BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING)

Detailed Syllabus

Programme Code: CIVB
Duration: 4 Years

EFFECTIVE FROM SESSION: 2019-2020

Faculty of Engineering & Technology
CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY
PANVEL, NAVI MUMBAI
(STATE PRIVATE UNIVERSITY ESTABLISHED UNDER ACT XXXII OF GOVT. OF MAHARASHTRA 2018 AND RECOGNIZED BY THE UGC)

About the Programme

B.Tech (Civil Engineering) is a full-time four-year graduation program, which aims at transforming a student into a technically sound professional. The syllabus contains courses on basic sciences, technical arts, humanities & liberal arts and professional courses. The mix of these courses has been evolved with an aim to produce professionals who have knowledge of not only Engineering but also who are good managers to contribute in a cross functional team and have human values. Being a professional program, it ensures a healthy balance between theoretical foundation and practical exposure to the present day world. The emphasis is to develop all round personality that would enable the students to take up the challenges of the corporate world and become responsible citizens of the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

PEO1	To prepare graduates for successful careers in various domains of Civil Engineering Profession by providing a strong foundation in mathematical analysis, scientific reasoning, and sound engineering fundamentals necessary to solve practical problems
PEO2	To expose graduates to emerging issues, and approaches to problem solving, in order to meet the changing needs of the Society, and the Indian industry in areas related to civil engineering design, planning, and construction.
PEO3	To inculcate team-spirit, and leadership capabilities among graduates through group-based activities and projects with emphasis on planning of experiments, use of software, development of skills for interpreting results of analyses, and writing of effective technical reports.
PEO4	To familiarize graduates with professional issues in civil engineering including: professional ethics, issues related to the global economy; emerging technologies; and fostering of job related skills with emphasis on improved communication skills.
PEO5	To imbibe a spirit of inquiry among graduates in order to promote keen interest in pursuing higher studies and engineering-research.

PROGRAMME OUTCOMES (PO):

PO1	An ability to solve problems in mathematics and science, and to apply this knowledge towards finding solutions to civil engineering problems.
PO2	An ability to design and conduct experiments and to analyze and interpret the results.
PO3	An ability to plan, and design civil engineering systems, components or processes as per relevant codes of practice, user requirements and constraints.
PO4	An ability to communicate effectively through verbal, written and graphical means in project-oriented assignments.
PO5	An ability to function effectively and to give directions to a multidisciplinary team.
PO6	An ability to develop attitudes, techniques and skills to succeed in competitive professional environment including higher studies in a global context.
PO7	An ability to be aware of historical and contemporary issues and to demonstrate the understanding of social impact of engineering solutions.
PO8	An ability to demonstrate the knowledge of professional standards and ethical responsibilities.
PO9	An ability to develop the spirit of innovation and entrepreneurial leadership focused towards the design and implementation of sustainable civil engineering systems.

SEMESTER-I									
Course Type	**Course Code**	**Course Name**	**L**	**T**	**P**	**IA**	**UE**	**Total Marks**	**Credits**
BS	MTHG1000	Engineering Mathematics- I	3	1	-	30	70	100	4
BS	PHYG1000	Engineering Physics	3	1	-	30	70	100	4
ES	CSEG1000	Programming for Problem Solving	3	-	-	30	70	100	3
ES	MECG1000	Engineering Mechanics	3	1	-	30	70	100	4
HSM	ENGG1000	English Communication Skill	3	-	-	30	70	100	3
BS	PHYG1001	Engineering Physics Lab	-	-	4	15	35	50	2
ES	CSEG1001	Programming for Problem Solving Lab	-	-	4	15	35	50	2
MC		Induction Program*	3 weeks duration						0
		Total	**15**	**3**	**8**	**180**	**420**	**600**	**22**

*Induction program for students to be offered right at the start of the first year.

MTHG1000	**Engineering Mathematics- I**	**3L:1T:0P**	**4 Credits**

Course learning objectives:

1. To make the students familiarize with concepts and techniques in Calculus, Complex number and Matrices.
2. To equip the students with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines

UNIT-1

Review on matrices: Definition of matrix ,types of matrix ,Algebra of matrices, Adjoint of matrix, inverse of matrix ,Unitary & Orthogonal matrices ,Echelon form ,Rank of a matrix, Normal form , PAQ normal form, System of homogeneous & Non homogeneous equations, Conditions of their consistency & Inconsistency & solutions; Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Guass Jordan Method (3) Jacobi iteration (4) Gauss Seidal Method

UNIT-2

Definition of Complex number ,Algebra of complex number ,Representation of complex number on complex plane, D'Moivre's Theorem., Powers and roots of Exponential & Trigonometric functions; Expansion of $sin^n\theta$, $cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ; Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Logarithmic functions; Separation of real and Imaginary parts of all types of Functions

UNIT-3

Numerical integration-Different type of operators such as shift, forward, backward difference and their relation. Interpolation, Newton Interpolation, Integration by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule.

UNIT-4

Partial derivatives of first and higher order, total differentials, differentiation of composite and implicit functions. Euler's Theorem on Homogeneous functions with two and three independent variables (with proof). Deductions from Euler's Theorem.

UNIT-5

Maxima and Minima of a function of two independent variables, Indeterminate forms, L-Hospital rule, Fitting of curves by least square method for line, parabola &exponential

Recommended Books & References:

1. A text book of Applied Mathematics, P.N.Wartikar and J.N.Wartikar,Vol – I and –II by Pune Vidyarthi Graha.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9th Ed.
4. Matrices by Shanti Narayan.
5. Numerical by S.S.Sastry, Prentice Hall

Course Outcomes (COs):

The students will be able to learn

1. Apply the concepts of complex numbers to the engineering problems.
2. Apply the knowledge of nth order derivatives of standard functions to engineering problems.
3. Apply the principles of basic operations of matrices to the engineering problems.
4. Apply the basic principles of partial differentiation to engineering problems.
5. Apply concepts of partial differentiation (maxima and minima), expansion of functions as an application of successive differentiation.

PHYG1000	Engineering Physics	3L:1T:0P	4 Credits

Course learning objectives:

1. To teach students basic concepts and principles of physics, relate them to laboratory experiments and their applications

UNIT-1: Wave Optics

Interference:- Introduction to electromagnetic waves and electromagnetic spectrum. Interference in thin film of uniform thickness (with derivation). Interference in thin film wedge shape (qualitative). Applications of interference: testing optical flatness, anti-reflection coating

Diffraction: Diffraction of light, Diffraction at a single slit, conditions for principal maxima and minima, diffraction pattern. Diffraction grating, conditions for principal maxima and minima starting from resultant amplitude equations, diffraction pattern. Rayleigh's criterion for resolution, resolving power of telescope and grating

Polarization: Polarization of light, Malus law, Double refraction, Huygen's theory of double refraction Applications of polarization: LCD.

UNIT-2: Laser and Optic Fibre

Laser: Basics of laser and its mechanism, characteristics of laser. Semiconductor laser: Single Hetro-junction laser. Gas laser: CO2 laser. Applications of lasers: Holography, IT, industrial, medical.

Optic Fiber: Introduction, parameters: Acceptance Angle, Acceptance Cone, Numerical Aperture. Types of optical fiber- step index and graded index. Attenuation and reasons for losses in optic fibers (qualitative). Communication system: basic building blocks. Advantages of optical fiber communication over conventional methods.

UNIT-3: Quantum Mechanics

De-Broglie hypothesis, Concept of phase velocity and group velocity (qualitative. Heisenberg Uncertainty Principle. Wave-function and its physical significance. Schrodinger's equations: time independent and time dependent. Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in RigidBox). Particle in

Finite potential well (Particle in Non Rigid box) (qualitative). Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode. Introduction to quantum computing.

UNIT-4:Semiconductor Physics

Free electron theory (Qualitative). Opening of band gap due to internal electron diffraction due to lattice Band theory of solids. Effective mass of electron Density of states. Fermi Dirac distribution function. Conductivity of conductors and semiconductors. Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration). Working of PN junction on the basis of band diagram. Expression for barrier potential (derivation). Ideal diode equation. Applications of PN junction diode: Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell. Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect.

UNIT-5: Magnetism and Superconductivity

Magnetism: Origin of magnetism. Classification of magnetism on the basis of permeability (qualitative). Applications of magnetic devices: transformer cores, magnetic storage, magneto-optical recording.

Superconductivity: Introduction to superconductivity; Properties of superconductors: zero electrical resistance, critical magnetic field, persistent current, Meissner effect. Type I and Type II superconductors. Low and high temperature superconductors (introduction and qualitative). AC/DC Josephson effect; SQUID: basic construction and principle of working; Applications of SQUID. Applications of superconductors.

UNIT-6: Non Destructive Testing and Nanotechnology

Non Destructive Testing: Classification of Non-destructive testing methods. Principles of physics in Non-destructive Testing. Advantages of Non-destructive testing methods. Acoustic Emission Testing. Ultrasonic (thickness measurement, flaw detection). Radiography testing.

Nanotechnology:- Introduction to nanotechnology. Quantum confinement and surface to volume ratio. Properties of nanoparticles: optical, electrical, mechanical. Applications of nanoparticles: Medical (targeted drug delivery), electronics, space and defense, automobile.

Recommended Books & References:

1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications
2. A textbook of optics – N Subrahmanyam and BriLal , S. Chand Publications
3. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications
4. Fundamentals of Physics, Resnick and Halliday (John Wiley and Sons)
5. Optics, Jenkins and White (Tata Mcgraw Hill)
6. Principles of Physics, Serway and Jewett (Saunders college publishing)
7. Introduction to Solid State Physics, C. Kittel (Wiley and Sons)
8. Principles of Solid State Physics, H. V. Keer, New Age International
9. Laser and Non-Linear Optics, B. B. Laud (Oscar publication)
10. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni (Capital Publishing Company.

Course Outcomes (COs):

On completion of the course, learner will be able to–

1. Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.
2. Learn basics of lasers and optical fibers and their use in some applications.
3. Understand concepts and principles in quantum mechanics. Relate them to some applications.

4. Understand theory of semiconductors and their applications in some semiconductor devices.
5. Summarize basics of magnetism and superconductivity. Explore few of their technological applications.
6. Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application.

CSEG1000	Programming for Problem Solving	3L:0T:0P	3 Credits

Course learning objectives:

1. To learn the fundamentals of computers and understand the various steps in program development. Learn the syntax and semantics of C programming language. To learn the usage of structured programming approach in solving problems.

UNIT-1: Introduction to Programming

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker. Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code. Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C , Fundamental data types, Variables and memory locations, Storage classes.

UNIT-2: Arithmetic expressions & Conditional Branching

Arithmetic expressions and precedence : Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively. Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.

UNIT-3: Loops & Functions

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements. Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

UNIT-4: Arrays & Basic Algorithms

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, Passing arrays to functions. Basic Algorithms: Searching &Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity. Distributed Database: distributed data storage, concurrency control, directory system

UNIT-5: Pointer & File Handling

Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation) File handling: File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

Recommended Books & References:

1. Schaum's Outline of Programming with C by Byron Gottfried , McGraw-Hill.
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill

5. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
6. Let Us C By Yashwant P. Kanetkar.
7. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
8. Programming in C by Kochan Stephen G. Pearson Education – 2015.
9. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication .
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication

Course Outcomes (COs):

On completion of the course, learner will be able

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language)..
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

MECG1000	Engineering Mechanics	3L:1T:0P	4 Credits

Course learning objectives:

The objective of this Course is to provide an introductory treatment of *Engineering Mechanics* to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

UNIT-1

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates

UNIT-2

Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite manoeuvres;

UNIT-3

Non-inertial frames of reference; Rotating coordinate system: Five-term acceleration formula. Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum;

UNIT-4

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance.

UNIT-5

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples, Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a coplanar manner

Recommended Books & References:

1. Engineering Mechanics, 2nd ed. — MK Harbola
2. Introduction to Mechanics — MK Verma
3. An Introduction to Mechanics — D Kleppner& R Kolenkow
4. Principles of Mechanics — JL Synge & BA Griffiths
5. Mechanics — JP Den Hartog
6. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
7. Mechanical Vibrations — JP Den Hartog (
8. Theory of Vibrations with Applications — WT Thomson.

Course Outcomes (COs):

On completion of the course, learner will be able to

1. Use scalar and vector analytical techniques for analysing forces in statically determinate structures
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
3. Apply basic knowledge of maths and physics to solve real-world problems
4. Understand measurement error, and propagation of error in processed data
5. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
6. Understand basic dynamics concepts – force, momentum, work and energy.

ENGG1000	English Communication Skill	3L:0T:0P	3 Credits

Course learning objectives:

1. To acquaint the students with appropriate language skills with the purpose of improving the existing ones – LSRW.
2. To make the learners understand the importance and effective use of non-verbal communication.
3. To make the learner proficient in public speaking and presentation skills.
4. To guide and teach the students to utilize the principles of professional business and technical writing for effective communication in the global world.
5. To deploy technology to communicate effectively in various situations.

UNIT-1: Communication and Communication Process

Introduction to Communication, Forms and functions of Communication, Barriers to Communication ((linguistic and semantic, psychological, physical, mechanical, cultural), and overcoming them, Types of communication: verbal and non-verbal communication.
Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Fast Reading, Strategies for Reading, Comprehension.
Listening : Importance of Listening, Types of Listening, Barriers to Listening.

UNIT-2: Writing Skills, Reading Skills & Listening Skills

Features of Good Language, Technical Style of writing, Writing Emails and it's etiquettes, Technical Reports: Report Writing: Types, Format and Structure of reports.

UNIT-3: Letter Writing

Types of letters: Job application letter, complaint letter, enquiry letter, reply to enquiry, sales letter. Essential and non-essential parts of letters, formats of letters.

UNIT-4: Grammar

Types of sentences, Antonyms and Synonyms, Use of Auxiliaries and Modal Auxiliaries, Synonyms and Antonyms, Pairs of confused words, Common Errors in sentences.

UNIT-5: Soft Skills

Body language, Team work and skills, Decision making ability, Negotiation skills and Interview skills.

UNIT 6: Dialogues Writing and Speaking

Greeting someone and responding to greet, Thanking someone and responding to thanks, Making inquiry and responding to enquiry on telephone, Making request and responding to request.

Recommended Books & References:

1. Communication in Organizations by Dalmar Fisher, Jaico Publishing House
2. Communication Skills by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
3. Business Correspondence & Report-writing by R.C. Sharma& Krishna Mohan, Tata McGraw-Hill Education.
4. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill.
5. Technical Writing & Professional Communication for non-native speakers of English by
6. Thomas N. Huckin & Leslie A. Olsen, McGraw –Hill.
7. Mastering Communication by Nicky Stanton, Palgrave Master Series

Course Outcomes (COs):

On completion of the course, learner will be able to

1. Understand and evaluate information they listen to and express their ideas with greater clarity.
2. Speak and respond effectively along the various channels of communication in a business organization.
3. Speak convincingly before an audience with the help of an expanded vocabulary and enhanced digital content.
4. Communicate through result oriented writing both within and outside the organization.
5. Write a set of effective and easy to understand technical description, instructions.

CSEG1001	Programming for Problem Solving Lab	0L:0T:2P	1 Credits

List of Experiments:

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
11. WAP to print the sum of all numbers up to a given number.
12. WAP to find the factorial of a given number.
13. WAP to print sum of even and odd numbers from 1 to N numbers.
14. WAP to print the Fibonacci series.

15. WAP to check whether the entered number is prime or not.
16. WAP to find the sum of digits of the entered number.
17. WAP to find the reverse of a number.
18. WAP to print Armstrong numbers from 1 to 100.
19. WAP to convert binary number into decimal number and vice versa.
20. WAP that simply takes elements of the array from the user and finds the sum of these elements.
21. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
22. WAP to find the minimum and maximum element of the array.
23. WAP to search an element in a array using Linear Search.
24. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
25. WAP to add and multiply two matrices of order nxn.
26. WAP that finds the sum of diagonal elements of a mxn matrix.
27. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.
28. WAP to swap two elements using the concept of pointers.
29. WAP to compare the contents of two files and determine whether they are same or not.
30. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

Laboratory Outcomes:

1. To formulate the algorithms for simple problems.
2. To translate given algorithms to a working and correct program.
3. To be able to correct syntax errors as reported by the compilers.
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs.
6. To be able to represent data in arrays, strings, structures, and manipulate them through a program.
7. To be able to create, read and write to and from simple text files.

PHYG1001	Engineering Physics Lab	0L:0T:4P	2 Credits

List of Experiments:

1. To determine of wavelength of monochromatic light using Newton's rings.
2. To determine radius of curvature of plano-convex lens using Newton's rings.
3. To determine position of diffraction minima by studying diffraction at a single slit.
4. To determine unknown wavelength by using plane diffraction grating.
5. To find out Resolving power of Diffraction Grating/Telescope.
6. To verify Malus Law.
7. Any experiment based on Double Refraction (Determination of refractive indices, identification of types of crystal).
8. Any Experiment based on Laser (Thickness of wire, determination of number of lines on grating surface).
9. An experiment based on optic fibers.
10. To study IV characteristics of Solar Cell and determine parameters (fill factor and efficiency).
11. To determine band gap of given semiconductor.
12. To determine Hall coefficient and charge carrier density.
13. Temperature dependence characteristics of semiconductor laser.
14. To find out Magnetic susceptibility of given material.
15. Ultrasonic Interferometer: Determination of velocity of ultrasonic waves in given liquid and find its compressibility.

