

CO2: Discuss the differences among measurement techniques

CO3: Identify, name, and characterize flow patterns and regimes

CO4: Understand basic units of measurement, convert units, and appreciate their magnitudes.

CO5: Demonstrate a practical understanding of friction losses in internal flows.

Text Books/References:

1. "Fluid Mechanics with Laboratory Manual," Bireswar Majumdar, Prentice Hall IndiaLearning Private Limited, January 2010.

2. Fluid Mechanics & Machinery Laboratory Manual," Dr. N. Kumara Swamy, CharotarBooks Dist.-Anand; 1st Edition, January 2014.

Course Code	Course Name	L	T	P	Credits
CVP402	Advanced Surveying Measurements Lab	0	0	2	1

Course Objectives:

At the end of the course, students would be able

- To handle and use Theodolite for measurement of Horizontal angles & Vertical angles.
- To layout different types of traverses using Theodolite.
- To handle and use Tacheometer
- To set out Works- Foundation markings, Simple Curves, and Transition Curves.
- To handle and use Total Station for measurement of Horizontal/ Vertical distances, traversing, and area calculation.

Syllabus:

List of Field Practical's:-

1. Study about Theodolite.
2. Setting out of Theodolite.
3. To find out the horizontal angles by Ordinary method.
4. To find out the horizontal angles by Repetition method.
5. To find out the horizontal angles by Reiteration method.
6. To find out the Vertical angles.
7. To find out the Bearing of a line.
8. To lay out the Horizontal angle.
9. To lay out the Vertical angle.
10. Prolongation of line by Backsight method.
11. Prolongation of line by Foresight method.
12. Prolongation of line by Double sight method.
13. Traversing with a Theodolite.
14. To find out the Height of a Building / object.
15. Setting out of Total Station.
16. Measurement of Horizontal Angle by Total Station.
17. Measurement of Vertical Angle by Total Station.
18. Traversing by Total Station
19. Calculation of Area by Total Station.

20. Marking Foundation of a Building.
21. Setting out Simple Right- & Left-Hand Curve.
22. Setting out Compound Curve.

Tacheometric Surveying:

1. Study about the Equipment and graduated staff.
2. Temporary adjustments of Tachometer.
3. Determination of constants "K&C" or (f + d & f/i)
4. To find out the distance of a line using (KS + C).

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Measure Horizontal and Vertical angles using Theodolite & Total Station.
CO2: Measure Height of Buildings using Theodolite and Tacheometer, Total Station.
CO3: Measure Horizontal distances using Tacheometer and Total station,
CO4: Setting out of Instruments
CO5: Measure Horizontal/ Vertical distances, Horizontal/Vertical angles, and area of sites

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP401	Structure Lab	0	0	2	1

LIST OF EXPERIMENTS:

1. Deflection of curved beams.
2. Behavior of Portal Frame under different load combinations.
3. Deflection of Truss.
4. Behavior of a cantilever beam under symmetrical and unsymmetrical loading.
5. Analysis of a redundant joint.
6. Verification of Maxwell's Theorem- To verify the Principle of Maxwell's Theorem.

Course Outcomes

At the end of the course, students would be able to:

CO1: To understand the behavior of structural members

CO2 : Ability to furnish and analyze designs and construct structural systems, produce related documents, drawings, and reports, and present objective estimates of the relatedquantities.

CO3: Practical application of principles and understanding various joints in different members.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP400	Local Area Survey	0	0	2	1

Description: Local Area Survey using modern survey equipment like Total Station. The survey must involve day work in a large area near to the Institute. Each student must map and contour the area and record all original field observations, calculations, and plots. The survey will be completed in 08 working days with 02 additional days for data presentation and record preparation.

Course Objectives:

- To impart intensive training in the use of Surveying instruments
- To train the students to appreciate practical difficulties in surveying the field
- Providing an opportunity to the students to develop team spirit
- To train the students for self-management

Syllabus:

Module 1: Introduction to survey, types of survey, the importance of survey in the field.
Module 2: Exposure to different types of survey projects carried out in the present-day industry.
Module 3: Introduction of leveling and handling of the total station.
Module 4: Methods of data collection using a total station.
Module 5: Methods to provide control points.
Module 6: Preparation of site plan and layout.
Module 7: Prepare L-Section and C-Section of the road.
Module 8: Preparation of contour plan of land.
Module 9: Hand on practical session on plotting and mapping by using the software.
Module10: Report making.

Certification:

Certificate of completion will be issued after

(a). Fulfilling attendance criteria i.e., it's **Compulsory** to achieve **100%**.

(b). Certificate of moral ethics during the survey issued by Coordinator program.

(c). To pass the assessment.

Means of Assessment:

1. Practical work 2. Report Writing 3. Presentation 4. Drawing 5. Viva-voce

Award:
Best performance award will be given on the bases of performance of students/Group:

Course Outcomes:

After undergoing the local area survey students will be able to:

CO1: Interpret the contours.

CO2: Work in teamwork.

CO3: Mark a road alignment of (L-section, Cross-section) a given gradient connecting any two stations on the map

CO4: Calculate the earthwork.

CO5: Prepare a topographical plan of a given area.

Course Code	Course Name	L	T	P	Credits
CVL501	Design of Concrete Structures	2	1	0	3

Course Objectives:

At the end of the course, students would be able:

- To understand the properties of reinforced concrete as a construction material
- To develop an understanding of various design philosophies and their differences
- To understand the behaviour and design of RCC beams in flexure and shear.
- To understand behaviour and design of compression members.
- To understand behaviour and design of one way and two-way slabs.
- To understand behaviour and design of isolated footings.

Syllabus:

UNIT I: PROPERTIES OF CONCRETE AND REINFORCING STEEL AND GENERAL DESIGN PHILOSOPHIES [H 6]

Characteristic strength, stress-strain curves for Concrete and steel, IS specifications. Design Philosophies-Working stress method, Ultimate load method & limit state method of design. Analysis & design of structures in flexure/torsion by limit state method.

UNIT II: ANALYSIS & DESIGN OF BEAMS [H 10]

Flexural behaviour of reinforced concrete beams, Analysis &design of Rectangular, T & L Sections, Codal Provisions. Behaviour of RCC Beams in shear, Design for shear, Anchorage & slipping of Reinforcement. Torsion of Beams and design; Detailing of reinforcement as per Codal provisions with reference to IS:456. Serviceability limit state of deflection & cracking—calculation of deflection, Codal requirements.

UNIT III: DESIGN OF COLUMNS [H 8]

Types RCC Columns- Short & long Columns, Analysis and design of Axially loaded RCC Columns, Design of RCC columns for uni-axial and bi-axial moments, Helical Reinforcement

and Transverse Reinforcement.

UNIT IV: DESIGN OF SLABS [H 8]

Design of one-way and two-way RCC slabs with and without corners held down. Introduction to design of slabs by Moment Coefficient Method. Introduction to Flat Slabs.

UNIT V: DESIGN OF FOOTINGS [H 10]

Types of footings, Design of isolated RCC footings and wall footings, Effect of varying water table conditions on design of footings.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: To understand the properties of reinforced concrete as a construction material.
CO2: To understand various design philosophies and their differences
CO3: To analyse and design RCC beams in flexure and shear.
CO4: To analyse and design various compression members.
CO5: To analyse and design one way and two-way slabs
CO6: To design isolated RCC footings.

Text Books

1. Design of Reinforced Concrete: Limit State Design by A.K.Jain.
2. Design of RCC Structures by Sinha.
3. Design of RCC Structures by Karve & Shah.

REFERENCES

1. Design of Reinforced Concrete & Pre-Stressed Concreto Structures by Kong & Evans
2. Reinforced Concrete Design by Pillia Menon.
3. Treasure of RCC Design by Sushil Kumar

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL502	Geotechnical Engineering-I	2	1	0	3

Course Objectives:

To develop analytical and experimental skills to determine various stresses acting on soil material.

Syllabus:

Unit I: Introduction [H 10]

Soil and its formation, various processes and agencies for formation; Types of Soils. Three-phase soil Model, Index properties, and classification of soils.

Unit II: Soil Hydraulics [H 8]

Flow-through soils, Darcy's Law. Permeability Factors and determination in the lab/Field. Steady-state Flow, seepage force, Laplace equation for steady-state flow, flow nets for homogenous embankments with & without toe filters.

Unit III: Soil Compressibility [H 8]

One Dimensional Consolidation, Terzaghi's equation. Consolidation test, e log p curves. Consolidation settlement, time required for settlement. Compaction, laboratory compaction tests, proctor compaction, compaction curve, and control on field compaction.

Unit IV: Effective Stress & Stress Distribution [H 6]

Total & effective stresses, Pore Water pressure, Stress distribution under concentrated load. Westergard's and Boussinesq's method

Unit V: Soil Investigation & Clay Mineralogy [H 10]

Laboratory & Field Investigation. Sub-soil exploration, Penetration methods, Geo-Physical methods, electromagnetic method, electric resistivity method, and Seismic method. Minerals Present in clay, dependence of behavior of clay on type of mineral.

Course Outcomes:

CO1: To classify soils and understand their index properties.

CO2: To analyze flow through soils.

CO3: To perform/demonstrate soil compaction tests.

CO4: To determine stress distribution in soils.

CO5: To utilize various methods of soil investigation in field and laboratory.

Text Books

1. Soil Mechanics by Gopal ranjan
2. Theoretical Mechanics by Terzaghi& Peck
3. Soil Mechanics by S.B. Saighal

REFERENCES:

4. Geotechnical Engineering by Purushotama Raj
5. Geotechnical Engineering by C.Venkataramiah
6. Geotechnical Engineering by K.R.Arora.
7. Geotechnical Engineering by S.K.Garg

Course Code	Course Name	L	T	P	Credits
CVL503	Water Supply Engineering	2	1	0	3

Course Objectives:

At the end of the course, students would be able:

- To impart various aspects of the supply of pure and safe drinking water to communities and the conservation of water.
- To make technology choices to deal with water quality issues, operate and maintain working treatment systems, and troubleshoot the problems in these systems.
- To design, construct, operate and maintain a water conveyance system.
- To acquire sufficient knowledge on the basic design of conventional and advanced water treatment processes.

Syllabus:

Unit I: Water Quality [H 6]

Introduction and scope, Various sources of water, Water Quality Parameters, significance, and codal recommendations of limits for various uses

Unit II: Water Consumption and Water Distribution [H 10]

Water Consumption for various uses, variation in Demand & Supply. Population forecasting methods, storage capacities of reservoirs, Systems of distribution, distribution networks

Unit III: Water Transportation [H 6]

Pipe designs, network analysis by various methods, pipe materials and joints, leakage prevention.

Unit IV: Treatment Process [H 14]

Water treatment: Conventional treatments like screening, sedimentation, Coagulation, Filteration, Disinfection. Advanced treatments like Ozonation and Activated carbonadsorption, etc.

Unit V: Sanitation [H 6]

Water supply in buildings, Plumbing, and fixtures, Sanitation of buildings

Course Outcome:

CO1: Select appropriate treatment for raw water useful for domestic as well as construction purpose.

CO2: Maintain the pipe-network for the water supply system effectively.

CO3: Calculate and Estimate the impurities present in water used for domestic as well as construction works.

CO4: Prepare layout plan and maintain water distribution and sewer networks.

CO5: Test raw water as per the standard practices

CO6: Plan and implement house plumbing work effectively.

Text Books

1. A textbook of "Water Supply and Sanitary Engineering" S.K.Garg, Khanna Publishers, Revised Edition,2010.

2. A textbook of "Water Supply and Sanitary Engineering" S.K.Hussain, Oxford & IBH publishers, 2017.

References

1.Hammer, M.J. and Hammer, M.J., "Water and WastewaterTechnology", 4th Ed..

2. Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill, 1998.

3. "Water Supply And Sanitary Engineering", Rangwala ; Charotar Publishing House Pvt. Ltd.;Edition : 29th Revised and Enlarged Edition : 2016.

4. Metcalf and Eddy, "Wastewater Engineering", 4th edition, McGraw-Hill, 2003.

Course Code	Course Name	L	T	P	Credits
CVL504	Engineering Hydrology	2	1	0	3

Course Objectives:

At the end of the course, students would be able:

- To impart the knowledge for understanding elementary aspects of hydrology.
- To know diverse methods of collecting the hydrological information, which is essential to understand surface and groundwater hydrology.
- To know the basic principles and movement of groundwater and properties of groundwater flow.
- To impart the knowledge of Fluvial Hydraulics for use in the planning, design, and management of water resources projects.

Syllabus:

Unit I: Hydrology [H 10]

Scope and applications of Hydrological cycle; precipitation measurement by rain Guages, gauge network adequacy, missing data determination, and consistency. Hyetographs andmethods of determining mean rainfall. Hydrological Abstractions: Evaporation, Transportation, Interception, Depression storage, Infiltration. Water Budget Equation.

Unit II: Streamflow [H 10]

Streamflow measurement: Direct and indirect methods, stage- discharge relationship. Factors affecting Runoff. Rainfall-Runoff relationships. Unit Hydrograph, Peak Flow, velocity & Discharge measurements. Hydrographs: Definition, components, base flow separation, effective rainfall, unit hydrograph, derivation, applications, and limitations.

Unit III: Flood Estimation and Groundwater [H 8]

Occurrence and distribution of floods; various flood estimation methods; viz Rational method, empirical methods, U.H. method, Design flood definition. Flood routing: Reservoir and channel routing. Occurrence and distribution of groundwater, types of aquifers, aquifer properties, Darcy's law, steady one- dimensional aquifer flow, Well Hydraulics: Steady flow

to wells in confined and unconfined aquifers

Unit IV: Reservior Design Studies [H 8]

Types of reservoirs, storage capacity, Mass-curve technique, fixation of capacity, safe yield, reservoir sedimentation: trap efficiency, capacity- inflow ratio, life of reservoirs.