Induction Program
The following activities to be performed by the newly enrolled students. 1. Physical activity 2. Creative Arts 3. Universal Human Values 4. Literary 5. Proficiency Modules 6. Lectures by Eminent People 7. Visits to local Areas 8. Familiarization to Dept./Branch & Innovations

SEMESTER-II									
Course Type	**Course Code**	**Course Name**	**L**	**T**	**P**	**IA**	**UE**	**Total Marks**	**Credits**
BS	MTHG2000	Engineering Mathematics II	3	1	-	30	70	100	4
BS	CHYG2000	Engineering Chemistry	4	-	-	30	70	100	4
ES	ELEG2000	Basic Electrical Engineering	3	1	-	30	70	100	4
MC	EVSG2000	Environmental Studies	2	1		15	35	50	0
ES	MECG2001	Engineering Graphics	1	-	4	30	70	100	3
ES	MECG2011	Manufacturing Practices	1	-	4	30	70	100	3
BS	CHYG2001	Engineering Chemistry Lab	-	-	4	15	35	50	2
ES	ELEG2001	Basic Electrical Engg. Lab	-	-	2	15	35	50	1
		Total	**15**	**3**	**14**	**195**	**455**	**650**	**21**

MTHG2000	**Engineering Mathematics- II**	**3L:1T:0P**	**4 Credits**

Course learning objectives:

1. To provide students with sound foundation in applied mathematics to solve real life problems in industry.
2. To understand the concept of Differential equation to the engineering problems.
3. To learn vector algebra and vector calculus.

UNIT-1: Beta and Gamma functions, and exact differential equation

Beta function and its properties, Gamma functions and its properties, Differential Equation of first order and first degree-Exact differential. equations, Equations reducible to exact equations by using integrating factors.

UNIT-2: Differential Calculus

Linear differential equations of the type $\frac{dy}{dx} + Py = Q$, equation reducible to linear form, Bernoulli's equation. Higher order Linear Differential Equation with constant coefficient-Complimentary function, particular integrals of differential equation of the type f(D)y = X where X is e^a , sin(ax+b), cos(ax+b), x^n, $e^{ax}V$, xV. Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and problems.

UNIT-3: Vector Algebra& Vector Calculus

Definition of vector, Dot product ,Cross product, Vector triple product ,Product of four vectors, Scalar point function ,Vector point function ,Vector differential operator ∇(del) . Gradient,

Divergence, Curl their properties &related problems. Applications- Normal, Directional derivatives, Solenoidal & Irrotational fields

UNIT-4: Double Integration

Definition, Evaluation of Double Integrals, Change of order of integration, Evaluation of double integrals by changing the order of integration and changing to polar form.

UNIT-5: Triple Integration & Application of Double Integration& Triple Integration

Definition and evaluation (Cartesian, cylindrical and spherical polar coordinates), Application to double integrals to compute Area, Mass, Volume. Application of triple integral to compute volume.

Recommended Books & References:

1. A textbook of Applied Mathematics, P. N. Wartikar and J. N. Wartikar, Vol –I and II by Vidyarthi Graha.
2. Higher Engineering Mathematics, Dr.B. S. Grewal, Khanna Publication
3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited,9th Ed.
4. Numerical Analysis by S.S.Sastry, Prentice Hall
5. Differential Equations, Sheply Ross, Wiley India
6. Vector analysis- Murray R-Spiegal-Scharn series

Course Outcomes (COs):

On completion of the course, learner will be able to

1. Apply the knowledge of nth order derivatives of standard functions to engineering problems
2. Apply the concepts of First Order and first degree Differential equation to the engineering problems.
3. Apply the concepts of Higher Order Linear Differential equation to the engineering problems.
4. Apply concepts of Beta and Gamma function to the engineering Problems.
5. Apply concepts of Double integral of different coordinate systems to the engineering problems.
6. Apply concepts of triple integral of different coordinate systems to the engineering problems.

CHYG2000	Engineering Chemistry	4L:0T:0P	4 Credits

Course learning objectives:

1. To impart the basic knowledge of atomic, molecular and electronic modifications that makes the student to understand the technology based on them.
2. To acquire the knowledge of electrochemistry, corrosion and water treatment which are essential for the Engineers and in industry.
3. To acquire the skills pertaining to spectroscopy and to apply them for medical field etc.
4. To impart then knowledge of stereochemistry and synthetic aspects useful for understanding reaction pathways

UNIT-1: Water and its treatment

Introduction – Chemistry of Water Molecule. Hardness of water. Types of hardness: temporary and permanent.(Numericals Based on Hardness). Units of hardness. Estimation of hardness of water by complexometric method.Methods of softening of water: Lime Soda Process (Numericals), Zeolite Process & ion exchange process (Numericals). Softening of Water Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination and ozonization. Desalination of water – Reverse osmosis. Numerical problems.

UNIT-2: Energy Sources

Fuels- Definition, classification (solid, liquid & gaseous fuels) - characteristics of a good fuel; Coal - analysis of coal - proximate and ultimate analysis and their significance; Petroleum - refining, knocking - octane and cetane number, cracking - fluid bed catalytic cracking; Natural gas, LPG, CNG - constituents, characteristics and uses. Numericals.

UNIT-3: Molecular structure and Theories of Bonding

Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N2, O2 and F2 molecules. π Molecular orbitals of butadiene and benzene.
Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries.

UNIT-4: Corrosion

Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion. Types of corrosion: Galvanic, water line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods. Surface coatings – metallic coatings –Methods of coating- Hot dipping, cementation – methods of application. Electro plating and Electro plating of Copper.

UNIT-5: Stereochemistry, Reaction Mechanism and synthesis of drug molecules

Introduction to representation of 3-dimensional structures, Structural and stereoisomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity and Absolute configuration. Conformation alanalysis of n- butane.
Substitution reactions: Nucleophilic substitution reactions: Mechanism of SN1, SN2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard additions on carbonyl compounds. Elimination reactions: Dehydro halogenation of alkylhalides. Saytzeff rule. Oxidation reactions: Oxidation of alcohols using KMnO4 and chromic acid.
Reduction reactions: reduction of carbonyl compounds using LiAlH4 & NaBH4. Hydroboration of olefins. Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

Recommended Books & References:

1. Physical Chemistry, by P.W. Atkins
2. Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan
3. University Chemistry, by B.H. Mahan
4. Fundamentals of Molecular Spectroscopy, by C.N. Banwell
5. Organic Chemistry: Structure and Function by K.P.C. Volhardt and N.E.Schore, 5th Edition.

Course Outcomes (COs):

On completion of the course, learner will be able to

1. The knowledge of atomic, molecular and electronic changes, band theory related to conductivity.
2. The required principles and concepts of electrochemistry, corrosion and in understanding the problem of water and its treatments.
3. The required skills to get clear concepts on basic spectroscopy and application to medical field etc.
4. The knowledge and configurational and conformational analysis of molecules and reaction mechanisms.

MTEG2001	Engineering Graphics	1L:0T:4P	3 Credits

Course learning objectives:

1. To impart and inculcate proper understanding of the theory of projection.
2. To impart the knowledge of reading a drawing.
3. To improve the visualization skill.
4. To teach basic utility of computer aided drafting (CAD) tool.

UNIT-1: Drafting Technology and Introduction to Any Drafting Software/Package

Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice, Dimensioning – linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Tolerances – methods of representing tolerances, unilateral and bilateral tolerances, tolerance on linear and angular dimensions, geometrical tolerances. Symbols used on drawing, surface finish symbols, welding symbols.

Advantages of using Computer Aided Drafting (CAD) packages, applications of CAD, basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

UNIT-2: Projection of Points and Lines

Lines inclined to both the Reference Planes (Excluding Traces of lines) and simple application based problems on Projection of lines. **Projection of Planes**:- Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes)

UNIT-3: Engineering Curves

Ellipse, Parabola, Hyperbola, normal and tangents to these curves, Involute, Cycloid, Epi-cycloid, Hypo-cycloid, Archimedean Spiral, Helix on cone and cylinder

UNIT-4 : Orthographic Projections & Isometric Projections

Reference planes, types of orthographic projections – First angle projections, Third angle projections, methods of obtaining orthographic views by First angle method, Sectional orthographic projections – full section, half section, offset section. Isometric view, Isometric scale to draw Isometric projection, Non-Isometric lines, and construction of Isometric view from given orthographic views and to construct Isometric view of a Pyramid, Cone, Sphere.

UNIT-5: Auxiliary Projections

Auxiliary planes – Auxiliary Vertical Plane (AVP), Auxiliary Inclined Plane (AIP), symmetrical auxiliary view, unilateral auxiliary view, bilateral auxiliary view. Free hand sketching -- FV and TV of standard machine parts – Hexagonal headed nut and bolt, foundation bolts, shafts, keys, couplings, springs, screw thread forms, welded joints, riveted joints.

PART I: Drawing sheet

Five drawing sheets to be prepared on half-imperial drawing sheet: (To be completed in 30 Hrs.)

Sheet No.1: Curves (2 problems) & projections of lines (2 problems)
Sheet No. 2: Projections of solids (2 problems) & section of solids (1 problem)
Sheet No.3: Orthographic projections (1 problem) & sect. ortho. Projections (1 problem)
Sheet No.4: Reading of orthographic projections (2 problems)
Sheet No.5: Isometric view (2 problems) & free hand sketches of fasteners.
Home –Work: one sketch book, A-3 consisting of minimum 3 problems from each module. Duly signed sketch book is part of term –work.

PART II: Computer Aided Drawing (Auto –CAD)

Practice on Auto –cad: Theory and practice to be completed during practical sessions.

1. Introduction to Auto –Cad.
2. Fundamental of 2 –D Constructions.
3. Orthographic projections.
4. Sectional orthographic projections.
5. Reading of Orthographic projections.
6. Fundamental of 3 –D drawing Isometric view.

Course Outcomes (COs):

On completion of the course, learner will be able

1. Apply the basic principles of projections in 2D drawings.
2. Apply the basic principles of projections in converting 3D view to 2D drawings.
3. Read a given drawing.
4. Visualize an object from the given two views.
5. Use CAD tool to draw different views of an object

ELEG2000	Basic Electrical Engineering	3L:1T:0P	4 Credits

Course learning objectives:

1. Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
2. Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
3. To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
4. Highlight the importance of transformers in transmission and distribution of electric power.

UNIT-1: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-2: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3: Transformers

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-4: Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT-5: Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

UNIT-6: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Recommended Books & References:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
3. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
8. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .

Course Outcomes (COs):

On completion of the course, learner will be able

1. To understand and analyze basic electric and magnetic circuits
2. To study the working principles of electrical machines and power converters.
3. To introduce the components of low voltage electrical installations

CHYG2001	Engineering Chemistry Lab	0L:0T:4P	2 Credits

Objectives:

The chemistry laboratory course consists of experiments related to the principles of chemistry required to the engineering student. The course will make the student to learn:

1. Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
2. To determine the rate constant of reactions from concentrations as an function of time.
3. The measurement of physical properties like adsorption and viscosity.
4. To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.

List of Experiments

1. Determination of total hardness of water by complexometric method using EDTA
2. Determination of chloride content of water by Argentometry
3. Estimation of an HCl by Conductometric titrations

4. Estimation of Acetic acid by Conductometric titrations
5. Estimation of HCl by Potentiometric titrations
6. Estimation of Fe^{2+} by Potentiometry using $KMnO_4$
7. Determination of rate constant of acid catalysed hydrolysis of methyl acetate
8. Synthesis of Aspirin and Paracetamol
9. Thin layer chromatography calculation of R_f values. eg ortho and para nitro phenols
10. Determination of acid value of coconut oil
11. Verification of freundlich adsorption isotherm-adsorption of acetic acid on charcoal
12. Determination of viscosity of castor oil and ground nut oil by using Ostwald's viscometer.
13. Determination of partition coefficient of acetic acid between n-butanol and water.
14. Determination of sur face tension of a give liquid using stalagmometer.

Laboratory Outcomes

The experiments included in the chemistry laboratory will make the student to gain the skills on

1. Determination of parameters like hardness and chloride content in water.
2. Estimation of rate constant of a reaction from concentration – time relationships.
3. Determination of physical properties like adsorption and viscosity.
4. Calculation of Rf values of some organic molecules by TLC technique

ELEG2000	Basic Electrical Engineering Lab	0L:0T:2P	1 Credit

Objectives:

1. To Design Electrical Systems.
2. To Analyze A Given Network By Applying Various Network Theorems.
3. To Expose The Students To The Operation Of DC Generator
4. To Expose The Students To The Operation Of DC Motor and Transformer.
5. To Examine The Self Excitation In DC Generators

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Verification of KVL and KCL.
3. Verification of Thevenin's theorem.
4. Verification of Norton's theorem.
5. Verification of Superposition theorem.
6. Verification of Maximum power transfer theorem.
7. Verification of Reciprocity theorem.
8. Magnetization characteristics of DC shunt generator.
9. Swinburne's test on DC shunt machine.
10. Brake test on DC shunt motor.
11. OC & SC tests on single phase transformer.
12. Load test on single phase transformer.
13. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes

After successfully studying this course, students will:

1. Explain the concept of circuit laws and network theorems and apply them to laboratory measurements.
2. Be able to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both single phase and DC Machines
3. Acknowledge the principles of operation and the main features of electric machines and their applications.
4. Acquire skills in using electrical measuring devices.

EVSG2000	Environmental Studies	3L:0T:0P	0 Credits

Course learning objectives:

Through interdisciplinary academic courses, internships, experiential, and co-curricular activities our students become passionate stewards of the environment, scholars in sustainability and environmental management, and experts in environmental studies. With a focus on environmental justice, students develop critical-thinking skills, analyze real-world problems, and understand the power of narrative to create sustainable solutions for local and global communities.

1. To provide students with a broad interdisciplinary liberal arts framework for understanding the relationship between humans and their environment;
2. To provide students with informed perspectives on biological and physical processes relevant to environmental problems, to help students understand responsible environmental policy and practice, and to engage students in ethical reflection regarding environmental problems in local, regional, national, and global communities;
3. To prepare students for careers, citizenship and environmental stewardship through experiential curricular and co-curricular opportunities;
4. To equip students with the knowledge and skills necessary to pursue professional careers and advanced study related to the multi-faceted nature of environmental studies

UNIT-1

Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, **Natural Resources:** Natural resources and associated problems.a) Forest resources : Use and over-exploitation, deforestation, case studies.Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT-2

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation- Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity : consumptive use,

productive use, social, ethical, aesthetic, and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

UNIT-3

Environmental Pollution: Cause, effects and control measures of :-a. Air pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Thermal pollution, g. Nuclear hazards, **Solid waste Management** : Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. **Disaster management**: floods, earthquake, cyclone and landslides.

UNIT-4

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions., Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act Wildlife Protection Act Forest Conservation Act Issues involved in enforcement of environmental legislation. Public awareness.

UNIT-5

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

UNIT-6

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

Recommended Books & References:

1. Textbook of Environmental Studies for Undergraduate Courses, Dr Erach Bharucha, Orient BlackSwan; Pune,
   E-copy: https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf
2. Environmental Studies for Undergraduate Courses, Dr. Sushmitha Baskar, Unicorn Books
3. A Textbook of Environmental Studies, by Asthana D.K., Asthana Meera, S Chand & Company

Course Outcomes (COs):

On completion of the course, learner will be able

1. Articulate the interconnected and interdisciplinary nature of environmental studies;
2. Demonstrate an integrative approach to environmental issues with a focus on sustainability;
3. Use critical thinking, problem-solving, and the methodological approaches of the social sciences, natural sciences, and humanities in environmental problem solving;
4. Communicate complex environmental information to both technical and non-technical audiences;
5. Understand and evaluate the global scale of environmental problems; and

6. Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world.

SEMESTER-III									
Course Type	**Course Code**	**Course Name**	**L**	**T**	**P**	**IA**	**UE**	**Total Marks**	**Credits**
BS	MTHG3000	Engineering Mathematics-III	3	1	-	30	70	100	4
DC	CIVB3010	Introduction to Civil Engineering	3	-	-	30	70	100	3
DC	CIVB3020	Surveying-I	3	-	-	30	70	100	3
DC	CIVB3030	Strength of Materials	3	-	-	30	70	100	3
ES	EETB3000	Basic Electronics	3	-	-	30	70	100	3
BS	ZBCB3000	Biology for Engineers	3	-	-	30	70	100	3
DC	CIVB3021	Surveying Lab	-	-	2	15	35	50	1
DC	CIVB3031	Strength of Materials Lab	-	-	2	15	35	50	1
ES	EETB3001	Basic Electronics Lab	-	-	2	15	35	50	1
MC	LLLB3000	Constitution of India	2	-	-	15	35	50	0
		Total	**18**	**1**	**6**	**225**	**525**	**750**	**22**

MTHG3000	**Engineering Mathematics III**	**3L:1T:0P**	**4 Credits**

Course learning objectives:

1. To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyze engineering problems.
2. To understand the concept of Fourier series and enhance the problem solving skill.
3. To learn the Laplace Transform, Inverse Laplace Transform of various functions, its application.
4. To understand the concept of Correlation and Regression to the engineering problems
5. To understand the concept of partial differentiation.

UNIT-1: Laplace Transform

Laplace transforms, shifting theorems, transforms of derivatives and integrals, differentiation and integration of transforms, inverse transforms, and applications to single and system of linear differential equations..

UNIT-2: Fourier series

Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

UNIT-3: Matrices

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

UNIT-4: Correlation & Regression
Karl Pearson's coefficient of correlation, covariance, Spearman's Rank correlation, Lines of Regression.
UNIT-5: Probability and Probability Distribution
Concepts of Probability - Additive and Multiplicative Laws- Bayes' Decision Rule, Random variable, discrete& continuous random variables, Expectation, Probability Distributions: Binomial, Poisson and Normal Distribution.
UNIT-6: Partial Differential Equations
Classification of partial differential equations of second order, Heat equation, Wav equation Solution of one dimensional heat conduction equation, steady state configuration for heat flow, solution of one dimensional wave equation, transverse vibrations of an elastic string, Numerical Solution of Partial differential equations using Bender-Schmidt Explicit Method and simplified Crank-Nicolson implicit method
Recommended Books:
1. A text book of Applied Mathematics, P.N.Wartikar and J.N.Wartikar,Vol – I and –II, Pune Vidyarthi Graha.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited
4. Numerical Methods, S.S.Sastry, Prentice Hall
5. Higher Engineering Mathematics, H.K. Dass and Er. Rajnish Verma, S. Chand Pvt. Ltd.
Course Outcomes (COs):
On completion of the course, learner will be able **1.** Demonstrate the ability of using Laplace Transform and Fourier Series in solving the Ordinary Differential Equations and Partial Differential Equations. **2.** Use matrix algebra with its specific rules to solve the system of linear equations. **3.** Apply the concept of Correlation and Regression to the engineering problems. **4.** Able to solve heat equations and wave equations. **5.** Expand the periodic function by using Fourier series. **6.** Apply the concept of probability and probability distribution in engineering problems.

CIVB 3010	**Introduction to Civil Engineering**	**3L:1T:0P**	**4 Credits**
Course learning objectives: 1. To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering 2. To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness. 3. 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.			
UNIT-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 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 engineer Overview of National Planning for Construction and Infrastructure Development; Position of construction industry vis-à-vis other industries			
UNIT-2			

Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineer in Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); 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

UNIT-3

Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling Hydraulics, Hydrology & Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures

UNIT-4

Structural Engineering: Types of buildings; tall structures; various types of bridges Water retaining structures; Other structural systems; Experimental Stress Analysis, Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR; Traffic &Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector

UNIT-5

Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD, GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM)

Recommended Books & References:

1. A Basic Concept of Civil Engineering by Sunder Narayan
2. Basics of Civil Engineering by Dhale Shrikrishna & Tajne Kiran M., S. Chand
3. Town Planning by Rangwala, Charotar Book Distributors
4. Water Supply And Sanitary Engineering by Rangwala, Charotar Book Distributors

Course Outcomes:

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

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

CIVB3030	Strength of Materials	3L:0T:0P	3 Credits

Course learning objectives:

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

UNIT-1

Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight.

Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

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

Theories of Failure: Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory).

UNIT-2

Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

UNIT-3

Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity.

Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre

UNIT-4

Deflection of Beams: Elastic curve, Governing differential equation, Double integration method, Macaulay's method, Area moment method, conjugate beam method for computation of slope and deflection of determinant beams.

UNIT-5

Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion.

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

Columns and Struts: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.

Recommended Books & References:

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

Course Outcomes:

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

1. To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion.
2. To suggest suitable material from among the available in the field of construction and manufacturing.
3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts.
4. To understand the basic concept of analysis and design of members subjected to torsion.
5. To understand the basic concept of analysis and design of structural elements such as columns and struts.

CIVB 3020	Surveying-I	3L:0T:0P	3 Credits

Course learning objectives:

1. Describe the function of surveying in civil engineering construction,
2. Work with survey observations, and perform calculations,
3. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements
4. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses
5. Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements

UNIT-1

Surveying: definition, divisions, classification and principles of surveying. Scales: plain, Vernier, diagonal, plan and map. Accuracy and errors: definitions, sources and kinds of errors, application of probability for computation of errors, laws of weights.

UNIT-2

Linear measurement: chain and tape surveying, types of chain and tape, ranging, obstacles and tape correction. Compass surveying: Measurement of directions, Reference meridians, bearing and azimuths, local attraction. Theodolite survey: Vernier theodolite, Measurements of horizontal and vertical angles, Horizontal Control, working of Electronic Theodolites.

UNIT-3

Leveling: Methods of determining elevations, Direct levelling- basic terms and definitions, principle, booking and reduction of field notes, curvature and refraction correction, use of Automatic level, Digital Level, Vertical Control. Contouring: contours, contour interval, horizontal equivalent, characteristics, methods and interpolation, use to prepare profiles. Tachometry: Principles of stadia systems, subtense bar and tangential methods.

UNIT-4

Traversing and triangulation: Principles of traversing by compass and theodolite, computations of traverse coordinates, omitted measurements, Principles and classification of triangulation systems, strength of figures, satellite stations, and triangulation field work. Introduction to modern surveying Instruments /Techniques like total station

UNIT-5

Elements of simple circular curves, theory and methods of setting out simple circular curves, transition curves- types and their characteristics, ideal transition curve, equations of various transition curves, Introduction to vertical curves. Survey Layout for culverts, canals, bridges, road/railway alignment and buildings.

Recommended Books & References:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

Course Outcomes:

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

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
2. Translate the knowledge gained for the implementation of Civil infrastructure facilities
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

EETB3000	Basic Electronics	3L:0T:0P	3 Credits

Course learning objectives:

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in Civil Engineering applications.

UNIT-1

PN junction diode, Depletion layer, barrier potential, forward and reverse bias, break down voltage, PIV characteristics of PN junction diode, knee voltage, ideal PN junction diode, junction capacitance, break down diode (Zener diode). Photo diode and light emitting diode

UNIT-2

Rectifiers and filters, Half wave and full wave rectifiers (centre tape and bridge), regulation ripple factor, R-C, L-C and Pi filters. Clipping and clamping circuit, voltage multiplier

UNIT-3

BJT introduction, Basic theory and operation of PNP and NPN transistors, characteristics of C-B, C-E, C-C configuration. Biasing: Base bias, emitter feedback bias, voltage divider bias, load line, operating point. Incremental analysis using h model.

UNIT-4

FET and Feedback amplifiers, FET: introduction, operation, JFET parameters, JFET

characteristics, JFET amplifiers. MOS FET: Introduction, operation, MOSFET parameters. Feedback amplifiers

UNIT-5

Integrated circuit, Characteristics of ideal, operational amplifiers. Application as inverting, non-Inverting amplifiers. Summer, difference, differentiator, integrator.

Recommended Books & References:

1. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India
2. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education
3. R. T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson

Course Outcomes:

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

1. Know broadly the concepts and functionalities of the electronic devices, tools and instruments
2. Understand use, general specifications and deployabilities of the electronic devices, and assemblies
3. Confidence in handling and usage of electronic devices, tools and instruments in engineering applications

ZBCB3000	Biology for Engineers	3L:0T:0P	3 Credits

Course learning objectives:

To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.

UNIT-1

Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric MODULEs and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon MODULEs and lipids.

UNIT-2

Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

UNIT-3

Information Transfer: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

UNIT-4

Macromolecular analysis: How to analyses biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

UNIT-5

Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and

endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Recommended Books & References:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Course Outcomes:

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

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyze biological processes at the reductionistic level
8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

CIVB3021	Surveying Lab	0L:0T:2P	1 Credit

List of Experiments

1. Measurement of distance by ranging and chaining.
2. Locating various objects by chain & cross staff surveying.
3. Determination of area of polygon by chain and cross staff survey.
4. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
5. Locating given building by chain and compass traversing, (One full size drawing sheet)
6. Determination of elevation of various points with dumpy level by collimation plane method and rise & fall method.
7. Fixing bench mark with respect to temporary bench mark with dumpy level by fly leveling and check levelling.
8. L-Section and cross section of road. (One full size drawing sheet for L-Section and cross section)
9. Measurement of horizontal angles theodolite by method of repetition.
10. Measurement of vertical angles with theodolite (One full size drawing sheet)

Course Outcomes:

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

1. Conduct survey and collect field data.
2. Prepare field notes from survey data
3. Interpret survey data and compute areas and volumes

CIVB3031	Strength of Materials Lab	0L:0T:2P	1 Credit

List of Experiments

1. Izod Impact Test
2. Charpy Impact Test
3. Direct Shear Test on Mild Steel Rod
4. Direct Shear Test on Timber Specimen
5. Direct Shear Test on Mild Steel Plate
6. Brinell Hardness Test
7. Bending Test on Mild Steel
8. Rockwell Hardness Test
9. Vickers Hardness Test
10. Tensile Test on Mild Steel
11. Tensile Test on Cast Iron
12. Compression Test on Mild Steel
13. Compression Test on Cast Iron
14. Torsion Test on Mild Steel

Course Outcomes:

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

1. Conduct different mechanical tests on different materials to collect different properties of materials

ECEG2001	Basic Electronics Lab	0L:0T:2P	1 Credit

List of Experiments

1. Study of CRO & Measurement of Voltage Amplitude & Frequency
2. V-I Characteristics of Silicon & Germanium PN Junction diodes
3. V-I Characteristics of Zener Diode
4. Characteristics of BJT in Common Emitter Configuration
5. Characteristics of JFET in Common Source Configuration
6. Half Wave and Full Wave Rectifier Without Filter
7. Half Wave and Full Wave Rectifier with Filter
8. Common Emitter BJT Amplifier
9. Hartley & Colpitts Oscillator
10. Applications of Operational Amplifier
11. Truth Table verification of Logic Gates

Course Outcomes:

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

1. Know broadly the concepts and functionalities of the electronic devices, tools and instruments
2. Understand use, general specifications and deployabilities of the electronic devices, and assemblies
3. Confidence in handling and usage of electronic devices, tools and instruments in engineering applications

LLLB3000	Constitution of India	2L:0T:0P	0 Credit

Course learning objectives:

The objective of the course is how to deal and adjust in the society under government regulations. Constitution is the highest law of the land and every department owes its origin to its laws. To make governance better an engineer must conduce to E-governance through computers and knowledge of cyber laws. An engineer must know the limits of state action and regulations by acquainting himself with the laws that applied by the bureaucrats. Since an engineer works at different places and sights, he must have the basic knowledge of centre – state relations with reference to policy of financing the key projects. The knowledge of Constitution is necessary for him in order to ensure that the rules and regulations under which public and private sector works, do not violate the provisions of the Constitution. Knowledge of corporate culture is necessary for him. He must understand the compulsions of the public private partnership and philosophy of state ownership of key industries.

UNIT-1

Introduction to Constitution of India, Role of Public Sector Undertakings in economic development, Public policy making in India and influence of new globalised world order

UNIT-2

I.T.Law in India - Section 4-10 of I.T Act: Cyber laws in India - Section 43-47 of I.T Act- Section 65-78 of I.T Act, E-Governance and role of engineers in E-Governance.

UNIT-3

Socialist policy of India and its relevance, Role of Planning Commission in economic development, Finance Commission and centre-State relations

UNIT-4

Fundamental Rights and Fundamental Duties, Directive Principles of State Policy, Politics of Industrialization in India and the policy of Liberalization Privatization and Globalization (LPG)

UNIT-5

Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development

Recommended Books & References:

1. An Introduction to the Constitution of India by: Brij Kishore Sharma
2. Relevant document related Government of India Policy.
3. Cyber Law by Dr. Gupta and Agarwal.
4. www.indiancourts.nic.in
5. Public Administration by Awasthi and Maheshwari

Course Outcomes:

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

1. Understand the basics of Constitution of India.
2. Understand the role of Public Sector Undertakings in economic development
3. Understand the Public policy making in India and influence of new globalized world
4. Understand E-Governance and role of engineers in E-Governance.
5. Understand the Socialist policy of India
6. Understand the role of Planning Commission in economic development
7. Understand the Finance Commission and centre-State relations
8. Understand the Fundamental Rights and Fundamental Duties

SEMESTER IV									
Course Type	**Course Code**	**Course Name**	**L**	**T**	**P**	**IA**	**UE**	**Total Marks**	**Credits**
DC	CIVB 4010	Engineering Geology	3	-	-	30	70	100	3
DC	CIVB 4020	Building Materials and Construction	3	1	-	30	70	100	4
DC	CIVB 4030	Structural Analysis-I	3	1	-	30	70	100	4
DC	CIVB 4040	Remote Sensing and GIS	3	-	-	30	70	100	3
DC	MECB 4040	Introduction to Fluid Mechanics	3	1	-	30	70	100	4
DC	CIVB 4011	Engineering Geology Lab	-	-	2	15	35	50	1
DC	CIVB 4021	Computer-aided Civil Engineering Drawing	-	-	4	15	35	50	2
DC	CIVB 4031	Structural Analysis Lab	-	-	2	15	35	50	1
DC	MECB 4041	Fluid Mechanics Lab	-	-	2	15	35	50	1
		Total	**15**	**3**	**10**	**210**	**490**	**700**	**23**

CIVB4010	**Engineering Geology**	**3L:0T:0P**	**3 Credits**

Course learning objectives:

The objective of this Course is to focus on the core activities of engineering geologists – site characterization and geologic hazard identification and mitigation. Through lectures, labs, and case study examination student will learn to couple geologic expertise with the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects and the quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction.

Engineering geology is an applied geology discipline that involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works. Engineering geology also includes the assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation. Engineering geologists are applied geoscientists with an awareness of engineering principles and practice—they are not engineers.

UNIT-1

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

UNIT-2

Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. *Igneous petrology*- Volcanic Phenomenon and different materials ejected by volcanoes. Types of

volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types, Classification of Igneous rocks on the basis of Chemical composition, Basic Igneous Rocks Like Gabbro, Dolerite, Basalt. *Sedimentary petrology*- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone, *Metamorphic petrology*- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks.

UNIT-3

Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits.

UNIT-4

Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

UNIT-5

Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

Recommended Books & References:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

Course Outcomes:

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

1. Understand the fundamentals of the engineering properties of Earth materials and fluids.
2. Understand the Rock mass characterization and the mechanics of planar rock slides and topples.
3. Understand the Soil characterization and the Unified Soil Classification System.
4. Understand the mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

CIVB4020	Building Material and Construction	3L:1T:0P	4 Credits

Course learning objectives:

1. How the wood, cement, admixtures is used for buildings and construction process.
2. To develop the building walls and foundations and how they are useful for buildings.
3. We know about building arches, roofs, doors, windows and ventilators; and how they are given for buildings.
4. To develop the form work and finishing work which is used for buildings and to solve the defects of building properties

UNIT-1

Scope of Study of building Materials: building materials and their performance, economics of the building materials. Stones: Requirement of good building stone, characteristics of building stone sand their testing. Common building stones. Methods of preservation of stones. Bricks: Manufacturing process of clay bricks, classification of clay bricks. Properties of clay bricks, testing methods for clay bricks. Problems of efflorescence & lime bursting in bricks & tiles.

UNIT-2

Gypsum: properties of gypsum plaster, building products made of gypsum and their uses. Lime: Manufacture of lime, classifications of limes, properties of lime. Cement: Raw materials used, Process of Manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement, Testing of cement properties, Uses of cement. Cement Concrete: Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Methods of Curing of concrete.

UNIT-3

Timber: Classification and identification of timber, Fundamental Engineering Properties of timber, Defects in timber, Factors affecting strength of timber, Methods of seasoning and preservation of timber. Wood based products. Asphalt: Bitumen and Tar: Terminology, specifications and uses, Bituminous materials. Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction. Paints varnishes and distempers: Common constituents, types and desirable properties, Cement paints. Ferrous metals: Desirable characteristics of reinforcing steel. Principles of cold working. Reinforcing telemechanical and physical Properties chemical composition. Brief discussion on properties and uses of Aluminum and lead. Glass: Ingredients, properties types and use in construction. Insulating Materials: Thermal and sound insulating material, desirable properties and types.

UNIT-4

Buildings: Components of building, area considerations, Construction Principle and Methods for layout, Damp proofing, anti termite treatment in buildings, Vertical circulation means: stair cases and their types, design and construction. Different types of floors, and flooring materials (Ground floor and upper floors). Bricks and stone masonary construction. Cavity wall & hollow block construction.

UNIT-5

Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel sand Chhajja, Principles of building Planning; Natural Ventilation, Water Supply and Sanitary fittings (Plumbing), Electric Fittings. Heating Ventilation & Air conditioning (HVAC), Mechanical Lifts and Escalators, Fire Fighting and Fire Protection of Buildings. Acoustics. Plastering and its types, pointing, Distempering, Colour washing, Painting etc. Principles & Methods of building maintenance

Recommended Books & References:

1. SK Duggal, "Building Materials" New Age International
2. Purushothama Raj, "Building Construction Materials & Techniques" Pearson Edu.
3. PC Varghese, "Building Materials" PHI
4. Rangwala, "Building Materials" Charotar Publishing House.
5. Sushil Kumar, "Building Construction" Standard Publisher.

Course Outcomes:

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

1. Demonstrate the ability to know about different materials such as stones, bricks, Tiles, wood, aluminum, glass & paints and their classification, manufacture and structural requirements
2. Ability to know about the materials used in making of concrete such as cement and admixtures.
3. Ability to know about tests on cement such as field and lab tests and uses of cement and admixtures
4. Understanding of various building components such as lintels, arches, types of roofs and joinery such as doors, windows and the materials used in making
5. Demonstrate various building services such as plumbing services, sanitary and ventilations.
6. Demonstrate the various types of ventilations, air conditioning, types of air conditioning, fire protection and classification of fire hazards and fire resistant materials used in construction

CIVB4030	Structural Analysis-I	3L:1T:0P	4 Credits

Course learning objectives:

This is an elementary course on Structural Analysis. Various methods and their underlying mechanics in determining response of structures when subjected to external agitation will be discussed in this course. This course is comprehensive at the basic level. Journey through this course will help students to

1. develop an understanding of various types of structures and their built to facilitate the performance of various activities connected with residence, transportation, storage, healthcare etc. in the field of civil engineering.
2. develop an understanding of the behavior of structure under serviceability load.
3. understand the mechanics of the material behavior of different types of structures.
4. make student aware of various procedure of analysis like Mohr's theorem, method of consistent deformation, reciprocal theorem, Betti's theorem, energy theorem etc. for statically indeterminate structures.
5. To develop good technical reporting and data presentation skills

UNIT-1

Introduction to Structural Analysis: Concept of a structure, Structural analysis, History of structural analysis, Classification of structures -Plane trusses, Beams, Frames, Crossbeams, Arches, Static indeterminacy of structures-Trusses, Beam and frames, Sign convention, Problems

Actions on Structures-Loads, Permanent loads, Live loads, Snow loads, Wind loads, Seismic loads, Thermal loads, Hydrostatic loads and land thrust, Problems

External Analysis of Plane Structures: External equilibrium of structures, External and internal actions, Types of plane structure supports, Static determinacy, static indeterminacy and structural stability-External & Internal analysis, Calculation of support reactions

Analysis of Trusses: Definition of a truss, Hypothesis of analysis, Sign convention and

representation of internal forces, Degree of static indeterminacy and stability of trusses-External analysis& Internal analysis, Analysis methods of trusses-Method of joint equilibrium, Method of sections, Composite trusses, Complex trusses, Space trusses, Space truss analysis, Problems
Internal Analysis of Beams and Frames-Normal force, shear force and bending moment, Sign convention, Beam analysis procedure, Diagrams of internal actions, Relationship between loading, shear force and bending moment, Static determinacy, static indeterminacy and instability of beams and frames, Plane frame analysis procedure, Problems

UNIT-2

Deflections of Elastic Beams: Energy Methods-Elastic deflection of beams, Calculation of deflections-Method of the differential equation of the elastic line, Direct integration method, Moment-area method, Conjugate beam method, Superposition principle, Problems
Structural Deflections: Energy Methods-Work of external actions, Internal or strain energy, Principle of energy conservation, Principle of virtual work, Method of virtual work: trusses, Method of virtual work: beams, Method of virtual work: frames, Conservation of energy and strain energy, Castigliano's theorem-Displacement theorem statement, Slope theorem statement, Application of Castigliano's theorem to truss analysis, Using Castigliano's theorem to analyze beams and frames, Maxwell–Betti law, Problems

UNIT-3

Cable Analysis-Introduction, Mechanical characteristics of cables, Hypothesis of cable analysis, Cable analysis-Cables subject to concentrated force, Cables subject to distributed forces, Cables subject to any force, Cables with an inflection point outside the cable, Suspension bridges, Problems

UNIT-4

Analysis of Arches-Introduction, Three-hinged arch-Semicircular arch under concentrated load, Semicircular arch under uniformly distributed load, Parabolic arch under concentrated load, Parabolic arch under uniformly distributed load, Semicircular arch with support settlements, Bi-hinged arch, Problems

UNIT-5

Influence Lines-Introduction, Influence line definition, Influence lines of a beam using the equilibrium method-Influence lines of a support reaction, Influence line of a shear force, Influence line of a bending moment, Influence lines of a frame using the equilibrium method-Influence line of support reaction VA, Analysis step, Influence lines of truss, Influence lines using the Muller–Breslau principle-Influence lines of a support reaction, Influence line of a shear force, Influence line of a bending moment of temperature, Influence lines of deflections, Problems

Recommended Books & References:

1. Structural Analysis Vol. I & II by Vazirani and Ratwani (Khanna Publishers).
2. Structural Analysis by Negi and Jangid (TMH Publications).
3. Fundamental of Structural Analysis by Sujit Kumar Roy and Subrata Chakrabarty (S.Chand Publishers)

Course Outcomes:

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

1. Apply fundamental concepts of mathematics, statics, mechanics of deformable bodies, and principle of dynamics to the solution of fundamental civil engineering structural analysis problems.
2. Understand the significance of the basic mechanical properties of structural materials.
3. Understand how to represent real structures by idealized structural systems.
4. Understand the deformations of structures under loading and be able to apply various

methods to determine the deformations.
5. Develop the ability to analyze cable and arch structures.
6. Solve statically indeterminate structures using classical methods.