Unit V: Fluvial Hydraulics [H 6]

Principles of sediment transport, critical tractive force, Shield's plot, Bed, and suspended load. Bed movement, White's Theory, Rigid and loose Boundaries.

Course Outcome:

CO1: To perform multiple analyses on precipitation data.

CO2: To estimate various components of the hydrological cycle such as streamflow, runoff, Evapotranspiration and infiltration.

CO3: To measure components of hydrological water balance in the field.

CO4: To perform hydrograph analysis and estimate the magnitude of flood.

CO5: To determine reservoir capacity and sedimentation.

CO6: To perform steady-state analysis of groundwater movement.

Text Books

1. Subramanaya, K. "Engineering Hydrology" Tata McGraw Hill, New Delhi, 2001.
2. Linsely, K., Kohler, A. and Paulhus L.H. "Hydrology for Engineers" McGraw Hill Book Company Inc. New York, 1975.
3. Ragunath, H.M. "Hydrology Principles Analysis and Design" New Age International (P) Ltd Publishers., New Delhi, 2005.

References

1. Garde, R.J. and RangaRaju K.G. "Mechanics of sediment transportation and alluvial stream problems". New Age International (P) Ltd. Publishers, New Delhi, 1994
2. Arora, K.R. "Irrigation Water power and water Resources Engineering". Standard Publishers Distributors, Delhi, 2002.
3. Wilson, E.M. "Engineering Hydrology" ELBS, English Language book Society/

Macmillam Education Ltd., London, 1999.

4. Asawa, G.L. Irrigation and Water Resources Engineering, New age International Publishers,2005.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL505	Structural Analysis III	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To learn the concept of drawing influence lines for determinate and indeterminate structures.
- To analyze the arches, cables, and suspension bridges.
- Understand the concept of plastic analysis of beams.

Syllabus:

UNIT I: INFLUENCE LINE DIAGRAMS FOR DETERMINATE STRUCTURES: [H 10]

Influence line for reactions in statically determinate beams, Principles of influence lines, and application to determinate structures (Beams, Trusses, Arches). Criteria for absolutemaximum moment and shear under a series of moving loads. Muller Breslau's Principle.

UNIT II: INFLUENCE LINE DIAGRAMS FOR INDETERMINATE STRUCTURES: [H8]

Influence line for shear force, bending moment, and support reaction components of indeterminate beams and arches.

UNIT III: ARCHES [H 8]

Types of Arches, Analysis of Three Hinged Arches, Two Hinged and Fixed Arches-Parabolic Arches and circular arches, Rib Shortening and temperature Effects.

UNIT IV: CABLES AND SUSPENSION BRIDGE [H 6]

Statics of suspension cable, Cables supported at different levels, Temperature effect, Analysis of suspension bridge with and without stiffening girders.

UNIT V: PLASTIC METHOD: [H 10]

Concept, Assumptions, Shape Factor for different cross-section, Collapse Load, Load Factor, Plastic modulus of a section, Plastic moment of resistance, Theorems of plastic analysis, Methods of analysis, Computation of Collapse load for a fixed beam and continuous beam.

Course Outcome:

CO1: Draw influence lines for statically determinate structures and calculate critical stressresultants.

CO2: Understand the Muller-Breslau principle and draw the influence lines for staticallyindeterminate beams.

CO3: Analyze three-hinged, two hinged, and fixed arches.

CO4: Analyze the suspension bridges with stiffening girders.

CO5: Understand the concept of Plastic Analysis and the method of analyzing beams.

Text Books

1. RC Hibbler- Analysis of Structures

2. Theory of Structures by S.Ramamrutham R.Narayan

References

3. Indeterminate Structural Analysis by C.K.Wang

4. Indeterminate Structural Analysis by R.L.Jindal.

5. Structural mechanics by Norris and Wilbur.

6. Analysis of Structures: Thandavamoorthy

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP503	Water Quality Lab	0	0	2	1

Course Objectives:

At the end of the course, students would be able:

- To introduce students to how the standard environmental experiments relating to water and wastewater quality are performed.
- To know which tests are appropriate for given environmental problems, statistically interpret laboratorial results and write technical reports, and apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.
- To Understand how to classify and analyze various quality parameters of raw water.
- To make the students as to suggest a required type of treatment to purify raw water.
- To make the students as analysts to differ quality requirements for industrial waters and domestic waters.

Syllabus:

1. To measure the dissolved oxygen concentration of a water sample.
2. To determine the pH of the given wastewater sample
3. To determine the turbidity of the given sample of wastewater using nephelo turbidity meter.
4. Determination of Total, Suspended and Dissolved Solids in a given water sample.
5. Determination of Alkalinity of a given water sample.
6. Determination of Chlorides of a given water sample.
7. Determination of Acidity of a given water sample.
8. Determination of Total Hardness (Soda-Reagent Method.) of a given water sample.
9. Determination of Colour/Odour of a given water sample.
10. Determination of Dissolved Oxygen content of a given water sample.

Course Outcome:

CO1: Perform standard environmental experiments relating to water quality, and know which tests are appropriate for environmental problems.

CO2: Statistically analyze and interpret laboratory results.

CO3: Analyse various physico-chemical and biological parameters of water in case of quality

requirements.

CO4: Understand and use the water and wastewater sampling procedures and sample preservations.

CO5: Demonstrate the ability to write clear technical laboratory reports.

REFERENCES:

1. "Water supply Engineering", by Santhosh Kumar Garg, Khanna publishers.
2. "Chemical analysis of water and soil", by Dr. KVSG Murali Krishna, Reem.
3. "Practical Manual of Water Quality Analysis", Chemical IndustryPress, January 2012.
4. "Laboratory Manual for the Examination of Water, Waste Water, and Soil," Hans Hermann Rump, Wiley-VCH; 3 edition, January 2000.

Course Code	Course Name	L	T	P	Credits
CVP502	Geotechnical Engineering Lab-I	0	0	2	1

Course Objectives:

To understand the laboratory tests used for the determination of physical, index, and Engineering properties of soil.

LIST OF EXPERIMENTS:

1. Soil Identification Tests
2. Water Content Determination Test
3. Field Density Measurement
4. Specific Gravity Test
5. Sieve Analysis Test
6. Sedimentation Analysis Test
7. Atterberg and Shrinkage Limits
8. IS Light Heavy Compaction Tests
9. Permeability Tests

Course Outcomes:

CO1: To determine basic soil properties and consistency limits.
CO2: Draw the complete particle size distribution curve of a given soil.
CO3: Determine the Compaction characteristic of a given soil.
CO4: Determine the Permeability of any given soil specimen.

References:

1. IS codes relevant to each test.
2. C. Venkatramaiah, Geotechnical Engineering, New Age International publishers, 2012.
3. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age InternationalPublishers, 2012
4. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers, 2011.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP505	Structural Analysis Lab-III	0	0	2	1

List of Experiments

1. Visiting the site, to know about practical aspects of structural planning, Orientation of columns, structural layout, reinforcement detailing drawings and its importance.
2. Analysis of two hinged arches.
3. Verification of Horizontal Thrust in a 3-Hinged Arch- To evaluate experimentally horizontal thrust in a 3-Hinged arch and draw an influence line diagram for the horizontal thrust.
4. Visiting the site, to know about practical aspects of Bridge and its various Elements.

Course Outcomes

At the end of the course, students would be able to:

CO1: To understand the behavior of structural members

CO2 : Ability to furnish and analyze designs and construct structural systems, produce related documents, drawings, and reports, and present objective estimates of the related quantities.

CO3: Practical application of principles and understanding various joints in differentmembers.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL601	Design of Advanced Concrete Structures	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To understand behavior & design of various types RCC footings
- To understand the behavior & design of cantilever & Counter fort Retaining wall.
- To understand the behavior & design of liquid retaining Structures
- To understand the behavior & design of shell Structures
- To understand the basics of prestressed concrete.

Syllabus:

UNIT I: FOUNDATIONS [H 10]
Introduction, Various types of RCC footings, the design of RCC footings, various types of combined footings.

UNIT II: RETAINING WALLS [H 8]
Stability analysis of retaining walls, design of cantilever and counter-fort type RCC retaining walls.

UNIT III: LIQUID RETAINING STRUCTURES [H 8]
Design of circular & rectangular water tanks with reference to IS: 3370.

UNIT IV: SHELL STRUCTURES [H 8]
Membrane analysis of spherical & conical domes by statical methods. Design of domes & ring beams.

UNIT V: PRE-STRESSED CONCRETE [H 8]
General principles, methods of pre-stressing, pre-tensioning & post-tensioning, losses in pre-stress. Design of rectangular beams.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Design RCC footings (Isolated footings and various types of combined footings)
CO2: Design cantilever and counterfort type RCC retaining walls.
CO3: Design circular and rectangular water tanks with reference to IS: 3370.

CO4: Design of domes and ring beams
CO5: Have basic knowledge of prestressed concrete

Text Books

1.Design of footings by Kurien
2. Design of RCC structures by Jain & Jai Krishan
3. Design on Advanced Concrete Structures by Bavakatti
4. Pre-stressed concrete structures by Krishna Raju

REFERENCES

1.Design of RCC Structures by B.C Punamia
2.IS 456 (2000) Plain and Reinforced Concrete- Code of Practice
3.IS 3370 Part (I-IV) -Code of Practice
4. IS 1343- Prestressed Concrete- Code of Practice

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL602	Geotechnical Engineering-II	2	1	0	3

Course Objectives:

- To understand various properties of soil And understand the concept of earth pressure and slope stability.

Syllabus:

UNIT I: [H 8]
SHEAR STRENGTH: Shear strength concept. Mohr's Coulumb equation. Laboratory determination. Triaxial compression test under different Drainage conditions, viz undrained, drained and consolidated, direct shear test. Unconfined compression test. Strength envelope

UNIT II:
BEARING CAPACITY AND FOUNDATIONS: [H 10]
Basic definitions and methods of determination, Prandtl's solution. Terzaghi's solution for ultimate bearing capacity. Size effects. Effects of rigidity of footings. Plate load test. Design principles for footing and rafts. Foundations on clay sand sands Foundations types and applications, Pile foundation types, classification and determination of load-carrying capacity, dynamic and static methods. Pile load test, pile groups efficiency of pile groups.

UNIT III:
EARTH PRESSURE: [H 10]
Lateral earth pressure. Rankine's theory Active and Passive States. Lateral earth pressure under various conditions, like surcharge, sloping backfill, and high water table behind the wall. Earth pressure diagrams. Total thrust. Tension Cracks.

UNIT IV: [H 6]
STABILISATION:
Methods of stabilization. Brief introduction to each of the methods of stabilization such as shotcrete, geo reinforcement

UNIT V:
STABILITY OF SLOPES: [H 8]
Infinite slopes, conjugate stresses, stability number Swedish and Friction circle methods. Submergence case, complete drawdown case, Steady seepage case.

Course Outcome:

CO1: To equip the knowledge of strength and mechanical behaviour of soils.
CO2: To understand the concepts of bearing capacity and foundations.
CO3: To understand the practical aspects of earth pressure and retaining structures.
CO4: To understand the concepts of slope stability along with its practical application

Text Books

1. Ranjan, G and Rao, P.,"Basic and Applied Soil Mechanics", New Age International Pvt. Limited, New Delhi, 2002.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, Delhi, 1987.
3. Singh, A., "Basic Soil Mechanics & Foundations", CBS Publishers & Distributors, 2004.
4. Taylor, D.W., "Fundamentals of Soil Mechanics", Wiley, New York, 1948.

References

1.Bowles, J.E., "Physical and Geotechnical properties of Soils", McGraw Hill Publishers, 1979.
2.Terzaghi, K., "Theoretical Soil Mechanics", Wiley, New York, 1943.
3.Terzaghi, K., Peck, R.B. and Mesri, G., "Soil Mechanics in Engineering Practice", 1996.
4.Jumikis, A.R. "Soil Mechanics", R.E. Krieger Pub. Co., Florida, US, 1984.
5.Purushothama, P. "Geotechnical Engineering", McG00raw Hill Education, 1995.
6.Venkataramaiah, C., "Geotechnical Engineering", New Age International Publishers, Daryaganj, New Delhi, 1995

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL603	Highway Engineering & Pavement Management System	2	1	0	3

Course Objectives:

To provide basic knowledge in transportation so that students can understand and solve transportation-related problems and design for highway mode of transportation, focusing on highway users' characteristics, geometric and pavement design, traffic engineering, and transportation planning.

SYLLABUS

UNIT-I: Introduction [H 4]

History of roads, Classification of roads, Introduction to Modes of transportation & its socio-economic impact

UNIT-II: Alignment design [H 10]

Route survey and highway location. Geometric design: cross section elements; sight distances, horizontal and vertical alignment

UNIT-III: Pavement design [H 10]

Types of pavement, Factors affecting pavement design, Methods of flexible pavement design, Introduction to the design of rigid pavement.

UNIT-IV: Highway materials and construction [H 10]

Properties of flexible pavement materials, Bituminous of concrete mix design (Marshall Method), Introduction to advanced & recycled road materials.

UNIT–V: Pavement management system [H 8]

Introduction to Pavement Management system (PMS). Concept of PMS. Importance of PMS in modern road construction. Data requirement & collection methods.

COURSE OUTCOME

Students who complete this course will be able to:

CO1: Give necessary information, prepare a horizontal and vertical alignment, including superelevation, which complies with AASHTO standards.

CO2: Understand the relationship between the environment and transportation infrastructure and its importance in project development of transportation projects.

CO3: Utilize CAD software to prepare a plan, profile, and x-sections depicting a typical roadway design.