CIVB4040	Remote Sensing and GIS	3L:0T:0P	3 Credits

Course learning objectives:
This course will make the student to understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

UNIT-1

Introduction, Basic concepts and principles of remote sensing; Definition components of remote sensing – energy sensor, interacting body – active and passive remote sensing – platforms – EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface. Application; Meteorology, land use, networking, hydrological studies, soil studies and coastal zone analysis.

UNIT-2

Photogrammetry; Aerial and Terrestrial; photo interpretation. Sensors; Radar imaging; colour scanners; thematic mapper.

UNIT-3

Geographic information system – components of GIS – hardware, software and organisational context – data – spatial and non-spatial maps – types of maps – projection – types of projection – data input – digitiser, scanner, editing – raster and vector data structures – comparison of raster and vector data structure.

UNIT-4

Analysis using raster and vector data – retrieval, reclassification, overlaying, buffering – data output – printers and plotters. Open source softwares.

UNIT-5

GIS and remote sensing applications – urban applications – water resources – urban analysis – watershed management – resources information system – hazard mitigation.

Recommended Books & References:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

Course Outcomes:
On completion of this course, the students will be able to
1. Retrieve the information content of remotely sensed data
2. Analyze the energy interactions in the atmosphere and earth surface features
3. Interpret the images for preparation of thematic maps
4. Apply problem specific remote sensing data for engineering applications
5. Analyze spatial and attribute data for solving spatial problems
6. Create GIS and cartographic outputs for presentation

MECB4040	Introduction to Fluid Mechanics	3L:1T:0P	4 Credits

Course learning objectives:
The objective of this course is to introduce the concepts of fluid mechanics useful in Civil Engineering applications. The course provides a first level exposure to the students to fluid

statics, kinematics and dynamics. Measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy all find useful applications in many engineering problems. A training to analyse engineering problems involving fluids – such as those dealing with pipe flow, open channel flow, jets, turbines and pumps, dams and spillways, culverts, river and groundwater flow - with a mechanistic perspective is essential for the civil engineering students. The topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

UNIT-1

Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density- height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis

UNIT-2

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non- uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

UNIT-3

Potential Flows: source, sink, doublet and half-body. Equation of motion along a streamline and its integrity**.** Bernoulli's equation and its applications- Pitot tube, orifice meter, venture meter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

UNIT-4

Equation of motion for laminar flow through pipes. Stokes' law, transition from laminar to turbulent flow, turbulent flow. types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control.

UNIT-5

Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect. Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance.

Recommended Books & References:

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

Course Outcomes:

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

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics

3. Understand classifications of fluid flow
4. Be able to apply the continuity, momentum and energy principles
5. Be able to apply dimensional analysis

CIVB4011	Engineering Geology Lab	0L:0T:2P	1 Credit

List of Experiments

1. Study of physical properties and identification of rock forming minerals referred under theory.
2. Study of physical properties and identification of economic minerals referred under theory.
3. Megascopic and microscopic identification of rocks & minerals
4. Megascopic and microscopic description and identification of igneous rocks referred under theory.
5. Megascopic and microscopic description and identification of sedimentary rocks referred under theory.
6. Megascopic and microscopic description and identification of metamorphic rocks referred under theory.
7. Interpretation and drawing of sections for geological maps showing tilted beds, faults, nconformities etc.
8. Geological cross sections and study of geological maps
9. Simple Structural Geology problems
10. Simple strike and Dip problems
11. Study of models of geological structures and out crops patterns of different types of rocks and land forms

CIVB4021	Computer-aided Civil Engineering Drawing	0L:0T:4P	2 Credits

List of Experiments

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

Simple engineering drawings with CAD drawing tools: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spine, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatchin g, Customizing toolbars, Working with multiple drawings. Following drawings are to be prepared for the data given using CAD Software

1. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
2. Different types of bonds in brick masonry
3. Different types of staircases – Dog legged, Open well
4. Lintel and chajja
5. RCC slabs and beams
6. Cross section of a pavement
7. Septic Tank and sedimentation Tank

CIVB4031	Structural Analysis Lab	0L:0T:2P	1 Credit

List of Experiments

1. To investigate and verification of beam deflection theories of simply supported beam and Cantilever beam.
2. To verify strain in an externally loaded beam with the help of a strain gauge indicator and to verify theoretically.
3. To study behavior of different types of columns and find Euler's buckling load for each case.
4. To study two hinged arch for the horizontal displacement of the roller end for a given system of loading and to compare the same with those obtained analytically.
5. To determine the horizontal thrust in a three hinged arch for a given system of loads experimentally and verify the same with calculated values.
6. To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally.
7. Experimental and analytical study of a 3 bar pin jointed truss.
8. To verify clerk Maxwell's reciprocal theorem.
9. Experimental and analytical study of deflection and unsymmetrical bending of a cantilever beam.
10. To determine the deflection of curved bars.
11. To find out stiffness and Flexibility of Spring in different loading condition (Stiffness of Spring test)

MECB4041	Fluid Mechanics Lab	0L:0T:2P	1 Credit

List of Experiments

1. To determine the co-efficient of drag by Stoke's law for spherical bodies
2. To determine the critical Reynold's number for flow through commercial pipes.
3. To determine the coefficient of discharge for flow over a broad crested weir
4. To study the characteristics of hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
5. To study the scouring phenomenon around a bridge pier model.
6. To study the scouring phenomenon for flow past a spur.
7. To study the momentum characteristics of a given jet
8. To determine head loss due to various pipe fittings.
9. To study the phenomenon of cavitation in pipe flow.

SEMESTER V

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DC	CIVB 5010	Geotechnical Engineering	3	-	-	30	70	100	3
DC	CIVB 5020	Design of Concrete structures-I	3	1	-	30	70	100	4
DC	CIVB 5030	Structural Analysis-II	3	1	-	30	70	100	4
DC	CIVB 5040	Environmental Engineering	3	-	-	30	70	100	3
DC	CIVB 5050	Concrete Technology	3	-	-	30	70	100	3
DC	CIVB 5060	Estimation & Costing	3	-	-	30	70	100	3
DC	CIVB 5011	Geotechnical Engineering Lab	-	-	2	15	35	50	1

DC	CIVB 5041	Environmental Engineering lab	-	-	2	15	35	50	1
DC	CIVB 5051	Concrete Lab	-	-	2	15	35	50	1
		Total	**17**	**3**	**6**	**225**	**525**	**750**	**23**

CIVB5010	**Geotechnical Engineering**	**3L:0T:0P**	**3 Credits**

Course learning objectives:

1. To develop an appreciation of soil as a vital construction material, so that it may subsequently be used in the design and construction of foundation for civil engineering structures.
2. To develop an understanding of the relationships between physical characteristics and mechanical properties of soils.
4. To inculcate the basic knowledge of soil such as its identification and classification, determination of various engineering properties and its suitability as a foundation/subgrade material.
5. To understand and experience experimental measurement of the physical and mechanical soil properties commonly used in engineering practice.

UNIT-1

Soil Properties: Preliminary definitions, phase diagram, interrelationship. Sieve and hydrometer analyses, Atterberg's limit. Classification systems – IS, MIT and Unified classification systems of soil. Soil structure. Compaction of soil – Theory of compaction, laboratory compaction tests, optimum moisture content and zero air void line. Field methods and compaction control

UNIT-2

Soil water, Permeability: Soil water, effective and neutral pressures. Darcy's law, factors affecting permeability. Laboratory determination of permeability. Permeability of stratified soils. Quick sand conditions and liquefaction of soil.

UNIT-3

Soil stresses: Stresses in soil mass due to surface loading. Boussinesq and Westergaard's formulae for point load. Pressure bulb. Vertical pressure under various uniformly loaded area. Newmark's influence chart. Approximate methods

UNIT-4

Compressibility and Consolidation: Virgin compression curve and definition of the terms. Terzaghi's one dimensional consolidation theory. Laboratory consolidation test, height of solids and change in voids ratio methods. Determination of coefficient of consolidation by log of time fitting and square root of time fitting methods. Consolidation settlement.

UNIT-5

Shear Strength of Soil: State of stress at a point, Mohr's stress circle. Shear strength of soil. Mohr and Mohr-Coulomb failure envelop. Direct, Triaxial, Unconfined and Vane shear tests, principles of drained and undrained tests, stress path

Recommended Books & References:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, Wiley Eastern Ltd., New Delhi, 2009.
2. Soil Mechanics and Foundation Engg. by V.N.S. Murthy, CBS Pub. New Delhi. 2007.
3. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons

Course Outcomes:

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

1. Understand the different types of soil based on their formation mechanism

2. Understand the various phase diagrams and derive various phase relationships of the soil
3. Understand the behaviour of soils based on their moisture contents
4. Determine the permeability of soils through various laboratory and field tests
5. Understand the physical significance of effective stress and its relation with pore pressure
6. Differentiate among various field methods of compaction and their usage based on the type of soil
7. Analytically compute the vertical stress in a semi-infinite soil mass due to various loading conditions
8. Understand the basic mechanism of consolidation of soil
9. Understand the significance of shear strength parameters in various geotechnical analyses

CIVB5020	Design of Concrete structures-I	3L:1T:0P	4 Credits

Course learning objectives:

The objective of this course is to introduce the theory and application of analysis and design of reinforced concrete elements. The course focuses on the understanding the behaviour of reinforced concrete components and systems subjected to gravity loads. After taking this course the students will be able to classify and identify structures based on their behaviour and further analyse, design and detail the various components of structure subjected to gravity loads. They will also be able to interpret and understand the relevant BIS codes and Special publications of BIS.

UNIT-1

Introduction- Review of Concrete making materials- Structural concrete- Grades- properties of Concrete- Modulus of elasticity-flexural strength-Characteristic and Design Values-Partial safety factor. Methods of design- Aims of design- RCC- Limit State method- Assumptions-Stress-Strain behavior of Steel and Concrete- Stress block parameters- Working stress method-comparison of design process

UNIT-2

Analysis and Design of Singly Reinforced Beams- Analysis of Singly Reinforced RC Section Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections- Moment of Resistance Design parameters- Design examples. Analysis and Design of Doubly Reinforced Beams-Necessity of Doubly Reinforced sections Analysis of Doubly Reinforced RC Section-Moment of Resistance- Design parameters- Design Examples

UNIT-3

Shear and Bond design of RCC- Shear forces in RC-Shear Resistance of RC- Truss analogydesign of Vertical stirrups-Bent-up bars- Limitation- Bond failure in RC- Check for bond resistance-Development length-Design for shear and bond; Analysis and Design of Flanged Beams- Analysis of flanged RC section- Singly and Doubly reinforced-Effective flange width-Moment of Resistance- design examples.

UNIT-4

Design of RCC Slabs- Design of One and Two way slabs- Effect of edge conditions- Moment of resistance-Torsion reinforcement at corners- Design examples; Design of Continuous Slab and Beams- Effect of continuity- analysis of continuous beam/slab Moment and shear coefficients for continuous beam/slab- Critical sections.

UNIT-5

Design of RC Columns- Design principles of RC columns- Assumptions- Rectangular and Circular columns- Helical reinforcement- Minimum eccentricity-Use of Interaction diagrams for

Axial load and Moment, Types of footings and pressure distribution under footing under axial load. Design of a wall footing for axial load. Design of isolated footing for axially loaded columns. Design of combined and strip footing.

Recommended Books & References:

1. Design of Reinforced Concrete Structures (Limit State) by A.K. Jain, Nemchand
2. Limit State Design of Reinforced Concrete, by P.C. Verghese, PHI
3. IS-456-2000, IS 3370(Part-IV), BIS 2000

Course Outcomes:

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

1. Recognize the design philosophy of the reinforced concrete structures.
2. Understand the difference between the structural behaviour of different reinforced concrete structural elements through demonstration experiments and analysis.
3. Analyze and design different elements of reinforced concrete structural elements under gravity loads and submit the designs in complete and concise manner.
4. Use the techniques, skills, and modern engineering tools necessary for design and detailing.
5. Analyze and interpret the results using analytical tools and further plan, design and detail different civil engineering structures.
6. Design a structure/component, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability as per the codal provisions.
7. Follow relevant and upcoming BIS standards and design philosophies prevalent in the world.

CIVB5030	Structural Analysis-II	3L:1T:0P	4 Credits

Course learning objectives:

The objective of this course is to develop an understanding of theory and application of the various methods of structural analysis

1. The importance and usefulness of statically indeterminate structures
2. Calculating the degree of external and internal static indeterminacy of the structures
3. Analyzing kinematic static indeterminacy;
4. Illustrating the strengths and weaknesses of statically indeterminate structures
5. Formulating the three moments equation at which the support settlement can be taken into consideration
6. Calculating the actions at the ends of each bar and deducing the support reactions

UNIT-1

Energy Methods in Structural Analysis: General Introduction, Principle of Superposition, Strain Energy, Castigliano's Theorems, Theorem of Least Work, Virtual Work, Engesser's Theorem and Truss Deflections by Virtual Work Principles

UNIT-2

Analysis of Statically Indeterminate Structures by the Matrix Force Method: Introduction, Analysis of Beams, Trusses and Frames, The Three-Moment Equations

UNIT-3

Analysis of Statically Indeterminate Structures by the Displacement Method: The Slope-Deflection Method: Introduction, Analysis of Beams, frames without sidesway and with sidesway, The Moment Distribution Method: Introduction, Analysis of Beams, frames without sidesway and with sidesway,

UNIT-4

Analysis of Statically Indeterminate Structures by the Direct Stiffness Method: Introduction, Analysis of Truss, Beams, frames

UNIT-5

Approximate Methods for Indeterminate Structural Analysis: Indeterminate Trusses and Industrial Frames, Building Frames

Recommended Books & References:

1. Intermediate Structural Analysis by C. K. Wang, Tata Mc Graw Hill Publishers
2. Basic Structural Analysis by C. S. Reddy, Tata Mc Graw Hill Publishers.
3. Theory of Structures (Volume II) by B .C. Punmia, Laxmi Publications
4. Structural Analysis – A Matrix Approach by Pundit, G. S. and Gupta, S.P. TMH

Course Outcomes:

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

1. Apply fundamental concept of mathematics, statics and mechanics to understand the essentials of the advanced method of structural analysis.
2. Understand the structural actions viz. rotations and displacements, especially in building frames subjected to vertical and lateral loadings.
3. Generate mathematical expressions involving all possible structural actions.
4. Analyze building framing system and its components under the action of gravity and lateral loads and thereby developing database for the design of the structure.
5. Identify, formulate and solve engineering problems and to effectively use and apply the computer friendly structural analysis techniques viz. stiffness and flexibility methods to the field problems.
6. Deal with the problems of moving loads in the structures and their analysis techniques such as influence line diagram.
7. Use the techniques and modern engineering tools necessary for engineering practice.
8. Recognize the importance of good written communication skill and to know how to compile the analysis results so that it can be effectively used for the design of the structure

CIVB5040	Environmental Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. To make the students conversant about the environmental pollution problems related to land, air and water.
2. To make the students conversant about the principles of water treatment processes including the problems involved in handling the different sources of water supply.
3. To impart basic knowhow of the process of collection and distribution of domestic wastewater and to make them learn about the different techniques of onsite treatment of sewage.
4. To impart a comprehensive knowledge of the different wastewater treatment processes including the latest state of the art technologies.
5. To get a brief idea of solid waste collection, its sources and characteristics and the different methods of disposal of solid waste.

UNIT-1

Sources, Quality and Quantity Perspectives of Water: Surface sources, subsurface sources, physical characteristics, chemical characteristics, biological characteristics, water quantity estimation, water consumption rate, fluctuations in rate of demand, design periods, population forecasting methods. *Collection and Conveyance of Water*: Intakes, types of Intakes, factors governing location of intakes, pumps, types of conduits, types of pipes, pipe appurtenances

UNIT-2

Purification of Water – Water Treatment: Operations involved in water treatment, screening, plain sedimentation, sedimentation aided with coagulation, filtration, disinfection, water

softening, miscellaneous treatments.

UNIT-3

Distribution System: Requirements of a good distribution system, methods of distribution, systems of supply of water, Distribution reservoirs, layout of distribution system, design of distribution system, analysis of pipe networks of distribution system, appurtenances in distribution system, detection and prevention of wastage of water in a distribution system.

UNIT-4

Sewers and sewer appurtenances: Hydraulic design of sewers: hydraulic formulae for design of sewers, minimum velocity of flow in sewers, maximum velocity of flow in sewers, effect of variation in flow of sewage on velocity of flow in sewers, forms of sewers, design of storm water drains. Construction of sewers: factors affecting the selection of material for sewer construction, materials for sewers, joints in sewers, shapes of sewers, maintenance, cleaning & ventilation of sewers. Sewer appurtenances.

UNIT-5

Quality and Quantity Perspectives of Sewage: Physical, chemical and biological characteristics of sewage, analysis of sewage, estimation of dry weather flow, estimation of storm water flow. *Treatment of sewage*: Preliminary & primary treatment of sewage: screening, grit removal basins, tanks for removal of oil and grease, sedimentation, sedimentation aided with coagulation. Secondary treatment of sewage: activated sludge process, sewage filtration, miscellaneous methods such as oxidation ditch, oxidation ponds, aerated lagoons, rotating biological contractors. Treatment and disposal of sludge, on-site disposal methods, advanced sewage treatment, treated effluent disposal & reuse.

Recommended Books & References:

1. Environmental Engineering, by Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, McGraw Hill Inc., New York, 1985
2. Water supply Engineering – Environmental Engineering (Vol. I), by P.N. Modi, Standard Book House, 2006
3. Water supply Engineering – Environmental Engineering (Vol. 3), by S.K. Garg, Khanna Publishers, 1999
4. Sewage treatment & Disposal and waste water Engineering – Environmental Engineering (Vol. II) by P.N. Modi, Standard Book House, 2008
5. Sewage Disposal and Air Pollution Engineering – Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, 1999

Course Outcomes:

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

1. Serve the community by making people aware with the different pollution related problems.
2. Gain knowledge of the different processes of water treatment and would be able to assist in the design of the water treatment plants.
3. Design a sewerage system for the town and would assist in the design of wastewater treatment plants.
4. Recognize the importance of management of solid waste and thus would assist in maintaining proper hygienic conditions.
5. Help in the prevention of water borne disease thus improving the health conditions of the people.

CIVB5050	Concrete Technology	3L:0T:0P	3 Credits

Course learning objectives:

1. Determine the properties of concrete ingredients i.e. cement, sand, coarse aggregates, water by conducting different tests.
2. Use different types of cement as per their properties for different field applications.
3. Design economic mix proportion for different exposure conditions and intended purposes.
4. Supervise various concrete operations.
5. Carry out field tests on concrete in fresh and hardened state.
6. Use different types of admixtures to improve the properties of concrete for different field applications.
7. Describe different types of concrete.
8. Infer the test results as per relevant IS provisions.

UNIT-1

Concrete Making Materials: Cement, Fine Aggregate, Coarse aggregate, Water, Chemical & Mineral admixtures. Hydration of Cement: Bogue's compounds, Hydration, Gel formation, Types of cement, pore & capillary water. Quality tests on cement: Different test on cement as per Indian standards Aggregates: Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis – Grading.

UNIT-2

Fresh concrete: Properties of fresh concrete- Workability – different tests of workability- Factors influencing workability compaction, finishing, curing

UNIT-3

Hardened concrete: Tests on hardened concrete as per IS codes – Relationship between different strengths – factors influencing strength, NDT techniques.

UNIT-4

Durability: Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack. *Concrete Mix design*: Different methods of mix design – factors affecting mix design – exercises

UNIT-5

Special Concretes: Light Weight Concrete, High Density Concrete, Pre-Placed Concrete, Fibre Reinforced Concrete, Ferro-cement, Polymer Concrete, Air Entraining Concrete, Role of Admixtures

Recommended Books & References:

1. Properties of Concrete by AM Nevelli, Prentice Hall Publishers
2. Concrete Technology by M. S. Shetty, S Chand Co., Publishers
3. Concrete Technology by M. L. Gambhir, Tata McGraw Hill Publishers
4. I.S: 456-2000- Code of Practice for Plain and Reinforced Concrete
5. S.P.:16- Design aids for Reinforced Concrete to IS:456-2000
6. S.P.:23- Handbook on Concrete Mixes

Course Outcomes:

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

1. Describe the materials used to make concrete, including their sources, production and properties.
2. Explain the properties of fresh concrete.
3. Explain the properties of hardened concrete including strength and durability.
4. Design normal concrete mixes and apply statistical quality control techniques to concrete quality.
5. Explain how good concrete is produced.
6. Identify, describe and carry out the main laboratory tests relevant to the use of concrete

on site.

CIVB5060	Estimation & Costing	2L:1T:0P	3 Credits

Course learning objectives:

1. To understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
2. To quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
3. To understand how competitive bidding works and how to submit a competitive bid proposal

UNIT-1

Introduction to estimates: Purpose of estimating; Different types of estimates - their function and preparation; Building estimates: Schedule of rates, Units of measurements, units of works; Road Estimates – Volume of earthwork, Different methods, Earthwork for hill roads; Railway and canal works – Estimates for a new track railway line; earthwork in canals.

UNIT-2

Analysis of rates, Purpose and requirements of rate analysis, Factors affecting rate analysis, Analysis of rates for main items. Abstract of Cost.

UNIT-3

Specifications – Definition and Types of specifications, Specifications of main items, Different areas in a building, Capital cost of a project, Material Statement, Area requirements for different functions, building by-laws.

UNIT-4

Contracts: Essentials of contracts, types of engineering contracts-advantages and disadvantages. Tenders: tender forms, tender documents & notices – time limits, necessity.

UNIT-5

Valuation: Purpose, difference between value and cost, qualifications and functions of a valuer, scrap & salvage value, sinking fund, capitalised value.

Recommended Books & References:

1. Estimation, costing, specifications and valuation in civil engineering by Chakraborti, M, National Halftone Co. Calcutta.
2. Estimation and costing in civil engineering: theory and practice by Dutta B.N., UBS Publishers Distributors Ltd.
3. Estimation and costing in civil engineering by Birdie, G.S., Dhanpat Rai Publishing co. Ltd.

Course Outcomes:

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

1. Understand and interpret civil engineering construction drawings.
2. Prepare Bill of Quantities (BOS), Bill of Materials (BOM) and Labour statements strictly adhering to the specifications and the construction drawing.
3. Develop insight in tendering of new projects and related contract documents.

CIVB5011	Geotechnical Engineering Lab	0L:0T:2P	1 Credit

List of Experiments

1. To determine the specific gravity of soil by density bottle and pycnometer
2. To determine the field density of soil by core cutter method
3. To determine the in-situ density of natural soil by the sand replacement method
4. To determine the in-situ density of soil by sand replacement method

5. To determine the particle size distribution of soil by sieve analysis
6. To determine the permeability of soil by constant head test
7. To determine the permeability of soil by falling head test
8. To determine the optimal moisture content of soil by proctor's compaction test
9. To determine the shear strength of soil by triaxial shear test
10. To determine the shear strength of soil by direct shear test

CIVB5041	Environmental Engineering Lab	0L:0T:2P	1 Credit

List of Experiments

1. Determination of pH.
2. Determination of Conductivity.
3. Determination of Acidity of water.
4. Determination of Alkalinity of Water.
5. Determination of Chlorides.
6. Determination of Hardness of water.
7. Determination of Fluorides.
8. Determination of Available Chlorine in bleaching powder.
9. Conducting Break Point Chlorination Test.
10. Determination of Residual Chlorine.
11. Determination of Dissolved Oxygen.
12. Determination of Chemical Oxygen Demand.
13. Determination of Biochemical Oxygen Demand.
14. Conducting Jar test for determining optimum dosage of coagulant.
15. Determination of Total Solids, Total Dissolved Solids & Settelable Solids.

CIVB5051	Concrete Lab	0L:0T:2P	1 Credit

List of Experiments

1. Determination of Fineness of cement.
2. Determination of consistency of standard Cement Paste.
3. Determination of initial and Final Setting times of Cement.
4. Determination of Compressive Strength of Cement.
5. Determination of Fineness modulus of Coarse and Fine Aggregates.
6. Determination of percentage of voids, Bulk density, Specific Gravity of coarse and Fine Aggregates.
7. Workability Tests: Slump Cone Test, Compaction factor test, Vee-Bee consistometer Test.
8. Preparing and curing concrete specimens for tests & Determination of compressive strength of concrete cubes.
9. Study of stress - strain characteristics of concrete and tests for tensile strength of concrete.
10. Experiments to demonstrate the use of non-destructive test equipment.
11. Mix Design: IS Code method.

SEMESTER VI

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DC	CIVB 6010	Hydraulic Engineering	3	-	-	30	70	100	3
DC	CIVB 6020	Design of Steel Structure	3	1	-	30	70	100	4

DC	CIVB 6030	Transportation Engineering	3	-	-	30	70	100	3
DC	CIVB 6011	Hydraulic Engineering Lab	-	-	2	15	35	50	1
DC	CIVB 6021	Steel Design Practice Lab	-	-	2	15	35	50	1
DC	CIVB 6031	Transportation Engineering Lab	-	-	2	15	35	50	1
DE		Departmental Elective I	3	-	-	30	70	100	3
DE		Departmental Elective II	3	-	-	30	70	100	3
OE		Open Elective I	3	-	-	30	70	100	3
		Total	**18**	**1**	**6**	**225**	**525**	**750**	**22**

DEPARTMENTAL ELECTIVES I & II		**OPEN ELECTIVE I**	
Course Code	Course Name	Course Code	Course Name
CIVB 6110	Foundation Engineering	CSEB6460	Cyber Law and Ethics
CIVB 6120	Industrial Pollution Control	CIVB6210	Environmental Geotechnology
CIVB 6130	Structural Dynamics	CIVB6220	Water Power Engineering
CIVB 6140	Surveying-II		
CIVB 6150	Repair and Rehabilitation of Structures		
CIVB 6160	Engineering Hydrology		

CIVB6010	**Hydraulic Engineering**	**3L:0T:0P**	**3 Credits**

Course learning objectives:

1. To develop the fundamental concept for methods of dimensional analysis and models studies.
2. To develop an understanding of the viscous flow and its governing equations.
3. To understand the basic concepts of boundary layer and theory of boundary layer flow.
4. To develop an understanding of the turbulent flow and its governing equations.
5. To apply the theories of laminar and turbulent flow to solution of some typical pipe flow problems in the field and boundary layer theory to estimate the drag and lift for various shapes of the objects.
6. To understand the design philosophy of turbines and pumps.

UNIT-1

Laminar flow, Navier's-Stokes equation of motion for laminar Flow; Laminar flow between two parallel plates, laminar flow through pipes, Dimensional Analysis & Modal Studies. Velocity distribution in turbulent flow; shear stress due to turbulence, turbulent flow in circular pipes, resistance of smooth and artificially roughened pipes, General resistance diagram.

UNIT-2

Boundary Layer Theory: Introduction, Development of boundary layer over a flat plate, boundary layer thickness, displacement, momentum and energy thicknesses, Application of momentum equation to boundary layer flow, local and mean drag coefficients, Hydro-dynamically rough and smooth surfaces, boundary layer separation and its control, Forces on Immersed bodies: Drag and lift, drag on flat plate, sphere, cylinder and disc, development of lift, Magnus effect and circulation, theoretical lift on rotating cylinder.

UNIT-3

Pipe Flow Problems: Losses in pipe flow, pipes in series, pipes in parallel, branching pipes, siphons, multi-reservoir problems, pipe networks, unsteady flow in pipes, water hammer analysis.

UNIT-4

Hydraulic Machines: Turbines: classification of turbines, Impulse and Reaction turbines, characteristic curves, draft tubes, Pumps: classification of pumps, centrifugal pump, efficiency and power, Output of centrifugal pumps, characteristics curves.

UNIT-5

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

Recommended Books & References:

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.

Course Outcomes:

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

1. Carry out model studies of various hydraulic structures such as weir, barrages, dams, bridge piers, spillways, energy dissipaters, flood embankments.
2. Solve various viscous flow problems such as flow through porous media, blood circulation in human body, design of settling tank, dusting in atmosphere, leakage through cracks in water tank.
3. Apply the theory of boundary layer flow to estimate the lift and drag on various shapes of the objects.
4. Solve the turbulent flow problems relating pipe flow and open channels
5. Apply the theories of laminar and turbulent flow to solution of pipe flow problems in the field.
6. Design various types of turbines and pumps.

CIVB6020	Design of Steel structures	3L:1T:0P	4 Credits

Course learning objectives:

1. Review of design concepts and applications
2. Design of tension members subjected to axial tension
3. Design of tension members subjected to axial tension and bending
4. Design of axially loaded compression members and built up members
5. Design of lacings and battens
6. Design of spliced tension and compression members
7. Design of column bases and grillage foundations
8. Design of flexural members, plate girder and its components
9. Design of roof trusses and its components
10. Plastic analysis and design of simple beams and frames other environmental factors.

UNIT-1

Properties of material and connections: Mechanical properties of steel, Loads and stresses, load combinations, Design of semi-rigid, rigid and moment resisting welded, riveted and bolted connections.

UNIT-2

Tension and compression members: Design of members subjected to axial tension, Design of

members subjected to axial tension and bending, Design of compression members, Design of built up columns, Design of splicing, Design of built up column and their bases, Design of grillage foundations, Design of beam-column connection.

UNIT-3

Flexural members and plate girder: Design of beams, Lateral stability of beams, Design of laterally supported and unsupported beams, Built-up beams, Encased beams, Design of Plate girder and its components.

UNIT-4

Design of industrial building: Structural framing and elements of an industrial building, Loads on a industrial building, Design of truss, Design of components of truss and bracing, Design of gantry girders.

UNIT-5

Plastic analysis and design: Introduction to plastic analysis, Theorem and methods of plastic analysis, Simple cases of beams and frames.

Recommended Books & References:

1. Steel Structures-Design and Practice by Subramanian, Oxford, University Press
2. Limit State Design in Structural Steel by M.R. Shriyekar, PHI, New Delhi
3. Design of Steel Structures by K.S. Sairam, Pearson, Delhi, India
4. Design of Steel Structures by S.K. Duggal, Tata McGraw-Hill Ltd, New Delhi
5. Design of Steel Structures by S.M.A Kazmi, and R.S Jindal, PHI, New Delhi, India

Course Outcomes:

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

1. Recognize the design philosophy of the steel structures
2. Understand the structural behaviour of different steel structural elements and their analysis
3. Analyze and design different elements of steel structural elements under gravity loads and submit the designs in complete and concise manner.
4. Use the techniques, skills, and modern engineering tools necessary for design and detailing.
5. Analyze and interpret the results using analytical tools and further plan design and detail different civil engineering structures.
6. Design a structure/component, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability as per the codal provisions

CIVB6030	Transportation Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. To give an overview of the transportation engineering.
2. To describe the basic characteristics of transportation planning and of the models used by transportation planners.
3. To describe highway design objectives, constraints and controlling factors.
4. To describe the criteria, standards and engineering procedures used to design principal elements of the highway alignment, and highway cross sections.
5. To understand the process of collecting information necessary for successful design of flexible and rigid pavements, including traffic data, material properties and other environmental factors.
6. To give an insight about the basics of Railway and Airport Engineering.

UNIT-1

Highway Planning and Geometric Design: Highway development and planning in India, Pavement Characteristics, Sight distances, Design of horizontal and vertical alignment.

UNIT-2

Highway Material and Construction: Properties of sub-grade and pavement component material, tests on stone aggregate and bituminous materials. Highway construction – WBM, bituminous and cement concrete pavement.

UNIT-3

Pavement Design: Design factors for flexible and rigid pavements. Group Index and CBR methods for flexible pavement design. Analysis of wheel load stresses in rigid pavement. Westergaard's method for design of rigid pavement.

UNIT-4

Railway Engineering: Gauges, creep and wear of rails. Sleepers, station and yards, points and crossing, Tractive resistance.

UNIT-5

Airport Engineering: Airport planning and Airport layout- runway orientation, Wind Rose diagram, basic runway length, corrections for runway length. Airport classification, geometric design. Airport capacity, Aircraft parking systems.

Recommended Books & References:

1. Highway Engineering by S. K. Khanna and Justo, C. E. G., Nemchand & Bros. Roorkee, India.
2. Airport Planning and Design by S. K. Khanna & M. G. Arora, Nemchand & Bros. Roorkee, India.
3. A Text Book of Railway Engineering by Saxena and Arora, Dhanpat Rai and Sons, Delhi, India.
4. Railway Track Engineering, J.S., Mundry, Tata Mc Graw-Hill, New Delhi, India.

Course Outcomes:

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

1. Understand the basic concepts of geometric design of highways by applying fundamental concepts of Mathematics and Laws of Mechanics.
2. Propose a feasible solution to fundamental highway engineering analysis/design problems.
3. Apply condition monitoring and maintenance of road pavements.
4. Conduct experiments on materials for Highway Engineering.
5. Develop technical skills for operations and design of road junction.
6. Develop technical skills for road pavement construction.
7. Design both flexible and rigid pavements.
8. Develop the understanding of various BIS, IRC and ISO standards and to design the highways in conformity with these codes.