CO4: Prepare well-written design narratives documenting the various parameters and standards used in the design process so another individual could review the work and understand what decisions and assumptions were used and why.

CO5: Understand the mathematics behind the development of tables and charts for determining highway design criteria.

CO6: Familiar with professional and ethical issues related to liability and conduct.

TEXTBOOK

1. Khanna, S.K. and Justo, C.E.G. 2002. "Highway Engineering". Nem Chand Brothers, Roorkee.

2.Bhanot, K.L.1990. "Highway Engineering", S. Chand and Company (P) Ltd., New Delhi.

REFERENCES

1.Rao, G.V. 1996." Principles of Transportation and Highway Engin0eering", Tata McGraw Hill, New Delhi

2.Pavement Design and Management Guide by Transportation Association of Canada, Ottawa, Ontario, Edn. Dr. Ralph Haas,

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL604	Quantity Survey and Cost Estimation	2	1	0	3

Course Objectives:

- To produce a forecast of the probable cost of a future project.
- Identify and prioritize cost-saving opportunities.
- To determine the true (full) costs of each item of the project.
- To evaluate the target of *road* construction project
- To assess and evaluate the differences in the value of the assets.

Syllabus:

UNIT I: Introduction to Estimation. [H 5]

Definition and importance of Quantity Surveying and Cost estimation. Definition of items of a work and their units. Data required for the preparation of an estimate. Types of preliminary Estimate and Detailed estimate. Forms used in estimating.

UNIT II: Detailed Estimation. [H 20]

Introduction to estimates of different types of buildings. Estimates of walls. Methods of building estimate; Longwall and short wall method, centerline methods. Estimate of masonry platform. Estimate of a masonry tank. Estimate of a single room building. Estimate of two room building with CGI roof over wooden trusses /over steel /R.C.C slab. Estimate of a RCC Beams. RCC Column. Bar bending schedule.

UNIT III: Analysis of Rates [H 6]

Definition and importance of analyses of rates. Introduction to Preparing of rates, Labour schedule, material schedule, and rate schedule. Analysis of rates for item of work of buildings e.g., Earthwork in the foundation, lime concrete in Foundation, concrete in foundation and superstructure, Brickwork in foundation and superstructure, stone masonry, RCC masonry, RCC work, Plastering, color washing, woodwork, DPC, and steelwork, etc.

UNIT IV: Estimation of Roads. [H 4]

Methods of estimating earthwork: (a) Mid Sectional Area Method. (b) Mean Sectional Area Method(c) Prismoidal Formula Method. (d) Graphical Method.

Estimate of a metallic road: Estimation of 3-layer metallic road. Introduction about influence of Material variation and cost in layered metallic road.

UNIT V: Valuation & Specifications [H 7]

Introduction of Valuation. Purpose and importance of valuation of building. Termes used in valuation. Methods of Valuation.

Specifications: General specifications & detailed specifications. Book of specifications. Importance of specifications, cost variation with specifications few examples.

Course Outcomes:

CO1: Give the Students a reasonable idea of the project's cost to help them decide whether the work can be undertaken as proposed or not.

CO2: Learner should be capable enough to analyze the project resources.

CO3: Learner should be able to make DPR of buildings.

CO4: Learner should know the cost variation due to material change in road construction.

CO5: Learner should assess and calculates the property value.

Text books/References:

1. Estimating & Costing by Datta.
2. Estimating & Costing by Mahajan.
3. Cost Estimation: Methods and Tools by Gregory K. Mislick, Daniel A. Nussbaum.
Civil Estimating and Costing by A.K.Upadhyay

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP602	Geo technical Engineering Lab II	0	0	2	1

Course Objectives

- To understand different characteristics of the soil.

List of Experiments:

Expt. No.	Name of the Experiment
1	Consolidation Test
2	Direct Shear Test
3	Unconfined Compression Test
4	Unconsolidated Undrained Triaxial Test
5	Vane Shear Test
6	Consolidated Undrained Triaxial Test
7	Standard Penetration Test
8	Plate Load Test

COURSE OUTCOMES

CO1: Determine consolidation characteristics of a given soil sample.
CO2: Obtain shear strength parameters of different types and consistencies of soils and under different drainage conditions.
CO3: Perform a Standard Penetration test of soil to obtain SPT (N) – value.
CO4: Determine allowable soil pressure of soil foundation system by vertical plate load test

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP603	Highway Material Lab	0	0	2	1

COURSE OBJECTIVES

The objectives of this course are to learn the transportation lab fundamentals of :

- Bitumen and & its engineering behavior.
- Aggregate & its engineering behavior.

LIST OF EXPERIMENTS:

1. TESTS ON AGGREGATE-

a) Aggregate grading
b) Specific Gravity
c) Crushing
d) Abrasion
e) Impact
f) Soundness
g) Flakiness
h) Shape
i) Fineness Modulus
j) Silica content
k) Silt content,
l) Alkalinity.

2. TESTS ON BITUMEN

a) Viscosity
b) Penetration,
c) Softening point
d) Flash & Fire Point.
e) Ductility, Specific gravity

3. TESTS ON BITUMEN-MIXES

a) Marshall Stability Method of Bitumen Mix Design
b) Marshall Flow Value Test
c) Stripping Test

COURSE OUTCOME

Students who complete this course will be able to:

CO1: Identify engineering properties of aggregate.

CO2: Identify the grade & properties of bitumen.

REFERENCES

1. Khanna, S.K. and Justo, C.E.G. 2002. "Highway Engineering". Nem Chand Brothers, Roorkee

2. Highway Materials and Pavement Testing by Khanna, Justo &Veeraragavan, Nem Chand Brothers, Roorkee

3. Material Testing Laboratory Manual by Kukreja, Kishore &Chawla, Standard Publishers, NaiSarak, Delhi

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP607	Industrial Training-I	0	0	2	1

Course Objectives:

At the end of the course, students would be able to:

- Gain Knowledge of Various Types of Field Projects
- Recognize the importance of material manufacturing in Civil Engineering
- Recognize the methods of Construction
- Gain knowledge of Quality checks at Construction sites

Syllabus:

The Training is composed of Two Parts:

1. Visiting various material manufacturing plants/sites and Project Sites and collecting information about the Project, its cost, duration, methods of manufacturing, analysis, design, and construction of the site. Also, to gain knowledge on Quality evaluationat different plants or sites.
2. Collecting all data, writing a Short technical report, and demonstrating for evaluation before a committee.

Course Outcome:

The composition of the committee consists of three Faculty members of the Department.

To accomplish the abilities/skills for the following.

CO1: Enhance Practical Knowledge of the Manufacturing and Construction Sites.

CO2: Building Professional Know-how.

CO3: Refreshing the Theoretical Subject Knowledge.

Textbooks/References:

1. Engineering Training Manuals by US Army
2. Dennis Lemaitre, Training Engineers for Innovation. 2018
3. M. MacDonald Steels, Effective Training for Civil Engineers. 1994

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP608	Seminar	0	0	2	1

COURSE OBJECTIVES

The objectives of this course are:

To encourage and motivate the students to read and collect recent and relevant information from their area of interest confined to the relevant discipline from technical publications including peer-reviewed journals, conferences, books, project reports, etc., prepare a report based on a central theme and present it before a peer audience.

A seminar shall be organized at the 7th semester of the Civil Engineering curriculum leading to the Degree of B.Tech in Civil Engineering. The students shall research a topic of their choice, either library research or laboratory research. The students shall be guided in their research work by the staff members of the department. The students shall make a power- point presentation of 15-20 minutes duration on the research work in front of their fellow students under the department's supervision. A discussion on the same topic follows the seminar presentation.

The students shall make a hard-copy of their seminar report & submit it in the Seminar coordinator's office before the intended date of the presentation.

COURSE OUTCOME

On completion of this course, a student will be able to:

CO1: Identify and familiarize with some of the good publications and journals in their field of study.

CO2: Acquaint oneself with the preparation of independent reports, name them based on a central theme, and write abstracts, main body, conclusions, and references to identify their intended meaning and style.

CO3: Understand effective use of presentation tools, generate confidence in presenting a report before an audience and improve their skills in the same.

CO4: Develop skills like time management, leadership quality, and bond with an audience.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL701	Design of Steel Structures	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To study structural steel properties and understand the behavior & design of welded and bolted connections.
- To understand the behavior and design of tension members.
- To understand the behavior and design of laterally supported & unsupported flexural members.
- To understand the behavior and design of Compression members.
- To learn about the behavior and design of various components of the plate girder.

Syllabus:

UNIT I: CONCEPTS OF DESIGN OF STEEL STRUCTURES [H 10]

Introduction to Structural steel and its properties. Design Philosophies. Bolted, and welded connections and their design.

UNIT II DESIGN OF TENSION MEMBERS [H 6]

Limit State design of tension members, Rolled and Built- up sections. Codal Provisions.

UNIT III: DESIGN OF FLEXURAL MEMBERS [H 8]

Design of flexural member, laterally supported, laterally unsupported, and built- up beams

UNIT IV: DESIGN OF COMPRESSION MEMBERS [H 8]

Buckling phenomenon of compression members, Design of compression members; Rolled and Built- up sec. design of column bases

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

UNIT V: DESIGN OF PLATE GIRDERS [H 10]

Design of plate Girder: General: Components of Plate Girder-optimum depth, bending strength, Shear strength, Shear Buckling, stiffeners, Bearings, Transverse stiffeners.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: To understand the behavior of structural steel and design of bolted & welded connections.

CO2: Design of rolled and built-up tension members.

CO3: Design of laterally supported and unsupported flexural members

CO4: Design of rolled and built-up compression members.

CO5: Design of various components of Plate girder.

Text Books

1) Design of steel structures By Subramanian

2) Steel structures – Design & Behaviour By Salmon & Johnson

3) Design of steel structures By SK Duggal.

References:

1)Design of steel structures By Vizrani and Ratwani

2) IS 800 (2007)- General Construction in Steel –Code of Practice

Course Code	Course Name	L	T	P	Credits
CVL702	Irrigation & Hydraulic Structures	2	1	0	3

Course Objectives:

This course is intended

- To introduce the basic concepts relevant to Irrigation.
- To understand the principles of Design of Irrigation & Hydraulic Structures.
- To study the causes and the preventive measures for water logging and flooding.

Syllabus:

Unit I: GENERAL INTRODUCTION [H 13]

The necessity of Irrigation in India, Advantages, and Disadvantages of Irrigation, Techniques of water distribution in farms, Soil moisture & Crop water requirements; Duty, Delta, Base period, Crop period, Consumptive use, Irrigation requirements

Unit II: CANAL IRRIGATION [H 9]

Types of canals, parts of a canal irrigation system with diagram, channel alignment, assessment of water requirements, distribution system of canal irrigation, estimation of channel losses; design of channels by regime & semi-theoretical approaches. Canal lining

Unit III: CROSS DRAINAGE WORKS [H 9]

The necessity of Cross Drainage works, their types & selection; Design of various types of Cross Types of Drainage works- Aqueduct, Syphon Aqueduct, Super passage, siphon, siphon super passage, Level Crossing, Detailed design of Aqueduct and Cross sections

Unit IV: DIVERSION HEADWORKS [H 9]

Parts of diversion headworks, types of weirs and barrages, introduction to design of weirs on permeable foundations, control of silt entry into a canal, silt excluders,Silt ejectors and their drawing. A basic introduction to Bligh's theory. A detailed study of khosla's theory.

Unit V: WATER LOGGING [H 2]

Causes & Preventive measures of waterlogging, Drainage of irrigated lands, saline & alkaline lands.

Course Outcome:

After completion of this course, the student will be able:

CO1: To optimize the effective usage of water resources for irrigation purposes.
CO2: To comprehend the basic design principles for the development of an efficient irrigation systems.
CO3: To design channels and other irrigation structures required for irrigation, drainage, flood control, and other water-management projects.
CO4: To identify a suitable method of irrigation and drainage of the waterlogged area.

Text Books

1.Arora, K.R., *"Irrigation Water power & Water Resources Engineering"*, Standard Publishers Distributors, Delhi, 2002.

2. B. Singh, *Irrigation Engineering*, Nem Chand and Sons, Roorkee

References:

1.Varshney & Gupta, *Theory and Design of Irrigation Structures*, Nem Chand and Bros, Roorkee

2.L. E. Hook, *Irrigation Engineering*, John Wiley and Sons, New York

3. J. D. Zimmerman, *Irrigation*, John Wiley and Sons, New York

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL703	Structural Dynamics	2	1	0	3

Course Objectives:

The following are the course objectives of the subject:

- To Provide Fundamental Understanding of Basics of Structural Dynamics.
- To impart knowledge of dynamic behavior of various structural systems using analytical and Experimental Methods.
- To Provide Fundamental Understanding of free and Forced Vibration in structures.
- To Provide basics for problem-solving ability for dynamic response in civil engineering analysis and design.
- Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response

Syllabus:

Unit I: [H 10]

Introduction to dynamic load (earthquake and blast loading), types of dynamic loads, the basic background of dynamic methods available (D'Alembert's principle, Newton's IInd law), a basic review of the stiffness of structures, development of equation of motion (problem statement and solution method).

Unit II: [H 6]

Dynamics equation of equilibrium, components of a basic dynamic system, Free vibration of SDOF (damped and undamped case), Models for energy loss, logarithmic decrement, Coulomb's Damping in structures.

Unit III: [H 8]

Dynamic equation of equilibrium forced vibration of SDOF (undamped and damped case), response to harmonic and periodic loads, pulse loadings, SDOF response to arbitrary functions, duhamel's integral, dynamic response factors.

Unit IV: [H 10]

Dynamic equation of equilibrium for MDOF systems (undamped case), solution of free vibration response for undamped systems, eigenvalue problems, natural modes, and properties. Introduction to Systems with Distributed mass (Continuous Systems), response spectrum.