CIVB6011	Hydraulic Engineering Lab	0L:0T:2P	1 Credit

List of Experiments

1. Laminar flow through pipes
2. Turbulent flow through pipes
3. Flow through Venturimeter
4. Determination of viscosity by capillary tube viscometer
5. Determination of viscosity by falling sphere viscometer
6. Flow visualization using Reynolds apparatus
7. Flow through bend meter

CIVB6021	Steel Design Practice Lab	0L:0T:2P	1 Credit

List of Experiments

Students are expected to know the basics software of drawing and design (AUTOCAD AND STAAD Pro). Course work includes submission design sheets. Use of AUTOCAD for drawings. The course focuses on understanding the behaviour of steel structural components subjected to gravity loads:

1. Design of axially loaded compression members and built up members
2. Design of lacings and battens
3. Design of column bases and grillage foundations
4. Design of flexural members, plate girder and its components
5. Design of roof trusses and its components

CIVB6031	Transportation Engineering Lab	0L:0T:2P	1 Credit

List of Experiments

1. California bearing ratio test on subgrade soil sample.
2. Determination of hardness of stone by Los Angles abrasion test.
3. Determination of toughness of stone by impact test.
4. Specific gravity and water absorption of stone aggregate.
5. Flakiness and elongation indices tests on stone aggregate.
6. Soundness test on stone aggregate.
7. Deval attrition test on stone aggregate.
8. Crushing strength test on stone aggregate.
9. Ductility test on bitumen.
10. Softening point test on bitumen.
11. Flash and fire point test on bitumen.
12. Penetration needle test on bitumen.
13. Viscosity test on bitumen.

CIVB6110	Foundation Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. To develop an understanding to perform site investigations and to determine the soil parameters needed to carry out foundation design.
2. To learn the subsurface exploration techniques and apply them to design the foundations and retaining walls.
3. To understand and be able to apply the modelling and analysis techniques used in design of foundation: (a) Coulomb's and Rankine's theory for earth retaining structure; (b) Terzaghi's and Skempton's analysis for bearing capacity; (c) Engineering News and Hiley's formula for load carrying capacity of pile.
4. To apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity, stability analysis of slopes and settlement calculations
5. To compute the lateral earth pressure, select size of retaining walls and ensure safety against external forces and moments.

UNIT-1

Earth Pressures and Retaining Structures: Active, Passive and Pressure at rest, Rankine's and Coulomb's theories; Influence of surcharge, layered soil and water table. Rebhann's and Culmann's graphical constructions of active pressure for cohesionless soil, Simplified procedure for design of sheet pile walls and anchored bulk heads.

UNIT-2

Stability of Slopes: Infinite slopes and their stability, Total and effective stress analysis, Concepts of factors of safety. Method of slices, Friction circle and Bishop's simplified methods. Taylor's stability number, Effect of steady seepage, Sudden draw down and submergence.

UNIT-3

Shallow Foundations: Definitions, Bearing capacity of footings, Terzaghi's, Meyerhof's and Skempton's analysis, Effect of rising and lowering of water table on bearing capacity, Permissible, Total and Differential settlements as per IS Code, Plate load test, Standard and Cone penetration tests for determining allowable bearing pressure.

UNIT-4

Deep Foundation and Site Investigation: Introduction to pile foundation. Load carrying capacity of piles by Engineering News and Hilley's formulae, Bearing and friction piles, Bearing Capacity of single pile and pile groups, Boring and sampling techniques, Disturbed and undisturbed soil samples, Area ratio, External and internal clearance.

UNIT-5

Design Criteria, Free and Forced vibrations for single degree of freedom system, Undamped and damped case, Vibration analysis of machine foundation, Determination of mass, spring stiffness, damping constant, Barkan's method for natural frequency, Transmissibility and amplitude.

Recommended Books & References:

1. Design Aids in Soil Mechanics and Foundation Engineering by Kaniraj, S.R, Tata Mc Graw Hill New Delhi, India.
2. A Text Book of Geotechnical Engineering by Khan I. H., Prentice –Hall of India Pvt. Ltd., Delhi, India.
3. Soil Mechanics and Foundation Engineering by Arora, K. R., Standard Publishers, New Delhi, India.

Course Outcomes:

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

1. Apply fundamental concept of mathematics, statics and mechanics to understand the essentials of the method of bearing capacity and stability analysis.
2. Analyse and design a variety of geotechnical engineering structures including foundations, piles, retaining walls, slopes and interpret data.
3. Recognize behavior of soils in slopes, behind retaining structures and phenomena affecting foundation capacity and settlement.
4. Determine allowable bearing pressures and load carrying capabilities of different foundation systems.
5. Evaluate appropriate bearing capacity correction factors and apply related equations in design.
6. Evaluate effects of water and layered soil systems on foundation performance.
7. Identify the appropriate deep foundation type for different soil profiles.
8. Specify pile material types for various applications and calculate side/tip capacity of driven piles in clay and sand.

CIVB6120	Industrial Pollution Control	3L:0T:0P	3 Credits

Course learning objectives:

1. To impart fundamental training and knowledge about the science & engineering of the industrial pollution

2. To develop basic understanding about the pollution types, its effects on the environment & human health, and their control measures.
3. To give students an in-depth importance and understanding of the severity of the industrial pollution and processes involved in the treatment of wastewater, and control of air pollution.
4. To train the students to present a case of any industry and its environmental management programme to build a direct transition in between the theory and practical.

UNIT-1

Characterization of liquid waste survey, sampling and material balance, segregation and equalization; Disposal of waste in environmental, effects on land receiving waters, standards.

UNIT-2

Wastewater treatment, physical, chemical and biological processes Wastewater reclamation and reuse in industry.

UNIT-3

Pollution abatement in major industries: Textile, paper and Pulp, Steel, Sugar, Distillery, Petroleum Refinery.

UNIT-4

Sources and generation of gaseous pollutants, Effects on materials, health and plants, Air quality monitoring.

UNIT-5

Air pollution control, methods for removal of particulates and gaseous pollutants, design principles.

Recommended Books & References:

1. Pollution Control in Industries by S.P.Mahajan, McGraw Hill Co.
2. Industrial Wastewater Treatment by Rao & Dutta, Oxford & IBH Publishers.

Course Outcomes:

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

1. Differentiate between environmental sciences, engineering and industrial pollution control
2. Address the importance of the environment in general and may apply fundamental concepts of Environmental Engineering & Sciences for any industry in their career.
3. Capable to face challenges and apply their knowledge in the areas of industrial infrastructure, and environmental remediation.
4. Hands-on basic design procedure, case studies, seminars, and short-trips provide an understanding of the problems at hand and thus make them capable to undertake any relevant task independently or as a team.
5. Motivate and create some awareness about the environment, to the industry in particular

CIVB6130	Structural Dynamics	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the dynamic behavior of civil engineering structures with an emphasis on buildings and bridges
2. To understand the formulation approaches of dynamic governing equations of structural systems
3. To understand the Free vibration and forced (harmonic, periodic, arbitrary, impulse) vibration of single-degree-of-freedom (SDOF) systems
4. To understand the Free vibration and forced (harmonic, periodic, arbitrary, impulse) vibration of multi-degree-of freedom (MDOF) systems

UNIT-1

Introduction of Structural Dynamics, Differential Equations in Civil Engineering, Types of Analysis, Static and Dynamic load, Degrees of Freedom (Ex: Generation of Stiffness matrix), Dynamic Equilibrium Equation, Solution of Equilibrium Equation

UNIT-2

Undamped free Vibration, Solution, Natural Period/Frequency, Energy in Free Vibration, Damped Free Vibration, Types of damping, Logarithmic decrement equation

UNIT-3

Undamped Forced vibration, Amplitude & Phase Angle, Dynamic amplification factor for deflection (Rd), Damped Forced vibration, Relationship between Rd, Rv and Ra

UNIT-4

Resonant frequency and Half power band width, Force Transmission and Isolation, Design of Vibration Measuring Instruments, Response to Unit Impulse, Response to Arbitrary Force (Duhamel's Integral), Response to Step and Ramp Forces, Response to Rectangular Pulse, Half Sinusoidal wave

UNIT-5

Time Stepping Methods, Central Difference Method, Newmark's Method, Equation of Motion for MDOF System, Solution of Equation, Natural Frequencies and mode Shapes, Modal Orthogonality, Approximate Method for finding Natural frequency

Recommended Books & References:

1. Dynamics of structures by Anil K Chopra
2. Structural Dynamics by Clough & Penzin
3. Structural Dynamics by Madhujit Mukhopadyay

Course Outcomes:

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

1. Analyse single degree of freedom systems without damping and with damping
2. Analyse multi degree freedom system and continuous systems using iterative techniques.
3. Evaluate dynamic response using numerical methods
4. Draw mode shapes and determine coefficients

CIVB6140	Surveying-II	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the basics and elements of different types of curves on roads and their preliminary survey
2. To learn about surveying applications in setting out of curves, buildings, culverts and tunnels
3. To get introduced to different geodetic methods of survey such as triangulation, trigonometric leveling
4. To learn about errors in measurements and their adjustments in a traverse
5. To get introduced to modern advanced surveying techniques involved such as Remote sensing, Total station, GPS, Photogrammetry etc.

UNIT-1

Curve setting-Horizontal curves, Elements of simple and compound curves, Methods of setting out, Reverse curve, Transition curve, Length of curve, Elements of cubic parabola, true spiral and cubic spiral, Vertical curve, parabola, Setting out of buildings, culverts, tunnels.

UNIT-2

Triangulation-different networks, orders and accuracies, intervisibility and height of stations, signals and towers, Baseline measurement, instruments and accessories, tape corrections,

extension of baseline, satellite stations, Reduction to centre.

UNIT-3

Trigonometrical levelling, Observations for heights and distances, Geodetic, observations, Corrections for refraction, curvature, axis signal, Reciprocal observations.

UNIT-4

Errors-Types of errors, Theory of least squares, weighted observations, most probable value, computations of indirectly observed quantities, method of normal equations, conditioned quantities, method of correlates, method of differences, adjustment of simple triangle and quadrilateral network without central station.

UNIT-5

Electromagnetic distance measurement (EDM) Principle–Types, Total station, Photogrammetry –Terrestrial and Aerial photographs, Photo interpretation, Stereoscopy, Remote Sensing – Principle, Idealized remote sensing system, Types, applications, Introduction to GPS–Segments, Principle of working, application.

Recommended Books & References:

1. Surveying Vol. II and Duggal, S.K. Tata McGraw Hill, 2004, I.
2. Surveying Vol.I and II, Punmia, B.C. Standard Publishers, 1994.
3. Surveying Vol. II and Arora, K. R. Standard Book House, 1996, I.
4. Advanced Surveying, Satheesh Gopi., Pearson Education, 2007.
5. The Global Positioning System and Surveying using GPS, Satheesh Gopi., Tata McGraw, 2005.

Course Outcomes:

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

1. Set out curves, buildings, culverts and tunnels
2. Carry out a geodetic survey, taking accurate measurements using instruments and adjusting the traverse
3. Apply mathematical adjustment of accidental errors involved in surveying measurements
4. Plan a survey for applications such as road alignment and height of the building
5. Invoke advanced surveying techniques over conventional methods in the field of civil engineering

CIVB6150	Repair and Rehabilitation of Structures	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the basics of maintenance and repair strategies of structures.
2. To learn about strength and durability characteristics of concrete.
3. To be introduced to different types of special concrete.
4. To learn about different techniques for repair and protection of structures.
5. To understand the Repair, Rehabilitation and Retrofitting of Structures

UNIT-1

Maintenance and Repair Strategies Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration

UNIT-2

Strength and Durability Of Concrete- Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness

UNIT-3

Special Concretes- Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete,

High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes

UNIT-4

Techniques for Repair and Protection Methods- Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection

UNIT-5

Repair, Rehabilitation and Retrofitting of Structures- Evaluation of root causes; Underpinning & shoring; some simple systems of rehabilitation of structures; Guniting, shotcreting; Non-Destructive testing systems; Use of external plates, carbon fibre wrapping and carbon composites in repairs. Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – Demolition Techniques – Engineered demolition methods – Case studies

Recommended Books & References:

1. Concrete Structures Repair Rehabilitation and Retrofitting by Bhattacharjee
2. Repair and Rehabilitation of Concrete Structures By Poonam I Modi And Chirag N Patel
3. Repairs and Rehabilitation of Structures by Abhijitsinh Parmar
4. Innovative Systems for Seismic Repair and Rehabilitation of Structures-Design and Applications by Ayman S Mosallan

Course Outcomes:

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

1. Assess strength and materials deficiency in concrete structures
2. Suggest methods and techniques used in repairing / strengthening existing concrete structures
3. Apply Non Destructive Testing techniques to field problems
4. Apply cost effective retrofitting strategies for repairs in buildings

CIVB6160	Engineering Hydrology	3L:0T:0P	3 Credits

Course learning objectives:

1. To develop an appreciation of need, importance and scope of hydrology in Indian perspective.
2. To develop an understanding of various components of hydrological cycle, their behaviour and factors affecting.
3. To discuss the importance of estimation of runoff, analysis of rainfall data and various hydrographs such as unit hydrograph, flood hydrograph and synthetic unit hydrograph.
4. To develop technical skills for preparation of water resources project documents by knowing the design parameters based on the knowledge of various types of hydrological parameters.
5. To build the necessary theoretical background of ground water hydrology, types of aquifers and their yields.
6. To solve simple problems on water -budget, infiltration, measurement of average rainfall, evaporation, potential evapotranspiration and flood hydrographs.

UNIT-1

Scope and applications of hydrological cycle, Hydrology applied in Engineering, Precipitations types and measurement, Rain gauge, Network analysis of rainfall data.

UNIT-2

Evaporation, Evapotranspiration, Consumptive use, infiltration and percolation, methods of

determination of infiltration, factors affecting infiltration.

UNIT-3

Surface runoff, factors affecting runoff, measurement of runoff, Analysis of runoff data. Hydrographs, Flow Mass curve and Flow duration curve, Concept of Unit Hydrograph, Methods of Estimation of Unit Hydrograph, Derivation and application.

UNIT-4

Ground Water Hydrology, Definitions, Types of Aquifers and Wells, Occurrences, Distribution, Darcy's law and its limitations, Well hydraulics.

UNIT-5

Flood estimation and flood routing: General, Design flood, estimation for ungauged and gauged water sheds, probable maximum flood, Routing classification, Reservoir routing, Hydrological Channel routing.

Recommended Books & References:

1. Engineering Hydrology by K. Subramanya, TMH, New Delhi, India.
2. Hand book of Applied Hydrology by Chow V.T, Mc Graw-Hill, N.Y., USA.
3. Hydrology by Wister, and Kohler and Paulhus, McGraw Hill, Tokyo, Japan.

Course Outcomes:

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

1. Understand the fundamental concepts of hydrological cycle, occurrence and distribution of surface, subsurface and deep ground water.
2. Understand the significance of various hydrological parameters, types and forms of precipitations.
3. Apply the knowledge in watershed management and reservoir yields.
4. Estimate the efficacy of rain gauge network, runoff from a catchment and ground water recharge.
5. Apply S-curve method for changing the duration of a given unit hydrograph and estimation of peak flood for un-gauged catchments.
6. Create the necessary theoretical background for computing the peak flood for a water resources project based on the unit hydrograph approach.

CIVB6210	Environmental Geotechnology	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand knowledge of soil physics, soil chemistry, hydrogeology, and biological processes along with the principles of soil mechanics.
2. To capable of identifying, preventing and solving problems involving facilities that may adversely affect the environment. s.

To identify the unconventional nature of the problem, which may have its bearing on multiple factors, e.g. an underground pipe leakage may not be due to the faulty construction of the pipe but caused due to the highly corrosive soil surrounding it

UNIT-1

Fundamentals of Geo-environmental Engineering-Scope of geo-environmental engineering - multiphase behavior of soil – role of soil in geo-environmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on geo-environment - case histories on geo-environmental problems.

UNIT-2

Soil-Water-Contaminant Interaction-Soil mineralogy characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of

interaction between soil particles, Concepts of unsaturated soil – importance of unsaturated soil in geo-environmental problems - measurement of soil suction - water retention curves - water flow in saturated and unsaturated zone. Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants.

UNIT-3

Waste Containment System- Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.

UNIT-4

Contaminant Site Remediation- Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation.

UNIT-5

Advanced Soil Characterization- Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.

Course Outcomes (COs):

The students will be able to

1. Understand the environmental problems related to the reduction of waste, waste disposal facilities and cleanup of contaminated sites.
2. Understand the knowledge of soil physics, soil chemistry, hydrogeology, and biological processes along with the principles of soil mechanics.
3. Understand the geo-environmental engineering problems, Soil-water contaminant interaction studies, concepts of unsaturated soil in geo-environmental engineering, Waste containment system

Recommended Books & References:

1. Sparks, D.L.,"Environmental Soil Chemistry" Academic Press, New York, 2002.
2. Hillel D.," Introduction to Soil Physics" Academic Press, New York, 1982
3. Bagchi ,A.," Design of landfills and integrated solid waste management" John Wiley & Sons, Inc., USA, 2004
4. Mohamed, A. M. O.,"Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, New York, 2006.

SEMESTER VII

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DC	CIVB 7013	Project Work-I	-	-	8	30	70	100	4
DC	CIVB 7022	Professional Training	*Field training during summer vacation after 6th Semester (1-2 months duration)*			-	50	50	1
DC	CIVB 7030	Design of Concrete Structure-II	3	1	-	30	70	100	4
DC	HUMG 7000	Engineering Economics	3	-	-	30	70	100	3
DC	CIVB 7031	Concrete Design Practice Lab	-	-	2	15	35	50	1
DE		Departmental Elective III	3	-	-	30	70	100	3
DE		Departmental Elective IV	3	-	-	30	70	100	3

OE		Open Elective II	3	-	-	30	70	100	3
		Total	**15**	**1**	**10**	**195**	**505**	**700**	**22**

DEPARTMENTAL ELECTIVES III & IV		**OPEN ELECTIVE II**	
Course Code	Course Name	Course Code	Course Name
CIVB 7110	Irrigation Engineering	CIVB7210	Disaster Management
CIVB 7120	Advanced Highway Engineering	CIVB7220	Sustainable Materials and Green Building
CIVB 7130	Bridge Engineering	MECB7450	Introduction to Philosophical Thoughts
CIVB 7140	Construction Technology and Management		
CIVB 7150	Traffic Engineering and Management		
CIVB 7160	Construction Practice		

CIVB 7013	**Project Work-I**	**0L:0T:8P**	**4 Credits**

Course learning objectives:

The object of Project Work I is to enable the student to take up investigative study in the broad field of Civil Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.

Assignments

1. Survey and study of published literature on the assigned topic
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility
4. Preparing a Written Report on the Study conducted for presentation to the Department
5. Final oral Presentation before a departmental committee.

Recommended Books & References:

1. Relevant books
2. Relevant IS codes
3. Journals related to the topics of project work
4. Relevant Software Packages

Course Outcomes:

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

1. Work in a team to select a problem for project work
2. Review and evaluate the available literature on the chosen problem
3. Formulate the methodology to solve the identified problem
4. Apply the principles, tools and techniques to solve the problem
5. Prepare and present project report

CIVB 7022	**Professional Training**	**0L:0T:0P**	**1 Credit**

Course learning objectives:

1. To develop an appreciation and importance of civil Engineering in developing the infra structure.
2. To develop an understanding regarding the various engineering principals to be used in the field construction activities.
3. To emphasizes on the use of the modern tools and plants used in the construction industry.
4. To develop a technical skill to prepare project documents.
5. Build the necessary practical background and exposure to the field problems.

Topics Covered

Minimum of one month industrial training in any area related to civil engineering. The summer training should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project, which may be assigned to him/her. The outcome of the training should be presented in the form of a report.

Recommended Books & References:

1. Knowledge of all core subjects related to the desired training program

Course Outcomes:

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

1. Understand the fundamental concepts of civil engineering, its necessity and importance.
2. Apply the knowledge in selecting suitable materials, and construction technique required for a particular construction activity.
3. Understand the significance of various suitable tools and plants to be used as per the given site conditions.
4. Execute and handle the projects individually and on team basis.
5. Manage the various activities of a construction project.

CIVB7030	Design of Concrete Structures-II	3L:1T:0P	4 Credits

Course learning objectives:

1. To make students conversant with the design of structures like Continuous beam, Tanks, Prestress Concrete Structures, Staircases and Retaining walls.
2. To enable the students execute the drawing with adherence to specification mentioned.

UNIT-1

Design of RC Footings- RC footings-Minimum depth of footing- Safe bearing capacity- Design for Bending-Shear in One way and Shear in Two way- Transfer of load at base of column.

UNIT-2

Design for Serviceability- Concept of Serviceability- Deflection- Span to depth ratio- Short-term Long-term deflection due to Shrinkage, Creep- Cracking-Crack width calculation.

UNIT-3

Design of staircases, Design of cantilever and counterfort type retaining wall and frames.

UNIT-4

Introduction to Water tank design, Design criterion, Design of rectangular and circular water tanks, Design of Intze tank and overhead tank staging.

UNIT-5

Introduction to Prestressed concrete, prestressing systems, losses in prestress, Design of short span girders, design of end blocks.

Recommended Books & References:

1. Design of Reinforced Concrete Structures (Limit State) by A.K. Jain, Nemchand
2. Limit State Design of Reinforced Concrete, by P.C. Verghese, PHI
3. IS-456-2000, IS 3370(Part-IV), BIS 2000

Course Outcomes:

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

1. Design the Reinforced Concrete footings
2. Design structures for serviceability
3. Design stair cases, retaining wall and water tanks
4. Understand the concept of Prestressed concrete

CIVB7040	Engineering Economics	3L:0T:0P	3 Credits

Course learning objectives:

1. To learn about introduction to economics.
2. To learn about value engineering.
3. To learn about cash flow
4. To learn about economics of sampling and Replacement and Maintenance
5. To learn about depreciation and Evaluation of public alternative

UNIT-1

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis Material selection for product Design selection for a product, Process planning.

UNIT-2

Make or buy decision, Value engineering Function, aims, and Value engineering procedure. Interest formulae and their applications -Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor- Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT-3

Methods of comparison of alternatives present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT-4

Replacement and Maintenance analysis Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT-5

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the year's digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation- Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

Recommended Books & References:

1. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.
2. Chan S. Park, Contemporary Engineering Economics, Prentice Hall of India, 2002.

Course Outcomes:

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

1. Understand Economics in general, Economics of India particularly for public sector agencies and private sector businesses.
2. Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives
3. Carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
4. Understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.

CIVB 7031	Concrete Design Practice Lab	0L:0T:2P	1 Credit

Course learning objectives:

The objective of the course is to make students skillful in designing & detailing of everyday structure along with the reference practice to various IS codes and specification.

This course in helpful to students in two ways:

Firstly, it directly helps a student who opts for a career in design practice after completing his graduation. Secondly, it is useful for those students also who wish to enter in the field work/ construction to earn their living. If the students has persuaded this course with devotion & sincerity then he will not have any difficulty in preparing working drawing for any job work or he can very well understand the design of his drawing for execution purposes & can realize the mentioned specification in the work during execution.

List of Experiments

Design & Detailing of following structures:

1. Beam
2. Slab
3. Column
4. Foundation
5. Slab culvert
6. Rectangular water tank
7. Intze tank

UNIT-2

Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. Examples

UNIT-3

PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion. Examples

UNIT-4

Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials

UNIT-5

Resource management, basic concepts, labour requirements, labour productivity, site productivity, non-productive activities, equipment management, materials management

Recommended Books & References:

1. Several codes & standards
2. Handbooks
3. Observation and Inferences from existing structures

Course Outcomes:

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

1. Apply the principle of physical sciences & skills of engineering to give a feasible solution to any problem faced during design& execution.
2. Analyze and incorporate in the design / modify the data in the solution e.g. value of loads

taken in design and use of human skills in the functional design of structure

3. Develop an ability to understand various ethical & social constraints e.g. constructability principles exposure of the structure to various types if environment abuses.
4. Develop an ability to work in a team with objective of achieving the goal and develop sportsman spirit.
5. Develop and inculcate engineering sense so that an engineer can apply engineering and technological knowledge & skills in the solution of problem, which he had never encountered.
6. Learn ethics & responsibility of a design engineer to give optimal design of any structure.
7. Present their design at various stages right from understanding the problem, preliminary design analysis and final section recommendation, writing of material & construction specification & good construction practices for any of the designed job.
8. Develop a broad understanding of the engineering solution & design incorporating the economic constraints and social impacts.

CIVB7110	Irrigation Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the importance of the methods of irrigation which use lesser quantity of water for growing crops in more area.
2. To understand the significance of loss of water in maintaining water requirement of various crops for more yield of crops.
3. To understand the decrease in yield of crops due to water logging.
4. To understand the design of unlined and lined irrigation canal network for smooth conveyance of water from source to the field for cultivation of crops.
5. To understand the adverse impact of silting of canals in reducing the discharging capacity of canals i.e. the command of canals to design the silt control structures on canals and rivers. To understand the elementary idea of sediment transport in alluvial channels for proper design of earthen canals.
6. To understand the design of cross drainage structures for uninterrupted water supply in natural channels and manmade canals.
7. To understand the design of storage and diversion canal head works for diverting the water from rivers into the canals.

UNIT-1

Irrigation development in India, present status of irrigation in India, methods of irrigation, land leveling and Irrigation schedule.

UNIT-2

Silt control in canals, Water requirement of various crops, Canal losses, water logging and lining of canals.

UNIT-3

Regime theories for the design of earthen channels, elementary idea about sediment transport, incipient motion of sediment and modes of sediment transport.

UNIT-4

Theory of uplift pressure, canal headwork, river training works.

UNIT-5

Canal regulation and cross drainage works including canal outlets.

Recommended Books & References:

1. Irrigation Water Resources and Water Power by P.N. Modi
2. Irrigation Engineering by Bharat Singh

3. Irrigation Egg. and Hydraulic Structures by S. K. Garg

Course Outcomes:

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

1. Realize the importance of optimal water use for growing the crops and apply methods for saving land from water logging.
2. Apply knowledge for efficient design methods for rapid conveyance of water with lesser loss in irrigation canals.
3. Apply the silt control devices in canals and natural channels for long life of irrigation schemes i.e. Silt excluders, Silt ejectors, Sediment transport in alluvial channels and reduction of channel resistance due to silt deposition on the bed and sides of canals.
4. Apply the knowledge in the design of hydraulic structures to be constructed at junction of natural and manmade channels with obstruction free flow.
5. Formulate irrigation networks across the country to make itself self-reliant in food grain production.
6. Emancipate the need of water resource conservation and management to overcome the natural calamities such as drought.

CIVB7120	Advanced Highway Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. Pavement design based on empirical and mechanistic relations between materials, geometry and performance.
2. Analysis and construction of hilly roads.
3. Design of surface drainage system.
4. Construction and maintenance of roads.
5. Design of overlays, use of Benkelman beam deflection method for flexible overlays.

UNIT-1

Pavement Materials-*Soil* - Classification, characteristics, compaction, evaluation of soil strength; stabilized pavement materials; *Aggregates*: requirements, properties and tests on road aggregates for flexible and rigid pavements. *Bitumen*: Origin, preparation, properties and tests, constitution of bituminous road binders; requirements; Criterion for selection of different binders. *Bituminous Emulsions and Cutbacks*: Preparation, characteristics, uses and

Tests, *Cement Concrete for Pavement Construction*: Requirements, and design of mix for CC pavement, IRC and IS specifications and tests, joint filler and sealer materials.

UNIT-2

Pavement Design: Design wheel loads, CBR, McLeod and Stabilometer methods for flexible pavement design. Burmister's method. Modified Westergaard's analysis. Evaluation of temperature, warping and frictional stresses. Design of joints, dowel and tie bars in cement concrete pavements. Bradbury's work and IRC recommendations for design of rigid pavements.

UNIT-3

Hill Roads: General considerations, Classification of hill roads, Alignment and geometrics of Hill roads. Design and construction of hill roads.

UNIT-4

Highway Drainage: Importance, significance and requirement of highway drainage system. Surface and Sub-Surface Drainage, Construction of Roads in Water Logged Areas. Drainage of Slopes and Erosion Control

UNIT-5

Highway Maintenance: Causes and Types of Pavement Failure, Maintenance of Flexible and Rigid Pavements, Maintenance of WBM and bituminous surfaces, special repairs in

flexible pavements. Strengthening of Existing Pavement. Objects, types and design of overlay. Benkelman beam deflection studies. Canal regulation and cross drainage works including canal outlets.

Recommended Books & References:

1. Highway Engineering by S. K. Khanna and Justo, C. E. G., Nemi Chand & Brothers, Roorkee, India.
2. Principles of Transportation and Highway Engineering by G. V. Rao, Tata Mc Graw-Hill, New Delhi, India.

Course Outcomes:

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

1. Apply fundamental concepts of mathematics and hydraulics to the design of highway drainage.
2. Apply condition monitoring and maintenance of road pavements.
3. Conduct field testing for design of overlays especially in case of bituminous constructions.
4. Develop technical skills for maintenance of flexible and rigid pavements.
5. Understand the basic concepts of geometric design of highways by applying fundamental concepts of mathematics and laws of mechanics.
6. Develop the understanding of various BIS, IRC and ISO standards and to design the highways in conformity with these codes.

CIVB7130	Bridge Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. To introduce different types of highway and railway bridges.
2. To understand different types of loads standardized by Indian Road Congress (IRC) and Indian Railway Standard Code of Practice for Bridges.
3. To select a specific type of concrete/steel bridge to be constructed at a particular location
4. To understand different methods of analyses and their application for designing deck slab of concrete bridges carrying wheel loads.
5. To design of slab culvert for IRC loading
6. To understand different methods of load distribution among the longitudinal girders of a T-beam bridge.
7. To design of deck slab of a T-beam bridge for IRC loading.
8. To design of longitudinal girders of a T-beam bridge.
9. To design of cross girders of a T-beam bridge.
10. To design of piers and abutments of a T-beam bridge.
11. To analyse and design of balanced cantilever bridge.
12. To analyse and design of cable stayed bridge.
13. To design of plate girder bridge
14. To design of truss Bridge
15. To design of Suspension Cable Bridge

UNIT-1

Classification of bridges, site selection, geometric and hydraulic design consideration, loading standards for highway and railway bridges, general design consideration; optimum spans

UNIT-2

Concrete bridges: culverts; Slab, T-beam, box girder bridges, balanced cantilever bridge, cable stayed bridge; arch bridge

UNIT-3

Steel bridges: plate girder bridge, truss bridge, suspension cable bridge, cable-stayed bridge.

UNIT-4

Substructures: design of piers and abutments, pile and well foundations

UNIT-5

Bearings and expansion joints, special wearing coats; seismic design considerations, special durability measures; provisions for inspection and maintenance

Recommended Books & References:

1. Essentials of Bridge Engineering by Victor, Oxford, New Delhi, India
2. Bridge Engineering by Punnuswamy, Tata McGraw Hill Publishing Co., New Delhi, India
3. Standard Specifications and Code of Practice for Road Bridges
4. Standard Specifications and Code of Practice for Railway Bridges
5. I.S: 875-1987 Part 1 and 12 - Code of Practice for Design loads for Buildings and Structures, BIS, New Delhi, India
6. I.S: 1893 2002- Indian Standard Code of Practice for Structural Safety of Structures, BIS, New Delhi, India

Course Outcomes:

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

1. Relate different design philosophies of the highway and railway bridges.
2. Understand the structural behaviour of different components of a reinforced concrete and steel bridge.
3. Analyze and design different components of a highway and railway bridge, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability under loads standardized by Indian Road Congress (IRC) and Indian Railway Standard Code of Practice for Bridges respectively and submit the designs in complete and concise manner.
4. Use the techniques, skills, and modern engineering tools and softwares necessary for design and detailing.
5. Analyze and interpret the results using analytical tools and further plan, design and detail different bridges using relevant and upcoming BIS standards.

CIVB7140	Construction Technology and Management	3L:0T:0P	3 Credits

Course learning objectives:

1. To make student conversant with the concepts and importance of the subject of construction management
2. To make student capable, of preparing work break down structure along with network analysis like CPM and PERT.
3. To make student conversant with the concept of materials management and human resource management

UNIT-1

Basics of Construction- Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution; Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts.

UNIT-2

Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. Examples

UNIT-3

PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion. Examples

UNIT-4

Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials

UNIT-5

Resource management, basic concepts, labor requirements, labor productivity, site productivity, non-productive activities, equipment management, materials management

Recommended Books & References:

1. Building Construction by Varghese, P.C., Prentice Hall India
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Construction Project management by Neeraj Kumar Jha., Theory & Practice, Pearson Education India
4. Project Planning with PERT and CPM by Punmia, B.C., Khandelwal, K.K., Laxmi Publications
5. Construction Management and Planning by Sengupta B and Guha H, TMH, New Delhi, India

Course Outcomes:

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

1. Develop a management system, incorporating constraints of time, cost, social, legal and ethical aspect of various phases of project life cycle.
2. Adapt oneself in team work and can interact with the persons of diverse skills and can freely communicate with fellow engineers and co-workers effectively.
3. Understand the values and ethics of professional practice.

Appreciate technological breakthrough and can notice the changes in practice and society.

CIVB7150	Traffic Engineering and Management	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the basic characteristics of traffic stream
2. To understand the different methods of traffic forecast.
3. To design hourly volume for varying demand conditions
4. To determine the capacity of different highway facilities including unsignalised and signalized intersections
5. To know the factors involved in traffic accidents.
6. To study the traffic flow theories and applications

UNIT-1

Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection

UNIT-2

Design Hourly Volume For Varying Demand Conditions: Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, demand functions. Determination of design hourly volume; critical hour concept

UNIT-3

Highway Capacity: Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections. Problems in

Mixed Traffic flow; Case studies

UNIT-4

Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions

UNIT-5

Traffic Flow Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications; Probabilistic Aspects Of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications

Recommended Books & References:

1. Textbook Of Highway And Traffic Engineering, Saxena, S. C., CBS Publishers
2. Traffic Engineering and Transport Planning by Kadiyali, L. R., Khanna Publishers
3. Traffic Engineering, Roger P. Roess, Elena S. Prassas and William R. McShane, Prentice Hall
4. Traffic Flow Fundamentals, May, A.D. Prentice Hall

Course Outcomes:

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

1. Estimate basic characteristics of traffic stream
2. Conduct traffic studies and analyze traffic data
3. Design traffic signal systems
4. Determine the capacity of highways

CIVB7160	Construction Practice	3L:0T:0P	3 Credits

Course learning objectives:

1. Construction is a highly practical subject. Students on all built environment degree programmes are expected to know and understand building technology from both a theoretical and practical standpoint.
2. Construction site visits are a popular way for students to become acquainted with the practical aspects of construction, but these visits can only show students a small proportion of the technology of construction.
3. Construction Practice provides students with a comprehensive overview of practical construction technology.
4. The sequences follow a logical progression through the subject and include contemporary and established practice, as well as modern methods of construction.

UNIT-1

Building planning, site selection, orientation from environmental and other factors, principles of planning buildings, open air spaces, requirement of parts of buildings, lighting and ventilation, requirements of various rooms, Building bye laws

UNIT-2

Components of building and their purpose and types; foundations, walls, columns, roofs, doors, windows; Bands and openings in the buildings; seismic requirements; Mechanical, Electrical & Plumbing (MEP) works in buildings; Vertical transport in structures; Building finishes

UNIT-3

Basic design of foundation of buildings, Terms used in brick masonry, Bonds and types of mortars. Excavation, dewatering, shoring, underpinning and scaffolding, drilling, blasting, well sinking and pile driving, cofferdams, formwork-fabrication and use

UNIT-4

Construction techniques for special structures such as slip forming and other special formwork systems for high-rise buildings, Damp proofing; causes and effect of dampness, materials and methods of damp proofing; Termite proofing: pre and post construction treatment; Thermal insulation, methods of thermal insulation, thermal insulation of roofs and exposed walls; Doors and windows

UNIT-5

Staircases: parts and type of stairs, dimensioning of staircase. Internal and external painting-types and methods of application; various types of finishes; Fire protection- fire hazards, characteristics of fire-resisting materials and common building materials; Cracks in walls, floors and ceilings-causes and repairs techniques; Routine maintenance of buildings and structures

Recommended Books & References:

1. A Textbook of Building Construction, Sharma, S. K., S. Chand Publishers
2. Building Construction, Varghese, P. C., PHI
3. Building Construction, Punmia, B. C., Lakshmi Publishers

Course Outcomes:

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

1. To understand the property, use , advantage and disadvantage of different materials used in construction
2. To understand the component of building with their function
3. To understand construction procedure of different components

CIVB7210	Disaster Management	3L:0T:0P	3 Credits

Course learning objectives:

1. To create awareness amongst students to basic issues of natural and manmade disasters.
2. To ensure the understanding of the disaster management cycle and relationship amongst vulnerability, preparedness, prevention and mitigation.
3. To invoke minimum ability and sensitivity amongst students to respond to disasters in their area of living and working.
4. To develop technical prowess and to mitigate the effects of disasters by capacity building amongst engineering fraternity towards formulation and implementation of disaster management strategies.
5. To relate amongst the basic approaches adopted in disaster risk reduction and institutional mechanism adopted in country towards creating resilient society.