Unit V: [H 8]

Dynamic response of MDOF systems by mode superposition method, Modal Participation Factors, orthogonality relationships of principal modes, general approach of linear systems ,static condensation method. Introduction to Pushover Analysis.

Course Outcome:

After this course, the students will have an understanding of:

CO1: Basics of Behaviour of Structures subjected to Dynamic Excitation.

CO2: Fundamental theory of dynamic equation of motion

CO3: Fundamental analysis methods for dynamic systems

CO4: Dynamic properties and behaviour of civil structures

CO5: Ability to apply structural dynamics theory to real-world problems like seismic analysis and design of structures.

Text Books:

1. Dynamics of structures by Anil K. Chopra
2. Dynamics of structures by Clough &Penzien

References

1.Structural Dynamics by Mario Paz

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL704	Waste Management Technology	2	1	0	3

Course Objectives:

At the end of the course, students would be able:

- To get knowledge on the working principles and design of various physical, chemical, and biological treatment systems for water and wastewater, including sludge.
- To get knowledge about the various modes of conveyance of wastewater from the source of its generation to the treatment plant.

Syllabus:

Unit I: Environmental Pollution [H 10]

Importance of clean environment, Sources of pollution to land, water & air, General effectsof pollution, pollution by sewage, calculation of stormwater & sewage, Time ofconcentration, and storm.

Unit II: Sewage Disposal [H 8]

Methods of sewage disposal, effects of disposal on land & in water bodies, self-purification of streams, BOD calculations, Types & design of sewers.

Unit III: Sewage Treatment [H 14]

Unit operations in sewage treatment, Screening, sedimentation, grit removal etc., septic and Imhoff tanks, soakage's for isolated systems, Filtration, activated sludge process, Oxidation ponds, Methods of aeration.

Unit IV: Solid Waste Management [H 10]

Solid waste problems, constituents of solid waste; Collection, transport, and disposal of Solid waste sanitary landfilling, composting, incineration.

Course Outcome:

CO1: An ability to estimate sewage generation and design sewer systems.

CO2: The required understanding of the characteristics and composition of sewage, self-purification of streams.

CO3: An ability to perform the basic design of the unit operations and processes used in sewage treatment.

CO4: Understand the standard methods for the disposal of sewage.

CO5: Gain knowledge on sludge treatment and disposal.

Text Books

1. "Sewage Treatment & Disposal & Waste Water Engineering. Vol. II', Dr.P.N. Modi Standard Book House Since 1960; 17TH edition (1 January 2020).

2. "Water supply & sanitary Engineering", B.C.Punmia , Laxmi Publications; Second edition (January 2016).

3. "Environmental engineering & management", Suresh K Dhameja S K Kataria and Sons (January 2010).

References:

1.T. J. McGhee, E. W. Steel, "Water Supply and Sewerage", McGraw-Hill College; 6th edition, 1991.

2.Metcalf and Eddy, "Wastewater Engineering: Treatment and Reuse" McGraw Hill Education; 4 edition (July 2017).

3.Water Supply and Waste Water Engineering" D Lal and A K Upadhyay S.K. Kataria & Sons; Reprint 2013 edition (January 2013).

4. "Environmental Engineering Sewage Waste Disposal and Air Pollution" S.K.Garg Khanna Publishers; Thirty Seventh edition (January 1979).

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL705	Traffic Engineering and Road Facilities	2	1	0	3

COURSE OBJECTIVES

The objectives of this course are:

- To learn the fundamentals of transportation Engineering .
- To introduce fundamental knowledge of traffic engineering so that students can understand and deal with traffic issues, including safety, planning, design, operation, and control.
- Students will learn and use software such as Highway Capacity Software and Synchro in traffic engineering projects.

SYLLABUS

UNIT I: [H 8]

Traffic Stream parameters, Components of traffic system- vehicle characteristics; human characteristics, road characteristics & traffic-control devices.

UNIT II: [H 10]

Intersections- signalized intersections, channelization and roundabouts, interchanges- requirement & design, flyovers, and grade separators.

UNIT III: [H 8]

Traffic signs- role and types, signalized intersections, signal timing design, signal coordination.

UNIT IV: [H 8]

Traffic flow parameters, fundamental relation of traffic flow, road capacity, andlevel of service concept.

UNIT V: [H 8]

Parking facilities- parking demand, on-street parking, off-street parking.
Traffic Safety: Accident Analysis, Traffic safety issues, countermeasures

COURSE OUTCOME

Students who complete this course will be able to:

CO1: Use statistical concepts and applications in traffic engineering.
CO2: Identify traffic stream characteristics
CO3: Understand elements of highway safety and approaches to accident Studies.
CO4: Design a pre-timed signalized intersection, and determine the signal splits.
CO5: Design an actuated signalized intersection
CO6: Identify the level of services for arterials.

TEXTBOOKS

1. Transport New York; Toronto. Planning and Traffic Engineering by CA O'Flaherty, John Wiley & Sons, Inc.,
2. Traffic Engineering by Mc Shane & Roess, Prentice-Hall of India Private Ltd, New Delhi
3. Principles and Practices of Highway Engineering by Kadiyali & Lal, Khanna Publishers,

REFERENCES

1.Principles of Transportation Engineering by Chakarborty & Das, PrenticeHall of India
2.Traffic Engineering and Transport Planning by L. R. Kadiyali, Khanna Publishers, 2-B,

Course Code	Course Name	L	T	P	Credits
CVP703	Dynamics Lab	0	0	2	1

Course Objectives:

The following are the course objectives of the subject:

- To equip students with an understanding of the fundamental principles and techniques for identifying different types of dynamic systems and classify them by their governing equations.
- Introduce fundamentals of vibrations of SDOF system.
- Introduce damped and undamped systems in civil engineering.
- Introduce free and forced vibration in structures.
- Introduce free and forced vibration of SDOF system.

Syllabus:

1. To study undamped free oscillations of a simple pendulum and determine the natural frequency of oscillations.
2. To study undamped free vibrations of a spring-mass system and to determine the natural frequency of vibrations.
3. To study the free vibration of a damped second order system and determine the frequency of damped vibrations. Also, draw the decay curve and determine the logarithmic decrement.
4. To study the vibrations of different types of beams.

Course Outcome:

After this course:

CO1: The student will understand free and forced vibrations in structures.

CO2: The student will have ample knowledge about the working of the spring-mass system.

CO3: The student will have a first-hand experience of resonance problems in structural dynamics.

CO4: The student will be able to differentiate the vibratory mechanisms of SDOF and continuous systems.

References:

1. Dynamics of structures by Anil K Chopra
2. Dynamics of structures by Clough & Penzien

Course Code	Course Name	L	T	P	Credits
CVP705	Traffic Engineering Lab/ Field Study	0	0	2	1

Course Objectives:

The following are the course objectives of the subject:

- Collection and analysis through Driver Test
- Check minimum eyesight standards of drivers
- To analyze the speed distribution of Traffic Streams
- Determine average travel time
- Study of traffic stream modelling
- Learn use of driver testing equipment and Learn analysis of data

Syllabus:

1. Study of Driver Testing unit
2. Study of Driver Vision Screen Tester
3. Spot Speed Study
4. Measurement of Travel Time and Delay for Congested Corridor
5. Moving Observer Method Study

Course Outcome:

On completion of this course:

CO 1. Students will gain knowledge of Driver test and will be able to analyze the data.

CO 2. Students will gain knowledge about checking eyesight standards of driver

CO 3. Students will be able to analyze the speed distribution of Traffic streams.

CO 4. Students will be able to determine average travel time.

CO 5. Students will study traffic stream modelling.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP709	Pre-Project	0	0	4	2

Course Objectives:

- To identify a research/industry related problem for the undergraduate project work with the respective faculty's guidance and prepare a design and work plan.

Syllabus:

Each group comprising of around 5 students shall identify a project related to the curriculum of study. At the end of the semester, a preliminary synopsis report on the project shall be submitted to the Department for assessment. The students are required to appear for viva voce, which shall be conducted in the department, in the faculty members' presence under the supervision of the HOD.

Guidelines For Evaluation:	
1. Attendance and regularity	05
2. Theoretical knowledge and individual involvement	45
3. Quality and contents of project synopsis	30
4. Presentation	20
Total	100 Marks

Course Outcome:

On completion of this course, a student will be able to:

CO 1. Conduct a literature survey in a relevant area of one's course of study and finally identify and concentrate on a particular problem in the field of civil engineering.

CO 2. Formulate a project proposal through extensive literature and/or discussion withlearned resource persons in the industry and around.

CO 3. Generate a proper execution plan of the project work to be carried out in phase second in the 8th semester through deliberations and improve presentation skills.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVP708	Industrial Training-II	0	0	2	1

Course Objectives:

At the end of the course, students would be able to:

- Gain Knowledge of Various Types of Field Projects
- Recognise the importance of material manufacturing in Civil Engineering
- Recognise the methods of Construction
- Gain knowledge of Quality checks at Construction sites

Syllabus:

The Training is composed of Two Parts:

1. Visiting various material manufacturing plants/sites and Project Sites and collect information about the Project, its cost, duration, methods of manufacturing, analysis, and design and construction of the site. Also, to gain knowledge on Quality evaluation at different plants or sites.
2. Collecting all the data, writing a Short technical report, and demonstrating for evaluation before a committee.

The composition of the committee consists of Four Faculty members of the Department.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Enhance Practical Knowledge of the Manufacturing and Construction Sites.

CO2: Building Professional Know-how.

CO3: Refreshing the Theoretical Subject Knowledge.

Text Books/References:

1. Engineering Training Manuals by US Army
2. Dennis Lemaitre, Training Engineers for Innovation. 2018
3. M. MacDonald Steels, Effective Training for Civil Engineers. 1994

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL801	Design of Bridge Structures	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To Classify different types of bridges and demonstrate fundamental knowledge of design of bridges and understand hydrologic and hydraulic aspects of waterway bridges
- Use influence lines to calculate maximum effects (forces) due to standard moving vehicle loads prescribed in IRC Codes. Select an appropriate load system as per IRC-6 and evaluate design forces and moments in bridges.
- To design the RCC slab culvert and Bridge deck slab.
- To design Plate Girder Bridges and Truss type bridges

Syllabus:

UNIT I: INTRODUCTION TO BRIDGES [H 10]

Introduction to bridges and types of bridges, History, and development of bridges, Bridge components; Various types of Loads on bridges, Standard loadings for highway; Introduction to Hydraulic Design of Bridges, Scour depth, Afflux, streamflow (discharges) measurements; Introduction to Sub-structure of Bridge and types of loads on sub-structure.

UNIT II: DESIGN OF RCC CULVERTS [H 8]

Introduction to culverts, Types of culverts, components of culverts, Design principles for culverts, Design of solid slab culvert.

UNIT III: DESIGN OF BRIDGE DECK SLABS [H 8]

Analysis and Design of RCC bridge deck slabs; Courbon's Method of Bridge Deck Analysis.

UNIT IV: DESIGN OF PLATE GIRDER BRIDGES [H 8]

Analysis and Design of Plate Girder Bridges, Composite bridges.

UNIT V: DESIGN OF TRUSS BRIDGES [H 8]

Various forms of steel trussed bridges, Analysis and Design of trussed bridges based on standard IRC loading; Design of Stringers and Cross Girders for single & multi-lane bridges for standard IRC loadings.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: To Classify different types of bridges.
CO2: To understand hydrologic and hydraulic aspects of waterway bridges.
CO3: To evaluate design forces and moments in bridges.
CO4: To design the RCC slab culvert and Bridge deck slab.
CO5: To design Plate Girder Bridges and Truss type bridges

Textbooks

1. Design of Bridges by Johnson victor
2. Design of Bridges by Krishna Raju

References

Relevant IRC/IS codes & specifications

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL802	Earthquake Resistant Design	2	1	0	3

Course Objectives:

The following are the course objectives of the subject:

- To provide a coherent development to the students for the courses in earthquake engineering.
- To present the foundations of many basic engineering concepts related to earthquake engineering.
- To give experience in the implementation of engineering concepts that are applied in the field of earthquake engineering.
- To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

Syllabus:

Seismic design of R.C.C. structures (up to 2-story Buildings) based on Codal provisions IS: 1893. Detailing of RCC Elements as per IS: 13920: 2016.

Course Outcome:

After this course,

CO1: The students will gain experience in the implementation of Earthquake Engineering on engineering concepts that are applied in the field of Civil Engineering.

CO2: The students will get a diverse knowledge of earthquake engineering practices applied to real-life problems.

CO3: The students will learn to understand the theoretical and practical aspects of earthquake engineering and the planning and design aspects.

CO4: The Student will be able to analyze and design framed structures for any type of earthquake excitation based on IS 1893:1984 for Earthquake resistant design of structures.

Text Books

1. Dynamics of structures by Anil K Chopra
2. Seismic design of structures by Pankaj Aggarwal, Shrikhande.

References:

1.Seismic design of RCC & Masonry structures by Pauley, T & Priestley.
2.Fundamental Concepts of Earthquake Engineering by Roberto Villavarde.

Course Code	Course Name	L	T	P	Credits
CVD803	Project	0	0	20	10

Course Objectives:

At the end of the course, students would be able to:

- Understand Team Work and attain Professional attitude
- Recognize and analyze Problem/s
- Attain result/s and demonstrate those results before expert/s
- Gain knowledge in report writing

Syllabus:

The Project Work is composed of Two Parts:

1. Collecting Literature. Doing Experimental Work, fieldwork, analyzing and designing, taking case studies, or building demonstrative models.
2. Collecting all data, writing a technical report and demonstrating for evaluation before a committee.

The composition of the committee is:

a. Three faculty members of the Department, including the Supervisor concerned.
b. An External Expert as approved by Competent Authority.

The Committee mandate of Internal evaluation will be:

1. 30% to Supervisor.
2. 70% to Committee out of which external expert will evaluate 50%.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Enhance the technical capacities.

CO2: Building Professional Know-how.

CO3: Refreshing the Subject Knowledge.

References:

1. Diana L.Friad, Project Work. Oxford University Press. 2002
2. Anders Siing Anderson, Simon B. Heilesen, The Roskilde Model: Problem-Oriented Learning and Project Work. Springer International Publishing. 2014

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Syllabus of Professional Elective Courses

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVLP01	Introduction to Civil Engineering	2	1	0	3

When the students enter the college to pursue a degree in Civil Engineering and as well pursue a career in Civil Engineering after graduation, they need to understand the breadth and depth available in this field for possible engagement. When many alternative disciplines of engineering appear to offer apparently more glamourous avenues for advancement, the Civil Engineering student should realize the solid foundations available in this mother of all engineering disciplines. The students should understand the enormous possibilities available for creative and innovative works in this all-pervasive field of engineering.
This course is designed to address the following:

- to give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- to motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Proposed Syllabus
Modules [Three Lectures per Module]
1. **Basic Understanding**: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career
2. **History of Civil engineering**: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers
3. **Overview of National Planning for Construction and Infrastructure Development.**
Position of construction industry vis-à-vis other industries, five-year plan outlays for construction; current budgets for infrastructure works.
4. **Fundamentals of Architecture & Town Planning**: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities
5. **Fundamentals of Building Materials**: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes
6. **Basics of Construction Management & Contracts Management**: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management
7. **Environmental Engineering & Sustainability**: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction.
8. **Geotechnical Engineering**: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling

9. **Hydraulics, Hydrology &Water Resources Engineering**: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects
10. **Ocean Engineering**: Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures
11. **Power Plant Structures**: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects
12. **Structural Engineering**: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies.
13. **Surveying & Geomatics**: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR.
14. **Repairs & Rehabilitation of Structures:** Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; non-Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.

Text/Reference Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai

Goals & Outcomes:

- Introduction to what constitutes Civil Engineering
- Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering
- Highlighting the depth of engagement possible within each of these areas
- Exploration of the various possibilities of a career in this field
- Understanding the vast interfaces this field has with the society at large
- Providing inspiration for doing creative and innovative work
- Showcasing the many monuments, heritage structures, nationally important infrastructure, and impressive projects to serve as sources of inspiration
- Highlighting possibilities for taking up entrepreneurial activities in this field
- Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVLP02	Mechanics of Composite Laminates	2	1	0	3

Course Objectives:

- To impart knowledge about the behavior of laminated composites at lamina as well as at laminate level and special features of composites for engineering applications.

Module 1 (H 12):
Introduction: Classification and characteristics of composite materials, basic terminology, uses of laminated composites, comparison of properties with traditional materials.

Module 2 (H 15):
Behavior of Lamina: Stress-strain relationship for anisotropic, orthotropic and isotropic materials, transformation of elastic constanst, failure criteria for an orthotropic lamina, introduction to micromechanical behavior, law of mixture for E1, E2, G12, V12.

Module 3 (H 15):
Behavior of Laminate: Classical lamination theory, stress-strain relationship for laminate, extensional bending and coupling stiffness, different configurations and corresponding stiffness, strength of laminates, inter-laminar stresses, introduction to behavior of thin-walled laminated structures.

Text/Reference Books:

1. Agarwal, B.D. and Broutman, L.J., "Analysis and Performance of Fiber Composite", John Wiley.
2. Kollar, L.P. and Springer, G.S., "Mechanics of Composites Structures", Cambridge Press. Developing World, The Bridge, Vol 34, No.2, Summer 2004.
3. Johns, R.M., "Mechanics of Composite Materials", Taylor & Francis

Course Code	Course Name	L	T	P	Credits
CVLP03	Building Information Modelling	2	1	0	3

Course Objectives:

To develop the exposure about the advanced communication processes in the construction industry and imparting the knowledge of emerging methods utilized for building information modeling.

Syllabus:

UNIT I: [H 10]

Traditional construction practices and their Inefficiencies, concept of BIM, Necessity of BIM, BIM in buildings and infrastructure, BIM platforms, latest software tools and processes, benefits of BIM, BIM towards lean practices.

UNIT II: [H 10]

Collaboration and Interoperability – data exchange methods and standardization, BIM for managers and clients, BIM for engineers and architects, BIM for contractors and builders, BIM for manufacturers and sub-contractors

UNIT III: [H 12]

Introduction to modelling approaches, nD modelling, BIM maturity levels, future construction management - BIM with Artificial intelligence, virtual reality and augmented reality with BIM

UNIT IV: [H 10]

Significance of BIM mandate by government, Motivations, Requirements, BIM education and training, Issue related to legal perspective, intellectual property, Cyber security, existing practices and social problems.

Course Outcome:

CO1: To expose the concept of communicating through information modelling

CO2: To familiarize the benefits of BIM over traditional processes

CO3: To enable the knowledge of integrating distinctive construction design tools

CO4: To impart the ideas for communicating the accurate and advanced building information

Text Books:

1. Hardin, B. and McCool, D., 2015. BIM and construction management: proven tools, methods, and workflows. John Wiley & Sons.
2. Kymmell, W., 2008. Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations (McGraw-Hill Construction Series). McGraw-Hill Education.

References:

1. Eynon, J., 2016. Construction manager's BIM handbook. John Wiley & Sons.
2. Sacks, R., Eastman, C., Lee, G. and Teicholz, P., 2018. BIM handbook: A guide to building information modeling for owners, designers, engineers, contractors, and facility managers. John Wiley & Sons.
3. Kumar, B., 2015. A practical guide to adopting BIM in construction projects. Whittles Publishing.
4. Karen, M.K. and Douglas, N., 2014. Building Information Modeling BIM in Current and Future Practice. Hoboken, New Jersey.

Course Code	Course Name	L	T	P	Credits
CVLP04	Engineering Geology and Seismology	2	1	0	3

Course Objectives:

- Origin, Internal and surface structures of the earth.
- Geological structures (Joint, veins, crack, faults, and fold), reasons of formation for each type, and their side effects on the engineering projects.
- Geological considerations in the design of tunnels, dams, and buildings
- To provide a coherent development to the students for the courses in the sector of earthquake engineering
- To present the foundations of many basic engineering concepts related to earthquake Engineering
- To give experience in the implementation of engineering concepts that are applied in the field of earthquake engineering
- To learn about the various instruments used in the recording of earthquakes.

Syllabus:

UNIT I: [H 8]

Geology and its relevance to civil engineering, Structural Geology; Folds, Faults and Mechanism of Faulting, Joints, Unconformities.

UNIT II: [H 6]

Engineering Geology; geological considerations in tunnels, dams, bridges, building sites; landslides.

UNIT III: [H 6]

Earthquakes; types and causes, distribution in the world, basic definitions, seismic zones.

UNIT IV: [H 10]

Engineering Seismology (Definitions), Introduction to Seismic Hazards and Earthquake Phenomenon. Geographical Distribution of Earthquakes and Seismo-techtonics.

UNIT V: [H 12]

Earthquake recording instruments, Warning systems, Global network, Monitoring of Earthquakes.

Course Outcome:

Upon completion of this course, the student will be able to:

CO1: Show an understanding of the physical properties used to identify Earth materials.

CO2: Show an understanding of the geomorphic processes that modify the Earth's surface.

CO3: Examine the various geological engineering problems faced in the design of dams,tunnels, and buildings.

CO4: Gain experience in Earthquake Engineering's implementation of engineering conceptsapplied in the field of Structural Engineering.

CO5: Learn to understand the theoretical and practical aspects of earthquake engineering.

Text Books/References:

1) Engineering Geology by Parbin Singh
2) Physical Geology by Arthur Holmes
3) Engineering Geology by F.G. Bell
4) Engineering Seismology by PN Aggarwal.
5) An introduction to Seismology, Earthquakes & Earth Structures by Sethstein &Michael Wysession

Course Code	Course Name	L	T	P	Credits
CVL-P05	Solid Waste Management	2	1	0	3

Course Objectives:

- To develop required skills in the students to acquire the following competency: Plan segregation, collection, transportation, recycling, and disposal of municipal solid waste so that its impact is minimal on the environment, economy and community.

Syllabus:

Unit I: Sources and Composition of Municipal Solid Waste [H 6]

Sources of solid waste. Types of solid waste. Characteristics of Solid Waste, Composition of solid waste and its determination.

Unit II: Properties of Municipal Solid Waste [H 6]

Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste,Biological properties of Municipal Solid Waste and Transformation of Municipal SolidWaste

Unit III: Solid Waste Generation and Collection [H 8]

Quantities of Solid Waste, Measurements, and methods to measure solid waste quantities. Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW

Unit IV: Handling, Separation, and Storage of Solid Waste [H 10]

Handling and separation of solid waste at site. Material separation by pick in, screens, float and separator magnets, and electromechanical separator, and other latest devices for material separation. Waste handling and separation at Commercial and industrial facilities. Storage of solid waste at the sources.

Unit V: Processing and disposal of Solid Waste [H 12]

Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc. Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of Combustion, Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design,

landfill operation, use Of old landfill, Differentiate sanitary land fill and incineration as final disposal system for solid waste, Biochemical processes: Methane generation by anaerobic digestion, composting and other biochemical Processes.

Course Outcome:

CO1 Explain municipal solid waste management systems to their physical properties andassociated critical considerations in view of emerging technologies

CO2: Outline sources, types and composition of solid waste with methods of handling,sampling and storage of solid waste.

CO3: Select the appropriate method for solid waste collection, transportation andredistribution.

CO4: Describe methods of disposal of municipal solid waste.

Text Books

1. Christensen, H. T., Solid Waste Technology & Management, Wiley, 2010, Volume 1 & 2.

2. Haug, T. R., The Practical Handbook of Compost Engineering, Lewis Publishers, 1993.

3. Reinhart, R. D. and Townsend, G. T., Landfill Bioreactor Design & Operation, CRC Press,1997, 1st Edition.

References:

1 Tchobanoglous, G. and Kreith, F., Handbook Of Solid Waste Management, McGraw Hill,2002, 2nd Edition.

2 Tchobanoglous, G., Theisen and Vigil, Integrated Solid Waste Management: EngineeringPrinciples and Management Issues, McGraw Hill, 1993.

3 Manual on Municipal 1 Solid waste Management, CPHEEO, Ministry of UrbanDevelopment, Govt. Of. India, New Delhi, 2000.

Course Code	Course Name	L	T	P	Credits
CVL-P06	Green Buildings	2	1	0	3

Course objectives:

Upon completion of the course, the student should be able to:

- Get a comprehensive overview of materials used for sustainable buildings and be acquainted with the concepts of sustainability in the context of building and conventional engineered building materials
- Understand the effects of technology on materials and how they are used for sustainability.
- Acquire knowledge on various aspects of green buildings.
- Obtain an understanding on minimizing the consumption of natural resources, including water
- Comprehend the concepts of embodied, operational, and Life cycle energy and minimizing energy consumption by optimal design.

Syllabus:

UNIT I: SUSTAINABLE BUILDING MATERIALS [H 12]

Introduction to sustainable building materials, qualities, use, examples-Natural building materials, locally available and locally manufactured materials, bio-materials-salvaged and recycled materials, Non-toxic materials, low Volatile organic content (VOC) Paints, Adhesive and sealants for use in building, VOC emission issues, and indoor air quality for sustainability and health hazard. Introduction of green building, concept of green building, History of green building, Need of green building in the present scenario, Importance of green building, Classification of green building, Assessment methods, LEED, GRIHA (Green Rating for Integrated Habitat Assessment) Clay bricks, types of kiln, comparative energy performance emission and financial performance, indoor air quality. Operational energyreduction and net zero energy building, optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic algorithm. Radiation budget, Surface water balance, Effects of trees and microclimatic modification through greening, Use of Building integrated photo voltaic (BIPV) and other renewable energy in buildings, basic concepts and efficiency. Energy codes ECBC requirement, concepts of OTTV etc. Green performance rating, requirements of LEED, GRIHA etc.

UNIT II CONCEPT OF EMBODIED ENERGY AND CARBON FOOTPRINT [H 8]

Material conservation: Idea of embodied energy, Development of the concept, factors to be considered, calculation techniques for embodied energy, Data sets available for calculation of embodied energy, Case studies of embodied energy calculations, Sample embodied energy calculations for a material, low energy materials, sustainable materials, Concept of embodied Carbon or Carbon footprint of material, carbon Emission and its reduction. Alternative materials, Calculation techniques, Life cycle costing analysis techniques.

UNIT III SUSTAINABLE CONSTRUCTION TECHNIQUES [H 6]

Alternative construction techniques such as SMB, CSEB and steam cured blocks, composite beam and panel, funicular shells, filler slabs, reinforced masonry, ferro-cement walls etc. Case studies, Water conservation: 3 R's for water conservation, rain water harvesting, grey water recycling.

UNIT IV INNOVATIVE USE OF MATERIALS [H 8]

Use of waste materials such as paper, glass bottles, tires, shipping containers, post-consumer and industrial waste such as fly-ash, building demolition waste, use of salvaged materials from flooring, columns, beams, timber, glass, etc. Role of material, carbon from cement, alternative cements and cementitious material, alternative fuel for cements for reduction in carbon emission, sustainability issues for concrete. Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. with alternativematerial for sustainability.

UNIT V THERMAL PERFORMANCE OF BUILDINGS [H 8]

Operational energy in buildings, role of materials, and thermal conductivity. Thermal comfort inside the building, factors affecting, cooling and heating requirement, Heat transmission through building sections, thermal performance of building sections, simple calculation for U-value and insulation thickness, Day-lighting and Ventilation.