UNIT-1

Natural and Man Made Disasters: Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Climatic change and extreme climate. Global warming, Sea level rise, ozone depletion. Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, Pollution and environmental degradation. Road, rail, sea and air accidents.

UNIT-2

Earthquake and Cyclone: Understanding dynamics of earth's interior and plate tectonics. Causes and classification of earthquakes. Seismology and methods of earthquake measurement. Concept of seismic zonation and micro-zonation. Earthquake and associated hazards. Preparedness, mitigations and civil engineering interventions. Climatology, Cyclones and tropical cyclones, Naming and radius of cyclone, monitoring of cyclone, Categories of Cyclonic disturbances, Causes of disaster during cyclone, damage and vulnerability assessment due to cyclone.

UNIT-3

Landslide and Flood: Understanding mass wasting and movement. Causes and classification of landslides. Landslide monitoring and landslide hazard zonation. Slope stability analysis and stabilization methods. Preparedness, mitigations and civil engineering interventions.
Understanding hydrosphere and hydrologic cycle. Causes and classification of floods. Preparedness, mitigations and civil engineering interventions.

UNIT-4

Disaster Preparedness and Mitigation: Human behavior and response. International and National Strategies for disaster reduction. Concept of disaster management. National disaster management framework. Central, state, district and local administration; Armed forces, police, NDRF in disaster response, rescue and relief. Role of NGOs, community based organizations and media. Role of different engineering disciplines in preparedness, response, rescue, rehabilitation recovery, prevention and mitigation.

Recommended Books & References:

1. National Disaster Management Policy-2009, Government of India, New Delhi.
2. Manual of Natural Disaster Management, Gupta etal., IIPA, New Delhi.
3. Disaster Management, Harsh Gupta, Universities Press.
4. Vulnerable India: A Geographical Study of Disasters, Kapur, Anu, Sage Publishers, New Delhi.

Course Outcomes:

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

1. Understand genesis and causes of natural and manmade disaster within the framework of fundamental concepts of basic sciences and engineering.
2. Perceive the vulnerability of their living and working places and level of preparedness within the existing setup of disaster management.
3. Analyze and critically examine the vulnerability of a region; and to employ adequate strategy and tools of intervention.
4. Build capacity to use specialized problem solving skills, methodologies and technology.
5. Setup priorities to develop coherent and adaptable disaster management plan

SEMESTER VIII

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DC	CIVB 8013	Project Work-II	-	-	8	30	70	100	4
DC	CIVB 8025	Seminar	-	-	4	15	35	50	2
DE		Departmental Elective V	3	-	-	30	70	100	3
OE		Open Elective III	3	-	-	30	70	100	3
OE		Open Elective IV	3	-	-	30	70	100	3
		Total	**9**	**-**	**12**	**135**	**315**	**450**	**15**

DEPARTMENTAL ELECTIVES V		**OPEN ELECTIVES III & IV**	
Course Code	Course Name	Course Code	Course Name
CIVB8110	Design of Earthquake Resistant Structures	CIVB8210	Metro Systems and Engineering
CIVB8120	Design of Hydraulic Structures	CIVB8220	Industrial Structures
CIVB8130	Air and Water Transportation	HUMG8000	Economic Policies in India
		CIVB8230	Environmental Impact Analysis
		CIVB8240	Foundation Analysis and Design

		CSEB8430	History of Science & Engineering

CIVB 8013	Project Work-II	0L:0T:8P	4 Credits

Course learning objectives:

The object of Project Work II is to enable the student to extend further the investigative study taken up under Project Work I, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.

Assignments

1. In depth study of the topic assigned in the light of the Report prepared under Project-I
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Presentation before a Departmental Committee.

Recommended Books & References:

1. Relevant books
2. Relevant IS codes
3. Journals related to the topics of project work
4. Relevant Software Packages

Course Outcomes:

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

1. Work in a team to select a problem for project work
2. Review and evaluate the available literature on the chosen problem
3. Formulate the methodology to solve the identified problem
4. Apply the principles, tools and techniques to solve the problem
5. Prepare and present project report

CIVB 8025	Seminar	0L:0T:4P	2 Credits

Course learning objectives:

To develop skills in doing literature survey, technical presentation and report preparation.

Assignments

Each student shall identify a topic of current relevance in the branch of Civil Engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class.

Recommended Books & References:

1. Relevant books
2. Relevant IS codes
3. Journals/Articles related to the topic of Seminar

Course Outcomes:

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

1. Select a topic relevant to analysis, design and management of a civil engineering system
2. Undertake a critical review of the literature on the chosen topic

3. Prepare a technical report on the selected topic
4. Present a technical report on the selected topic before the audience

CIVB8110	Design of Earthquake Resistant Structures	3L:0T:0P	3 Credits

Course learning objectives:

1. To evaluate seismic forces for various structures as per relevant Indian standards
2. To design and ductile detailing of structures for seismic resistance as per Indian standards
3. To understand the base isolation concept

UNIT-1

Elements of Earthquake Engineering: Earthquake magnitude and intensity, Focus and Epicentre, Causes and Effects of Earthquakes, Characteristics of Earthquake, Seismic zone mapping.

UNIT-2

Structural Systems For Seismic Resistance: Structural systems – building configuration, frames, walls, dual systems–response in elevation, plan, influence of structural classification, Concepts of seismic design

UNIT-3

Analysis for Earth Quake Loads: IS:1893-2002- Seismic Coefficient method- modal analysis, Applications to multi-storied building frames – water tanks – chimneys.

UNIT-4

Ductile Detailing: Ductility of R.C structures- Confinement- detailing as per IS-13920-1993- moment redistribution – principles of design of beams, columns – beam column joints – soft story concept.

UNIT-5

Base Isolation: Isolation systems – Effectiveness of base isolation.

Recommended Books & References:

1. Earthquake resistant design of structures, Pankaj Agarwal and Manish Shrikhande, PHI
2. I.S. 1893 - 2002, Criteria for Earthquake Resistance design of Structures
3. Dynamics of structures – A.K. Chopra, Prentice Hall.

Course Outcomes:

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

1. Apply seismic coefficient and response spectrum methods for analysis of multi storied buildings
2. Apply concepts of ductility in the design of multi-storey structures
3. Analyze a water tank structure based on latest earthquake code
4. Understand the concepts of base isolation

CIVB8120	Design of Hydraulic Structures	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the different types of hydraulic structures
2. To understand the principles of design of different hydraulic structures
3. To analyze and design gravity dams
4. To analyze and design earth and rock fill dams
5. To design spillways and energy dissipation structures
6. To design of penstocks and surge tanks

UNIT-1

Introduction -Classification of dams, Gravity dams, Earth dams, Arch dam, Buttress dam, Steel dams, Timber dams, selection of site for dam, selection of type of dam, investigations of dam sites, Engineering surveys, Geological investigations, Types of hydropower plants, site selection

for power plant, General arrangement of a hydropower project.

UNIT-2

Principles of Design of Hydraulic Structures -Hydraulic structures on permeable foundations, Theories of subsurface floor, Khosla's method of independent variables, Exit gradient, Location of Hydraulic jump, water surface profiles, scour due to subsurface flow, Design Principles, Energy dissipation principles.

UNIT-3

Gravity Dams - Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam, Finite Element Method, Design of gravity dam, joints in gravity dam, Galleries in gravity dam, Adits and shafts, Construction of gravity dam, Foundation Grouting, Instrumentation of gravity dams.

UNIT-4

Earth dams - Types of earth dams, Causes of failure of earth dams, Seepage analysis, phreatic line, flow net construction, criteria for safe design of gravity dams, typical cross sections of earth dams, Stability analysis, Seepage control, design of filters.

UNIT-5

Spillways and energy dissipation systems-Essential requirements of spillways, Required spillway capacity, component parts of spillway, Types of spillways, Design of Ogee spillway, Design of shaft spillway, Design of siphon spillway, Design of stilling basins. Hydropower structures-Storage power plant, Runoff River plant, Pumped storage plant, Water conveyance systems, Tunnels and Penstocks, Gates, Surge tanks, Power house layout.

Recommended Books & References:

1. Handbook of Dam Engineering, Golze, A. R., Von Rostrand Reinhold Co.
2. Concrete Dams, Sharma, H.D., CBIP Publication
3. Dams and Reservoirs: Planning, Engineering, Siddiqui, I H, Oxford University Press
4. Irrigation Water Resources and Hydropower Engineering, Modi P.M., Standard Publishing Company.
5. Irrigation Water Resources Engineering, Arora K.L., Standard Book Publishing Co.

Course Outcomes:

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

1. Analyse and design gravity dams
2. Analyse and design earth and rockfill dams
3. Design spillways and energy dissipation structures
4. Design of penstocks and surge tanks

CIVB8130	Air and Water Transportation	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand the air transportation
2. To understand the Structural Design of Airport Pavements
3. To understand the different types of water transportation
4. To understand the docks, Dredging, Coastal Erosion and Protection

UNIT-1

Air Transportation: Aircraft Characteristics-Landing gear configurations, aircraft weight, engine types, Aircraft performance characteristics: speed, payload and range, runway performance, declared distances, wingtip vortices.

UNIT-2

Geometric Design of the Airfield-Airport classification: utility airports, transport airports; Runways: runway configurations, runway orientation, wind rose, estimating runway length,

sight distance and longitudinal profile, transverse gradient, Taxiways and taxilanes: widths and slopes, taxiway and taxi lane separation requirements, sight distance and longitudinal profile, location of exit taxiways, design of taxiway curves and intersections, end-around taxiways, Aprons: holding aprons, terminal aprons and ramps, surface gradients, Control tower visibility requirements.

UNIT-3

Structural Design of Airport Pavements-Soil investigation and evaluation: CBR, Plate-bearing test, Young's modulus, FAA pavement design methods: equivalent aircraft, cumulative damage failure, Design of flexible and rigid airport pavements. Airport Lighting, Marking, and Signage - Requirements of visual aids, approach lighting system configurations, visual approach slope aids, threshold lighting, Runway and taxiway lighting and marking, airfield signage. Terminal Area-Passenger terminal system and its components, Apron gate system: number of gates, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft.

UNIT-4

Water Transportation: Ports and Harbours-Types of water transportation, water transportation in India, Ports and harbours: requirements, classification, ship characteristics, Harbour works: breakwaters, jetties, fenders, piers, wharves, dolphins, etc., Navigational aids: types, requirements, light house, beacon lights, buoys, Port facilities: general layout, development, planning, facilities, terminals.

UNIT-5

Docks, Dredging, Coastal Erosion and Protection- Docks and repair facilities: design, dry docks, wet docks, slipways, Locks and lock gates: materials, size, Dredging: classification, dredgers, uses of dredged materials, Coastal erosion and protection: seal wall, revetment, and bulkhead.

Recommended Books & References:

1. Airport Engineering: Planning, Design and Development of 21st Century Airports, Ashford, N. J., Mumayiz, S. A., and Wright, P. H., John Wiley & Sons
2. Airport planning and Design, Khanna, S. K., Arora, M. G., and Jain, S. S, Nem Chand and Bros, Roorkee
3. A Course in Docks and Harbour Engineering, Bindra, S.P., Dhanpat Rai and Sons,
4. Dock and Harbour Engineering, Seetharaman, S., Umesh Publications, New Delhi

Course Outcomes:

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

1. Fix the orientation of the runways
2. Carryout the geometrical design of the airport infrastructure
3. Prepare structural designs of runway, taxiway, and apron-grate area
4. Prepare a plan of the airport terminal area
5. Prepare a plan of the sea port
6. Provide solution to protect coastal erosion

CIVB8220	Industrial Structures	3L:0T:0P	3 Credits

Course learning objectives:

1. To Design steel gantry girders and portal frames
2. To Design connections for different loading conditions
3. To Design storage structures, bunkers and silos
4. To Design light weight metal structures

UNIT-1

Analysis and Design of Steel Gantry Girders, Analysis and Design of Portal Frames-Single bay two storey.

UNIT-2
Analysis and Design of Gable Structures, Analysis and Design of Knee Brace.
UNIT-3
Analysis and Design of Light weight metal structures, Analysis and Design of connections-Shear and Flexure Design.
UNIT-4
Analysis and Design of Steel Bunkers, Analysis and Design of Design of Silos.
UNIT-5
Analysis and Design of Steel Chimneys
Recommended Books & References:
1. Design of Steel Structures, Arya and Azmani, Nem Chand Brothers, Roorkee 2. Reinforced Concrete Design, Punmia B.C, Ashok Kr. Jain, Arun Kr. Jain 3. Design of Steel Structures, Ramachandra, 12th Edition, Standard Publishers
Course Outcomes: On completion of this course, the students will be able to 1. Design steel gantry girders and portal frames 2. Design connections for different loading conditions 3. Design storage structures, bunkers and silos 4. Design light weight metal structures

CIVB8240	**Foundation Analysis and Design**	**3L:0T:0P**	**3 Credits**
Course learning objectives: 1. To Understand the behaviour of problematic soil 2. To Design foundations on expansive soils 3. To Analyse the lateral stability of piles and wells 4. To Evaluate design parameters for dynamic loading			
UNIT-1			
Well foundations: Introduction – types and shapes of Caissons – Grip length, Estimation of bearing capacity and settlement of well foundation, Sinking of well foundation and remedial measures, Design of various elements/components of well foundation, Forces acting on well foundation, Lateral stability of well foundations by IRC method, Problems.			
UNIT-2			
Pile foundations: Pile behavior under axial loads (piles under compression) – Review uplift capacity / resistance of piles (piles under tension), Lateral load capacity/ Resistance of piles, WINKLER'S hypothesis – Differential equations, BROM'S solution for laterally loaded vertical piles in sand and clay, IS Code method, Problems.			
UNIT-3			
Combined Footings and Mat/Raft foundations: Computation of loads – Design steps – Proportioning of footings, Bearing capacity and settlement of Mat foundation, Types of rafts – Conventional methods of design (Rigid beam analysis), Beams on Elastic foundations, Problems.			
UNIT-4			
Foundations on Expansive soils: Identification and characteristics of Expansive soils. Free swell index and swell potential, Swell pressure – Factors –Test, Effect of swelling on building foundations, Fundamental design in expansive soil – CNS layer and other concepts, Under reamed pile and Drilled pier foundations, Problems.			
UNIT-5			
Soil Exploration: Introduction – Methods of Soil Exploration, Exploratory borings in the field,			

Soil sampling – Rock coring, Field Tests, Subsurface exploration program – Preparation of borehole logs, Soil exploration report.

Recommended Books & References:

1. Construction and Geotechnical methods in Foundation Engineering, Robert M. Koerner McGraw-Hill Pub. Co., New York
2. Geotechnical engineering, Das, BM, Cengage learning, New Delhi.
3. Basic and applied soil mechanics, Gopal Ranjan, Rao ASR, New age publication, Delhi.

Course Outcomes:

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

1. Understand the behaviour of problematic soil
2. Design foundations on expansive soils
3. Analyse the lateral stability of piles and wells
4. Evaluate design parameters for dynamic loading

CIVB8210	Metro Systems and Engineering	3L:0T:0P	3 Credits

Course learning objectives:

1. To understand overview of metro systems.
2. To analyze vehicle dynamics and structure; tunnel ventilation systems; air - conditioning for stations and buildings and electrical system.
3. To apply electronic signaling systems and Automatic fare collection.
4. To understand basics of construction planning & management, construction quality & safety systems.

UNIT-1

General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials

UNIT-2

Civil Engineering-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

Electronics and Communication Engineering- Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

UNIT-4

Mechanical & TV + AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators

UNIT-5

Electrical: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

Recommended Books & References:

1. Railway Transportation Systems -Design, Construction and Operation, By Christos N. Pyrgidis, CRC Press

Course Outcomes:

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

1. Understand overview of metro systems.
2. Analyze vehicle dynamics and structure; tunnel ventilation systems; air -conditioning

for stations and buildings and electrical system.
3. Apply electronic signaling systems and Automatic fare collection.
4. Understand basics of construction planning & management, construction quality & safety systems.

CIVB8220	Environmental Impact Analysis	3L:0T:0P	3 Credits

Course learning objectives:

1. To Identify the environmental attributes to be considered for the EIA study
2. To Formulate objectives of the EIA studies
3. To Identify the methodology to prepare rapid EIA
4. To Prepare EIA reports and environmental management plans

UNIT-1

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

UNIT-2

Identifying the Key Issues: Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection - Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues.

UNIT-3

EIA Methodologies: Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods, Environmental index using factor analysis, Cost/benefit analysis, Predictive or Simulation methods. Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.

UNIT-4

Reviewing the EIA Report: Scope, Baseline Conditions, Site and Process alternatives, Public hearing, Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System,Integrated Impact Assessment.

UNIT-5

Review of EMP and Monitoring: Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, What should be monitored? Monitoring Methods, Who should monitor? Pre-Appraisal and Appraisal.

Recommended Books & References:

1. Environmental Impact Analysis, Jain, R.K., Urban, L.V., Stracy, G.S., Van Nostrand Reinhold Co., New York
2. Environmental Impact Assessment, Barthwal, R. R., New Age International Publishers,

3. Environmental Impact Assessment, Rau, J.G. and Wooten, D.C., McGraw Hill Pub. Co., New York
4. Environmental Impact Assessment Methodologies, Anjaneyulu. Y and Manickam. V. B.S. Publications, Hyderabad
5. Environmental Impact Assessment-Theory and Practice, Wathern. P , Routledge Publishers, London

Course Outcomes:

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

1. Identify the environmental attributes to be considered for the EIA study
2. Formulate objectives of the EIA studies
3. Identify the methodology to prepare rapid EIA
4. Prepare EIA reports and environmental management plans

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