Course outcomes:

At the end of the course, the student should be able to:

CO1: Examine the properties of common construction materials and understand the transition towards sustainable materials and their behaviors under different environments.

CO2: Suggest materials and technologies to improve buildings' energy efficiency and identify embodied energy of materials.

CO3: Describe the concept of Green Building and justify the necessity of Green Buildings.

CO4: Assess a building on the norms available for green building and explain the concept of carbon footprint

CO5: Examine and identify the green building rating systems and their contribution to sustainability.

CO6: List the major energy efficiency areas for building-Green materials.

CO7: Apply the principles of sustainable development in building design.

RECOMMENDED BOOKS

1. Sustainable Buildings-Design Manual, The Energy and Resources Institute
2. Understanding Green Building Materials- Traci Rose Rider and Jessica McNaughton
3. Green Building Fundamentals- Mike Montoya
4. Sustainable Construction- Green Building Design and Delivery-Charles J.Kibert

Course Code	Course Name	L	T	P	Credits
CVL-P07	Assessment & Repair of Structures	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- Know about various deterioration and disintegration mechanisms in Structures
- To obtain knowledge of various Repair and retrofitting techniques for Structures
- To gain knowledge of maintenance of Buildings
- To obtain knowledge of various maintenance models for structures

Syllabus:

Unit I: Deterioration and Methods of Repair of Structures: [H 8]

Disintegration Mechanisms, Moisture Effects, Thermal Effects, Structural Effects, Faulty Construction, Methods and locations of Repair of Structures.

Unit II: Surface Repair & Retrofitting Techniques: [H 8]

Strategy Design, Selection of Repair Materials, Surface Preparation, Bonding repair materials to Existing concrete, Placement Methods.

Unit III: Other Repair Methods: [H 6]

Epoxy Bonded Replacement Concrete, Preplaced Aggregate Concrete, Shotcrete/Gunite, Grouting, Injection Grouting, Micro concrete.

Unit IV: Maintenance of Buildings: [H 12]

Definition, Role of building maintenance in construction process Maintenance generators, Expression of Standards, selection of level of maintenance and fixing standards, Planned maintenance: Planning vis-a-vis Adhoc maintenance, schedule contingency maintenance, levels of planning, planned inspection, etc.

Unit V: Maintenance Models and Design: [H 8]

Maintenance cycle, maintenance profile, repair replacement models, statistical methods, decision models, optimal renewal cycle, budgeting etc. Effect of design on maintenance, Diagnosis, appraisal, structural defects various methods of repair

Course Outcome:

To accomplish the abilities/skills for the following

CO1: Recognizing the defects or deteriorations in Buildings.

CO2: Understanding repairing methods for Structures.

CO3: Gaining Knowledge of Maintenance of Structures and its various methods.

Text Books

1. Emmons, P.H., Concrete Repair and Maintenance, Galgotia Publication. 2001

2. FEMA 273; NEHRP Guidelines for the Seismic Rehabilitation of Buildings. 1997

3. ATC- 40: Seismic Evaluation and Retrofit of Concrete Buildings, Vol. 1 & 2. 1997

References:

1 M.J.N., Seible, F. and Calvi, G.M., Seismic Design and Retrofit of Bridges by Priestley, John Wiley. 1996

2. Building Maintenance Management-R.LEE

3 Developments In Building Maintenance -I.EJ. GIBSON

4. Concrete Structures: materials, Maintenance And Repair D.CAMPBELL,ALLE

Course Code	Course Name	L	T	P	Credits
CVL-P08	Advanced Construction Technology	2	1	0	3

Syllabus:

Unit-I [H 12]

Concrete Construction methods

Form work design and scaffolding, slip form and other moving forms, pumping of concrete and grouting, mass concreting (roller compacted concrete), ready mixed concrete, various methods of placing and handling concrete, accelerated curing, Hot and cold weather concreting, Under water concreting, Prestressing.

Unit-II [H 8]

Steel and composites construction methods:

Fabrication and erection of structures including heavy structures, Prefab construction, industrialized construction, Modular coordination.

Unit-III [H 8]

Erection Techniques

Major types of mobile crane, Lifting capacities of cranes, modification in cranes for heavy lifting, crane booms, Rated loads for lattice and telescopic boom cranes, Working ranges of cranes, Tower cranes: - classification, operation, tower crane selection.

UNIT IV [H 8]

Tunneling equipment, Tunnel boring machine, Pipe Jacking, selection of tunnel alignment, tunneling using Road Headers, Cut and fill techniques, jack down techniques, box type tunneling techniques.

Unit-V [H 6]

Special construction methods:

Construction in Marine environments, High rise construction, Bridge construction including segmental construction, incremental construction and push launching techniques, River valley projects.

Course outcomes:

CO1: Students will be familiar with the technology of major construction as outlined in the listed topic headings.

CO2: Students will be able to describe, analyze, compare and evaluate the technology of high-

rise construction and be aware of some of the problems that can be associated with poor management of construction projects.

BOOKS RECOMMENDED:

1. Purifoy, Schexnayder, Construction Planning, Equipment and Methods, Tata Mc Graw Hill

2. Edward Nawy , Concrete Construction and engineering Handbook , CRC Press.

Course Code	Course Name	L	T	P	Credits
CVL-P09	Advanced Structural Analysis	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- To introduce the fundamentals of the matrix method of trusses and beams
- To illustrate the formation of stiffness matrices for trusses and beams
- To familiarize with procedures involved while formulating a problem in finite element analysis
- To impart knowledge of the basic element types encountered in finite element analysis

Syllabus:

UNIT I: MATRIX METHODS OF TRUSSES STRUCTURAL ANALYSIS [H 8]

Introduction to matrices and properties of matrices, Concept of Matrix Method & Flexibility Method. Formulation of Stiffness matrix for simple Planar Elements, Analysis of Planar Trusses (basic).

UNIT II: MATRIX METHODS OF BEAMS AND FRAMES [H 8]

Formulation of element stiffness matrix for beam/ frame element. Analysis of Beams (basic) and Frames (basic) using stiffness method under nodal and between the nodal loads.

UNIT III: INTRODUCTION TO FINITE ELEMENT METHOD (FEM) [H 10]

Introduction to Finite Element Method of Structural Analysis. Problem Classification, Modelling, and Discretization. Interpolation, Elements, notes, and D.O.F. Example Applications and history of FEM. Solving problems by FEM.

UNIT IV: ONE-DIMENSIONAL ELEMENTS AND COMPUTATIONAL PROCEDURES [H 8]

Bar and Beam Elements. Bar and Beam elements of arbitrary orientation. Assembly of Elements. Properties of Stiffness matrices. Boundary Conditions. Exploiting Sparsity. Solving Equations. Mechanical and thermal Loads or Stresses. Structural Symmetry.

UNIT V: BASIC ELEMENTS IN FINITE ELEMENT ANALYSIS [H 8]

Preliminaries, Interpolation and shape functions. Formulas for element matrices. Linear Triangle (CST), Quadratic Triangle (LST). Bilinear rectangle (Q4). Quadratic rectangle (Q8, Q9). Regular Solid Elements. Choice of interpolation Functions. Improved triangles and Quadrilaterals.

Course Outcomes:

On completion of the course, the students will be able to:

CO1 Able to formulate stiffness matrices for trusses and beams.

CO2 Analyse the trusses and matrices using the matrix method of analysis.

CO3 Formulate and model the problem to solve it using the finite element method.

CO4 Analyse some basic structures using the finite element method.

Text Books

1. Basic Structural Analysis by CS Reddy
2. Structural Analysis by R. C. Hibbler

References:

1 Matrix Analysis of Framed Structures by Harry H.West

2 Concepts & Applications of Finite Element Analysis by Robert D Cook

3 Finite Element Method by Deb Debasis

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVLP10	Disaster Preparedness & Planning Management	2	1	0	3

COURSE OBJECTIVES

- To Understand basic concepts in Disaster Management
- To Understand Definitions and Terminologies used in Disaster Management
- To Understand Types and Categories of Disasters
- To Understand the Challenges posed by Disasters
- To understand Impacts of Disasters Key Skills

SYLLABUS

Module 1 [H 8]: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation).

Module 2 [H 8]: Disasters - Disaster's classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Module 3 [H 8]: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Module 4 [H 10]: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community,
local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Module 5 [H 8]: Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text/Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
7. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Outcomes:

The student will develop competencies in

- the application of Disaster Concepts to Management
- Analysing Relationship between Development and Disasters.
- Ability to understand Categories of Disasters and
- realization of the responsibilities to society

Course Code	Course Name	L	T	P	Credits
CVL P11	Design Software (Advanced)	0	0	4	2

Course Objectives:

At the end of the course, students would be able to:

- Know various techniques of modeling building structures
- To obtain knowledge of analyzing and designing various structural elements
- To gain knowledge of modeling and design of masonry buildings
- To obtain post-processing analysis and design report and to compare with manual calculations for validation of results

Syllabus:

Unit I: Multi-Story Residential Modelling using SAP Software: [H 10]

Study of the design of various building elements; Planning various components of a building with column positioning; Introduction of SAP; Modelling of the building in the SAP is giving all boundary conditions (supports, loading etc.).

Unit II: Multi-Story Residential Design using SAP Software: [H 10]

Analysis and Design of various structural components of the modal building; Study of analysis Data of the software; Detailing of beams, columns, slab with section proportioning and reinforcement.

Unit III: Design of Footings using SAP Software: [H 6]

Modeling and designing various types of footings- Isolated, Combined, Strap, Strip, and Mat in SAP software.

Unit IV: Modelling and Design of Masonry Buildings using SAP Software: [H 8]

Modeling and Design of Masonry Buildings in Design Software like SAP software. Modeling of Walls, Openings, and various other elements of a masonry building.

Unit V: Post Processing of Design Data: [H 8]

Building Post-Processing Data related to bending, shear, Torsion, and displacements. Comparing different manual charts and software-based data.

Course Outcome:

To accomplish the abilities/skills for the following

CO1: Recognizing the benefits of designing by Software.

CO2: Understanding various design techniques of different components of a Building.

CO3: Gaining Knowledge of Post Processed design data for understanding of design problems.

References:

1.SAP 2000, integrated solution for structural analysis and design, getting started, Computers and Structures INC.

2. U.H.Varyani. Structural Design of Multi Storeyed Building. 2014

Course Code	Course Name	L	T	P	Credits
CVL-P12	Operation Research & Optimization	2	1	0	3

Course Objectives:

The course aims to build students' capabilities for analyzing different situations in the industrial scenario involving limited resources and finding the optimal solution within constraints. This course also aims to introduce students to use quantitive methods and techniques for effective decisions-making; model formulation, and applications that are used in solving business decision problems.

Syllabus:

Unit I: Introduction [H 8]

Introduction to operation Research, Linear Programming problem. Formulation of LPP, Graphical solution of LPP, simplex method, artificial variables, big-M method.

Unit II: Transportation Problems [H 8]

Formulation, solution of balanced transportation problem. Finding initial basic feasible solutions. North-west corner rule, least cost method, and Vogues approximation method

Unit III: Assignment Model and Hungarian method [H 6]

Assignment Model Formulation, Hungarian method for an optimal solution; solving unbalanced problems; travelling salesman problem and assignment.

Unit IV: Sequencing Models [H 10]

Solution of sequencing problem; processing and jobs through two machines, processing n jobs through three machines; Processing two jobs through m machines.

Unit V: Dynamic Programming [H 10]

Introduction to Dynamic programming problems, Characteristics and applications of Dynamic Programming, Mathematical formulation and optimal Solution of Dynamic Programming problems.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1. Understand variety of problems such as assignment, transportation, travelling salesman etc.

CO2. Convert the problem into a mathematical model.

CO3. Understand different queuing situations and find the optimal solutions using models for different situations.

CO4. Solve the problems mentioned in point 1 using linear programming approach using software.

CO5. Analyze any real life system with limited constraints and depict it in a model form.

Text Books/

1. A.M. Natarajan, P.Balasubramani, A. Tamilarasi, Operations, Pearson Education, 2005.
2. P. K. KantiSwarup and M. M. Singh. "Operation Research." *Sultan Chand & Sons* (1985).

References:

1. P. Sankaralyer, Operations Research, Tata McGraw Hill 2008
2.Operations Research Edition 2008, Aditham B. Rao, Jaico Publishing House, Mumbai.

Course Code	Course Name	L	T	P	Credits
CVL -P13	Quality Control	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

- Know about various construction projects and their management.
- To obtain knowledge of resource scheduling in a construction Project.
- To gain knowledge of Project Monitoring and its Control.
- To obtain knowledge of Quality Control Indicators.

Syllabus:

Unit I: Construction Project Management: [H 6]

Project Management, Objectives of a Project, Scientific Way of Managing Project, Construction Industry and National Growth, Project Stakeholders, phases and Project Organization; Project scheduling levels.

Unit II: Duration Estimation, Network Estimation, and Analysis: [H 8]

Duration Estimation - Types, Inputs, Methods, Parametric Estimation; Factors influencing Productivity, Example for Ideal Productivity, Factored Productivity and Working Time Factor; Piling Activity Example, Applicability of different methods to Estimate Activity Duration; Summary of Key Topics, Types of Networks; Networks - Introduction, Techniques.

Unit III: Resource Scheduling: [H 10]

What is Resource?, Influence of Resources on Schedule, Two-Span Bridge Example, Resource Decisions; ABCD Example Project; Resource over-allocation; Projects &Resources, Example of Two Resources, Exercise, Two-Span Bridge Example; Review Problem -1; Problem -2 (Cash Resource); Resolving Over-Allocation; Problem 1- Two Resources; Resolving Resource Allocation Problems; Resource Profile Requirements; Resource Levelling - Example Network; Minimum Moment Concept.

Unit IV: Project Monitoring: [H 8]

Introduction to Precedence Diagramming Method (PDM); PDM network representation and its issues, Network Calculation; PDM – Problem #1; Issues in PDM, Negative Lags, Problem#2 Solution; PDM – Analysis with non-continuous duration, Floats; Defining Relationship (Based on Construction Method) - Simple Shed; Project Monitoring & Control – Typical Project Time

Monitoring Process, Levels and Frequency of updates.

Unit V: Quality Control: [H 8]

Introduction, Quality, Control, Inspection, Quality Control, Statistical Process Control, Quality Circles, Total Quality Management, ISO 9000 Series, Application of ISO 9000 Seriesand ISO 14000 Series. Classes of Concrete, Mix Design, Construction plan, Storage method, Production and procurement, Sampling and Testing, Management of Concrete Pouring

Course Outcome:

To accomplish the abilities/skills for the following:

CO1: Duration Estimation of Projects by various methods.

CO2: Scheduling of Project.

CO3: Determination of Quality Indices.

Text Books

1. James P. Lewis, "Project Planning, Scheduling & Control", McGraw-Hill Education; 3rd Edition.
2. Gregory T. Haugan, "Project Planning and Scheduling", Management Concepts.
3. James J. O'Brein, "Construction Inspection Handbook: Quality Assurance/Quality", Springer 3rd Edition, 1989.

Course Code	Course Name	L	T	P	Credits
CVL-P14	Design of Masonry Structures	2	1	0	3

Course Objectives:

At the end of the course, students would be able to:

Know various materials and methods of construction of masonry structures

To obtain knowledge of various codal considerations in design of masonry structures and methods of design of masonry structures

To gain knowledge of various tests used to determine the properties of masonry structures

To obtain knowledge of various units of construction of masonry and their assemblages

Syllabus:

Unit I: Introduction to Masonry Structures: [H 10]

Introduction to Masonry Structures (History, Nature of Masonry Structures and Behaviour of Masonry under Seismic Forces). Contemporary Masonry Structures. Masonry Units and Masonry Mortar and their properties. Masonry Assemblages and masonry elements. Different forms of Masonry Systems (reinforced masonry, Confined masonry, Pre-stressed masonry). Analysis and Design of Masonry Systems, Different codes for design of masonry systems like IS 1905:1987, NBC Vol 1 Part 6, Codes related to masonry materials like IS 1597: Part 11992, IS 2572:1963, IS 2572-2005. Overview of Study of codes related to earthquake related Design of Masonry Systems like IS 4326:2013.

Unit II: Clay and Concrete Masonry and their Properties: [H 10]

Overview of Masonry Materials like Clay masonry Units, Physical and Engineering Properties of Masonry Units like compressive strength, Modulus of Elasticity, Flexural tensile strength, water absorption, and testing methods. Efflorescence as a property of masonry unit. Geometry of Masonry Units. Concrete masonry Units, Function of Concrete Masonry Unit, Various Physical and Engineering Properties of Concrete Masonry Units like compressive strength. Property of masonry mortar like water absorption, workability and water retentivity, bond, compressive strength, flexural strength, and volume change (Shrinkage). Grout properties like compressive strength. Reinforcement in masonry. Types ofreinforcement. Masonry Buildings and assemblages, Brick and bed material interaction in

masonry assemblages. Compressive strength properties of masonry assemblage. Standard

Prism test for determining prism compressive strength. Elastic Modulus of masonry in compression. Code compliances related to prism tests. Behaviour of masonry in tension and in shear. Shear strength of bed Joints.

Unit III: Strength and Behaviour of Masonry: [H 10]

Mechanical Behaviour of Masonry under compression, Theoretical framework for failure stress under compression, Deformation Properties of brickwork under compression, Geometrical Second Order effects, Vertical Load bearing capacity of Masonry URM Wall, Strength of Compression Elements like in Wall-Slab interaction, Wall Strength in terms of End rotations, mechanical behaviour of masonry in out-of-plane bending, Conventional Bending analysis, Arching and Rigid arching mechanism, One way and Two way horizontal Flexure. In-plane action of shear with compression. Various failure modes in compressionand shear bi-axial stress.

Unit IV: Design of Masonry Components and Systems: [H 6]

Structural Design Framework, Lateral Supports and Stability of Structures, Wall thickness and Wall effective length. Wall Slendemess ratio, Permissible compressive, tensile and shear stress, Lintel Design, Design steps to be followed and Design guidelines for Reinforced Masonry, PM Interactions, Shear Reinforcement Design. Anchorage Design.

Unit V: Special Masonry Structures: [H 6]

Confined Masonry Construction, Structural Components, and Guidelines for confined masonry construction, Behaviour of confined masonry. Infill Masonry and its behaviour. Modelling Infill walls.

Course Outcome:

To accomplish the abilities/skills for the following.

CO1: Recognizing the various materials involved in construction of masonry structures and their properties.

CO2: Understanding the design concept of masonry structures.

CO3: Gaining Knowledge of various tests used in determining properties of masonry.

Text Books/

1. Paulay T et al, "Seismic Design of Reinforced Concrete and Masonry Buildings". John Wiley. 2013

2. Williams, Clement, C. "The Design of Masonry Structures and Foundations". 1997.

References:

1. Dayaratnam Pasala Et.Al, "Brick and reinforced brick structures", Medtech Publishers, 2018.
2. Various Codes like IS 1905:1987, NBC Vol 1 Part 6, IS 1597: Part 1 1992, IS 2572:1963, IS 2572:2005.

Course Code	Course Name	L	T	P	Credits
CVL -P15	Railway And Airport Engineering	2	1	0	3

COURSE OBJECTIVES

- to learn the Transportation Engineering fundamentals of:
- To expose the students to Railway planning, design, construction and maintenance, and planning and design principles of Airports and Harbours.

SYLLABUS

UNIT I: TRANSPORTATION SYSTEM [H 6]

Importance of transportation systems, history of railways and its development, development of Indian railways.

UNIT II: PERMANENT WAY [H 6]

Permanent way and its component, formation, ballast, sleepers, rails. Creep and tilt in rails.

UNIT III: RAILWAY TRACKS [H 10]

Track resistance and tractive effort, gauge problem, super-elevation near branching of curves, gradients. Track fittings and fastenings, points and crossings, station Platforms, yards, and sidings.

UNIT IV: AIRPORT [H 10]

Classification of airports; planning, surveys, site selection of airports; Airport geometrics: runway length and patterns & orientation, wind rose diagram, width, and grades of runway, taxiways, and aprons.

UNIT V: AIRPORT PAVEMENT DESIGN [H 10]

Airport pavement design: difference between highway and airport pavements, introduction to various design methods, airport drainage.

COURSE OUTCOME

Students who complete this course will be able to:

CO1: The students will have the ability to Plan and Design various Civil Engineering aspects of Railways, Airports, and Harbour.

TEXT BOOK

1. Rangawala, S.C. 2002. "Railway Engineering", Charotar Publishers, Anand
2. Arora, S.P. and Saxena. 2001. " Railway Engineering" , Dhanpat Rai Publishers, New Delhi.
3. Khanna, Arora and Jain. 2002. "Airport Planning and Design", Nem Chand and Brothers, Roorkee.
4. Horren Jeff. "Airport Planning and Design

Course Code	Course Name	L	T	P	Credits
CVL-P16	Hydropower Engineering	2	1	0	3

Course Objectives:

The basic objectives

- To gain insight into the basic concepts of hydropower engineering
- To provide insight into the design of various components of hydro-power structures such as Dams, penstock, tunnels, surge tanks, draft tubes etc.
- To study the selection of suitable turbines for various types of hydropower plants.

Syllabus:

Unit I: INTRODUCTION [H 12]

Sources and forms of energy, types of power plants and their comparison, elements of hydropower scheme, hydropower development in India, Hydropower plants classification based on head, storage capacity and layout.

Estimation of Hydropower potential, Processing of hydrological data, Use of extreme and long term hydrological data, mass and elevation volume curves, flow duration curves.

Load and power studies: firm power, secondary power, load curve, load factor, load duration curve, firm capacity, reservoir capacity, capacity factors, Diversity Factor.

Unit II: WATER CONVEYANCE SYSTEM [H 10]

Power canals: Alignment, Surges in Canals, Design of power canals.

Penstocks: Alignment, types of penstocks, Economic diameter of penstocks, Anchor blocks, Water Hammer, Resonance.Behaviour of surge tanks, types of surge tanks, hydraulic design, design of simple surge tank-stability.

Unit III: DAMS [H 10]

Selection of site, preliminary investigations, Final investigations.

Types of Dams, Basic principles of design & details of construction of Gravity Dams. Earthen dams, rock-fill dams and their basic design Considerations. Spillways: Types of spillways, Spillway gates, Design of stilling basins.

Unit IV: HYDRAULIC TURBINES [H 6]

Types of turbines and their performance characteristics, Selection of turbines and their specific speed, Turbine setting, Scale ratio, Comparison of turbines, Governing of hydraulic turbines.

Unit V: POWER HOUSE DETAILS [H 4]

General layout of power house & arrangement of hydropower units, Underground power stations.

Course Outcome:

After completion of this course, the student will be able:

CO1: To understand the role of hydropower in the energy system, in India and internationally.

CO2: To describe the different concepts relevant to hydropower engineering.

CO3: To design essential elements of hydropower plant like conveyance structures, Impoundment structures and Powerhouse.

CO4: To select appropriate Turbine units for a hydropower setting.

Text Books

1. Dandekar, M.M. "*Waterpower Engineering*".
2. Deshmukh, M.M. "*Waterpower engineering*", Danpat Rai & Sons, New Delhi
3. Nag P.K., "*Power Plant Engineering*" Tata McGraw Hill, 2nd Edition, 4th Fourth reprint 2003.

References:

1.Dr.Sharma P.C, Kataria S. K. & Sons, "*Power Plant Engineering*" 2009
2.Rai-Khanna. G.D., "*An introduction to power plant technology*" Publishers, Delhi, 2013

Course Code	Course Name	L	T	P	Credits
CVL-P17	Prestressed Concrete	2	1	0	3

Course Objectives:

The following are the course objectives of the subject:

- To introduce the students to the basic concepts and principles of Prestressed concrete structures.
- Be able to perform analysis and design of prestressed concrete members.
- To give an experience in the implementation of engineering concepts that are applied in field of Prestressed Concrete
- To introduce the students to various prestressing techniques and their application in civil engineering structures.

Syllabus:

Unit I: [H 8]

Basic concept of prestressing – Advantages of prestressed concrete over reinforced concrete – materials for prestressed concrete and their characteristics. Uniform prestress distribution in prestressed concrete – non-uniform prestress distribution – moments of resistance.

Unit II: [H 10]

Tensioning devices, Pre-tensioning systems, post-tensioning systems, thermo-electric prestressing, chemical prestressing; Nature of prestress losses, Losses due to: Elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, anchorage slip. Total losses allowed for in Design.

Unit III: [H 8]

Analysis of pre-stressed structural members for axial loads, flexure, shear & torsion. Analysis calculations for various elements.

Unit IV: [H 10]

Transfer of Stress in Pretensioned Members, Anchorage Zone stresses in Post-Tensioned Members, Limit state Design Criteria for Prestressed Concrete Members, Principles of Dimensioning Concrete Members.

Unit V [H 6]

Design of Pre-stressed sections for flexure, axial tension, shear & Torsional forces. Combination of stresses.

Course Outcome:

After this course,

CO1: Students will understand the general mechanical behaviour of prestressed concrete.

CO2: Students will be able to analyse, and design prestressed concrete flexural members.

CO3: Students will be able to analyse and design for vertical and horizontal shear in prestressed concrete.

CO4: Students will be able to analyze transfer and development length as well as prestress losses.

Text Books:

1. N. Krishna Raju, Prestressed Concrete, Tata McGraw Hill Publishing Co. Ltd, New Dehi
2. K Mallick, A P Gupta, Prestressed concrete, Oxford and IBI Series.

References

1 R. H. Evans, Bennet E W, Prestressed concrete theory and design, Chapman and Hall, London.

2 T. Y. Lin, Ned H.Burns Design of Prestressed Concrete Structures, Wiley John Wiley and Sons

Course Code	Course Name	L	T	P	Credits
CIV-P18	Environmental Impact Assessment & Audit	2	1	0	3

Course Objectives:

At the end of the course, students would be able:

- Formulate objectives of the EIA studies
- Identify the need to assess and evaluate the impact on environment.
- Know about Environmental audit and Environmental Impact Assessment

Syllabus:

Unit I: Introduction [H 8]

Definition, significance and scope of impact assessment, Need & objective, types of environmental impacts, methods of environmental impacts, major steps in impact assessment procedure, generalised approach to impact analysis, social impact assessment.

Unit II: Environment Impact Assessment [H 12]

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Unit III: Global Environmental Issues [H 6]

Green House Effect, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust.

Unit IV: Environmental audit [H 8]

Recent trends in industrial waste management, Cradle to grave concept, Life cycle analysis, Clean technologies; Environmental audit and Legislation: Definition and concepts, Environmental audit versus accounts audit, Compliance audit, Relevant methodologies, Various pollution regulations, Introduction to ISO and ISO 14000.

Unit V: Environmental Protection Acts [H 8]

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution

Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries

Course Outcome:

CO1. Aware and sensitise about the present days environmental issues at global and local scale.

CO2: Get acquainted with environmental and social impacts of any developmental activity.

CO3: Knowledge about environmental impact assessment with its objectives and procedure.

Text Books

1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.

2. Glynn, J. and Gary, W. H. K. – Environmental Science and Engineering, Prentice Hall Publishers

3. Suresh K. Dhaneja – Environmental Science and Engineering, S.K. Kataria & Sons Publication. New Delhi.

References

1 Bhatia, H. S. Environmental Pollution and Control, Galgotia Publication (P) Ltd. Delhi.

2 Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers Rutledge, London, 1992.

3 Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications

4. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

Course Code	Course Name	L	T	P	Credits
CVL-P19	Ground Improvement Techniques	2	1	0	3

COURSE OBJECTIVES:

- To understand various ground improvement techniques.

SYLLABUS:

Unit I: [H 8]

Introduction Soil Types, Soil Investigation & Classification, Ground Modification/Stabilization, Need for Engineered Ground Improvement, Classification of Ground Improvement Techniques, Suitability, Feasibility and Desirability of Ground Improvement Techniques, Current & Future Developments

Unit II: [H 8]

Ground Improvement Techniques Mechanical Modification: Introduction to Mechanical Modification, Principles of Soil Densification, Properties of Compacted Soil, Compaction Control, Specification of Compaction, Requirements, Types of Compaction Equipment

Unit III: [H 8]

Hydraulic Modification: Objectives & Techniques, Dewatering Systems, Soil- Water Relationships, Single& Multiple- Well Formulas, Drainage of Slopes, Filtration & Seepage Control, Preloading & Vertical Drains, Electrokinetic Dewatering & Stabilization.

Unit IV: [H 10]

Chemical Modification/Stabilization: Effect of various admixtures on Engineering Properties of Soils such as Cement, Lime, Fly ash, Bitumen, Cement Lime Fly ash. Other chemical additives such as NaCL, CaCL2, CaSO4 , Ca (OH)2, NaOH etc., Grouting- Applications to Embankments, Foundations& Sensitive Soils, Admixtures in Pavement Design.

UnitV: [H 8]

Thermal Modification: Thermal Properties of Soils, Heat Treatment of Soils, Ground Freezing, Strength & Behaviour of Frozen Ground. Modification By Inclusions & Confinement: Evolution of Soil Reinforcement, Applications of Geosynthetics Material in Civil Engineering, Soil Nailing, Soil Anchors, Soil Confinement by Formwork.

COURSE OUTCOMES

CO1: Analyze the field problems related to problematic soils and solve the problems using theground improvement techniques.

CO2: Summarize and practice ground improvement using Mechanical modification techniques..

CO3: Design drainage for seepage control, assess dewatering field problems.

CO4: Application of physical and chemical ground improvement techniques using thermal modification, like grouting, shotcreting and gruniting technology.

CO5: Demonstrate the ground improvement techniques such as ground anchors,rock bolting andsoil nailing.

Text Books

1. Methods of Treatment of Unstable Ground: Belt – Butterworths, 1975

2. Engineering Principles of Ground Modification: Manfired, R. H.

3. Engineering Treatment of Soils: Bell, F. G

References:

1 Geosynthetics for Soil Improvement: ASCE, GST No. 18, New York

2 Grouting Theory & Practice: Nonveiller, E

3 Soil Stabilization: Ingles, O. G. &Metcalf, J. B.

B. TECH CIVIL ENGINEERING BATCH 2020 AND ONWARDS

Course Code	Course Name	L	T	P	Credits
CVL-P20	Pre-Engineering & Prefabrication of Structures	2	1	0	3

COURSE OBJECTIVES:

- To impart knowledge to students on modular construction, industrialized construction and design of prefabricated elements and construction methods. At the end of this course the student shall be able to design some of the prefabricated elements and also have the knowledge of the construction methods using these elements.

SYLLABUS:

Unit I: [H 6]

Introduction to Pre-Engineered Buildings: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered building

Unit II: [H 6]

Pre-Engineered Building Components: Primary System: Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases.

Unit III: [H 4]

Design Loads on Pre-Engineered Buildings: Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code.

Unit IV: [H 8]

Design Methodology: Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/tw, bf/tf ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations. Analysis and Design of Rigid Frames. Rigid Frame Moment Connection, Shear Connection- Anchor bolt and base plate design (Pinned and Fixed)

Unit V: [H 6]

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

Unit VI: [H 6]

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls. Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

Unit VII: [H 6]

Applications - Designing and detailing of precast unit for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns.

COURSE OUTCOMES

CO1 Classify different materials used for pre-engineered buildings
CO2 Analyze the prefabricated load carrying member
CO3 Design and detailing of precast unit for factories
CO4 Apply pre-engineered building design methodology

Text Books

1. Alexander Newman, Metal Building Systems Design and Specifications, 2nd Edition
2. K. S. Vivek & P.Vaishavi – Pre Engineered Steel Buildings, Lambert Academic Publishing
3. CBRI, Building materials and components, India, 1990.
4. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994.
5. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
6. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
7. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.

Course Code	Course Name	L	T	P	Credits
CVLP21	Water Shed Management	2	1	0	3

SYLLABUS:

Unit I: [H 6]

INTRODUCTION

Importance of Water Shed Development for improvement in Environment. Status of Watershed Development in India, Watershed Concepts

Unit II: [H 6]

Land:

Survey(layout), Soil and Soil Moisture Conservation, Rainwater Management, Reclamation of saline soils.

Unit III: [H 6]

Water: :

Data and Analysis, Integrated Water Resources Management, Conjunctive Use

Unit IV: [H 6]

Greenery:

Agriculture, Crop Husbandry, Sustainable Agriculture, Biomass, Management, Dryland Agriculture, Irrigation, Pastures and Silvipastures, Horticulture, Social Forestry, Afforestation.

Unit V: [H 6]

Energy:

Renewable Resources, Biomass, small hydropower, Ocean Tides and Waves.

Unit VI: [H 6]

Socioeconomics: Peoples' part, State and Integrated Approach, Sustainable Society, Economics.

Unit VII: [H 6]

Appropriate Technology Farm Equipment, Contour Methods, Check Dams, Water Catchment and Harvesting, Low Cost Technology, Rural Technological Delivery Systems.

COURSE OUTCOMES

CO1: To perform studies related to watershed management.

CO2: To prepare pre-feasibility and detailed project reports, etc.

CO3: To appreciate the concept of integrated water resources management.

CO4: To understand the concepts of renewable energy, biomass, etc.

CO5- To equip with the rural technological delivery systems and low cost technology that can be used in the farm.

Text Books

1. Murthy, J.V.S. Watershed Management, New Age International Publishers (P) Ltd. India.
2. Suresh, R. Watershed Hydrology, Standard Book House, India.
3. Das, Ganshyam. Hydrology and Soil Conservation Engineering, Prentice Hall of India.

Course Code	Course Name	L	T	P	Credits
CVLP22	Finite Element Method	2	1	0	3

COURSE OBJECTIVES:

- To illustrate the principle of mathematical modeling of engineering problems
- To introduce the basics and application of Finite Element Method

SYLLABUS:

UNIT I: [H 8]

Introduction to Finite Element Method – Background and general description of the method summary of the analysis procedure.

UNIT II: [H 12]

Theory of Finite Element method, spring element, bar element- Discretization concept- Concept of element – various elements shapes – displacement models – Convergence- shape functions – condensation of internal degrees of freedom-Summary of analysis procedure.

UNIT III: [H 12]

Finite Element Analysis - Development of shape functions for different elements, Truss-Beam-Plane elements- Plane stress and plane strain-Assemblage of elements construction of stiffness matrix and loads – boundary conditions –patch test-solution of overall problem.

UNIT IV: [H 10]

Isoparametric Formulation -Concept of Isoparametric element – One- and Two-dimensional elements-Natural coordinates- Development of Higher order elements- Lagrange – Serendipity –Interpolation-formulation of element stiffness and loads.

Course Outcomes:

- CO1 Summarize the basics of finite element formulation.
- CO2 Apply finite element formulations to solve one dimensional Problems.
- CO3 Apply finite element formulations to solve two dimensional scalar Problems.
- CO4 Apply finite element method to solve two dimensional Vector problems.
- CO5 Apply finite element method to solve problems on iso parametric element and dynamic Problems.

TEXT BOOKS:

1. Introduction to Finite element Method by Tirupathi chandra Patla and Belugundu.
2. The Finite element Method in Engineering, 5th edition by S.S.Rao 2007.

Syllabus for Open Elective Courses to be floated by Civil Engineering Department

Open Electives Courses

S. No	Course Code	Course Title	Hours Per Week			Credits
			L	T	P	
1.	CVLOE1	Civil Engineering Materials and Construction Techniques	2	1	0	3
2.	CVLOE2	Metro Systems and Engineering	2	1	0	3
3.	CVLOE3	Disaster Management	2	1	0	3
4.	CVLOE4	Advanced Solid Mechanics	2	1	0	3

Note:
The students of the Department of Civil Engineering have to choose Open Electives from the list of Open Electives offered by other Departments of School of Engineering.

Course Code	Course Name	L	T	P	Credits
CVLOE1	Civil Engineering Materials and Construction Techniques	2	1	0	3

Syllabus:

UNIT I: Bricks& Timber [H 10]:

Bricks: Classification, Characteristics of good bricks, Ingredients of good brick earth, Different forms of bricks, testing of bricks as per BIS. Defects of bricks.
Timber: Types of timber, Seasoning of timber; Methods, Defects in Timber, Decay of Timber, Preservation of Timber,Testing of Timber, Veneers , Plywood.

UNIT II: Cement, PCC & RCC [H 8]:

Cement:Cement: OPC,PPC , Composition, Types of cement. Plain concrete, composition andgrades of concretes RCC: Properties and composition of RCC, Applications and uses of RCC, Types of steel used in RCC.

UNIT III: Form work & Scaffolding [H 6]:

Form work, Scaffolding, shoring, Shuttering and underpinning; their types, characteristics.

UNIT IV: Structural elements [H 8]:

Performance and application to building processes.Foundation,DPC, brick masonry and stonemasonry. Beams columns and slabs. Lintel beams and plinth beams, Roofs and floors.Trusses

UNIT V: Construction equipment& Repairing [H 10]:

Selection, cranes, hoists, mixers, transit mixer, conveyors, vibrators, bulldozer, dumpers, trenchers, excavators, hoe, gruders, piling hammers, pumps, compressors, bitumen mixer, bitumen mix plant, rollers, clam shell, aggregate production techniques, crushers.
Minimum repair works, repair of cracks and sinking of floor.

Course Outcomes:

CO 1. Knowledge regarding characteristics of bricks and timber
CO 2. Knowledge regarding Cement, Plain cement Concrete and Reinforced concrete
CO 3. Knowledge regarding formwork and scaffolding
CO 4. Various structure elements of building.

Text Books/References:

1. Building materials by Parbinsingh.
2.Building materials and construction by Gurcharan Singh
3.Construction Methods Plant and Equipment by R.L. Purifoy.4.Building Construction by S.P. Arora& S.P. Bindra

Course Code	Course Name	L	T	P	Credits
CVLOE2	Metro Systems and Engineering	2	1	0	3

Syllabus:

UNIT 1 [H 8]

GENERAL: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials

UNIT 2 [H 14]

Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers, and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

UNIT 3 [H 8]

Signaling systems. Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

UNIT 4 [H6]

Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators

UNIT 5 [H 6]

Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

Course Code	Course Name	L	T	P	Credits
CVLOE3	Disaster Management	2	1	0	3

Syllabus:

UNIT 1 [H 10]

Earthquake, causes and classification, Estimation of size of earthquake, Magnitude and intensity, seismic waves, Isoseismal maps, Recurrence intervals, Fault slip rates, Response spectrum.

UNIT 2 [H 8]

Floods, causes of floods, Flood damages, Flood analysis and flood plain zooning. Drought and its impact.

UNIT 3 [H10]

Cyclones and Tsunami, their causes characteristics and their impact, Prediction and control Measures,Avalanches – Mechanism, Classification, Control measures.

UNIT 4 [H 6]

Landslides - Mechanism, Causative factors, Landslides monitoring and prediction, Landslide hazard zonation.

UNIT 5 [H 8]

Vulnerability and Risk Management, Case studies for natural hazards, Fire hazard.

Course outcomes

The students will be able to

CO 1. Differentiate the types of disasters, causes and their impact on environment andsociety

CO 2. Assess vulnerability and various methods of risk reduction measures as well asmitigation.

CO 3. Disaster damage assessment and management.

Text Books/References:

1. Reiter, L Earthquake Hazard Analysis, Issues and Insights, Columbia University Press.

2. Hyndman D. and Hyndman D, Natural Hazard and Disasters, Brooks/cole.

3. Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States.

Course Code	Course Name	L	T	P	Credits
CVLOE4	Advanced Solid Mechanics	2	1	0	3

Course Objective:

- To analyze the transformation of stresses and strains in 3D.
- To study engineering properties of materials, force-deformation, and stress-strain relationship.
- To understand the plastic behaviour of deformable bodies

Syllabus:

Introduction to stress tensor components, Equilibrium equations, Stress transformation, Principal stresses, Boundary conditions. Theory of 3D Strains: Introduction to strain tensor components, Strain transformation, Principal Strains, Compatibility, Stress-strain relationship, Generalized Hooke"s law, Strain-energy, St. Venant's principle. Plane problems in Cartesian and polar coordinates, Stress functions, axisymmetric problems, Stress concentration, Unsymmetrical bending and Torsion. Theory of Failure. Introduction to plasticity for metals.

Course Outcome:

Upon completion of this course, student should be able to,

- Solve the advanced practical problems related to the theory of elasticity, concepts of stress and strain, strain energy, and failure criteria.
- Propose materials and structural elements to the analysis of complex structures.

Text Book/Reference Book:

1. M. Filonenko-Borodich, "Theory of Elasticity", University Press of the Pacific, 2003.

2. L.S.Srinath, „Advanced Mechanics of Solids", 3rd ed., McGraw-Hill Education, 2009.

3. S.P. Timoshenko and J. N. Goodier, "Theory of Elasticity", 3rd ed., McGraw-Hill Education, 2010