RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

Syllabus

For

B.Tech In Civil Engineering

RADHA GOVIND UNIVERSITY
RAMGARH, JHARKHAND

Syllabus

For

B.Tech 1st Semester

In

Civil Engineering

Semester ofStudy	Category of course	Course Code	Subjects	Mode of delivery *L-Lecture; T-Tuto Practical*	
First	Basic Science Course	BSC101	Physics I	3	1
	Basic Science Course	BSC103	Mathematics – I	3	1
	Engineering Science Courses/Basic ScienceCourse	ESC101/ BSC102	Basic Electrical Engineering/ Chemistry I	3	1
	LABORATORIES				
	Engineering Science Courses	ESC102	Engineering Graphics & Design	1	0
	Basic Science Course	BSC101P	Physics Lab	0	0
	Engineering Science Courses/Basic ScienceCourse	ESC101P/ BSC102P	Basic Electrical Engineering Lab / Chemistry Lab	0	0
Total (B) = 5.5 Credits Grand Total (A) + (B) = 17.5 Credits					
Second	Basic Science Course(BSE)	BSC105	Physics II	3	1
	Engineering Science Courses/Basic ScienceCourse	ESC101/ BSC102	Basic Electrical Engineering/ Chemistry I	3	1
	Basic Science Course	BSC104	Mathematics – II	3	1
	Engineering Science Courses	ESC103	Programming for Problem Solving	3	1
	Humanities and Social Sciences including Management Courses	HSMC101	English	2	0
	LABORATORIES				
	Engineering Science Courses	ESC104	Workshop/ Manufacturing Practices	1	0
	Engineering Science Courses/Basic ScienceCourse	ESC101P/ BSC102P	Basic Electrical Engg. Lab / Chemistry Lab	0	0
	Engineering Science Courses	ESC103P	Programming for Problem Solving	0	0
	Total (B) = 5 Credits Grand Total (A) + (B) = 24 Credits				
	Grand Total for 1st Year = 41.5 Credits				

Course Code	**BSC 101**
Category	**Basic Science Course**
Course Title	**Physics-I** (i) Introduction to Electromagnetic Theory – For ME (ii) Introduction to Mechanics – For Civil, MEMS (iii) Oscillation, Waves and Optics - For EEE (iv) Semiconductor Physics – For ECE, CSE (v) Basics of Electricity, Magnetism & Quantum Mechanics- For Chemical Engg.

Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	

Pre-requisites Mathematics course with vector calculus, High-school educationMathematics course on differential equations and linear algebra

PHYSICS- I
INTRODUCTION TO ELECTROMAGNETIC THEORY 38hrs

COURSE OBJECTIVES:

1. Understand the fundamental principles of electrostatics in vacuum, including the calculation of electric fields and potentials for various charge distributions, and solve Laplace's and Poisson's equations.
2. Apply the principles of electrostatics in linear dielectric media, including the effects of electric polarization, electric displacement, and solve problems involving dielectrics.
3. Analyze magnetostatics, including the application of the Bio-Savart law, calculation of static magnetic fields, and understanding the concept of vector potential.
4. Apply the principles of magnetostatics in linear magnetic media, including the effects of magnetization and bound currents, and solve problems involving magnetic materials.
5. Understand Faraday's law of electromagnetic induction, including the calculation of EMF produced by changing magnetic flux, and analyze applications of electromagnetic braking.
6. Analyze Maxwell's equations, including the derivation of the differential form of Faraday's law

Module 1: Electrostatics in vacuum **8**

Electric field and electrostatic potential for a charge distribution; Laplace’s and Poisson’s equationsfor electrostatic potential and uniqueness of their solution. Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in termsof electric field.

Module 2: Electrostatics in a linear dielectric medium **4**

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems inpresence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectricslab, dielectric slab and dielectric sphere in uniform electric field.

Module 3: Magneto static

Bio-Savart law, Static magnetic field; vector potential and calculating it for a given magnetic field;the equation for the vector potential and its solution for given current densities.

Module 4: Magneto statics in a linear magnetic medium **4**

Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on **B** and **H**. Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussionof magnetic fieldin presence of magnetic materials.

Module 5: Faraday's law and Maxwell's equations **8**

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form ofFaraday's law expressing curl of electric field in terms of time-derivative of magnetic field andcalculating electric field due to changing magnetic fields in quasi-static approximation; energy storedin a magnetic field.

Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time dependent electric field; calculating magnetic field due to changing electric fields in quasistatic approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Pointing.

Module 6: Electromagnetic waves **8**

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; Relation between electric and magnetic fields of an electromagnetic wave; energy carried by waves. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence.

COURSE OUTCOMES:

CO1 Understand the basics of electrostatics in vacuum.
CO2 Understand the basics of electrostatics in material medium.
CO3 Analyses the basics of magneto statics in vacuum.
CO4 Apply the basics of magneto in magnetic material medium.
CO5 Students to get familiarized with the Faraday's Law and Maxwell's equation leading to the application of EMW in vacuum and in media.
CO6 Design and development of engineering system

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	1	-	-	1	-	-	1	-	1	3	2	-
CO 2	3	3	1	1	-	-	1	-	-	1	-	1	3	2	-
CO 3	3	3	1	1	-	-	1	-	-	1	-	1	3	2	-
CO 4	3	3	1	1	-	-	1	-	-	1	-	1	3	2	-
CO 5	3	3	1	1	-	-	1	-	-	1	-	1	3	2	-
CO 6	3	3	1	1	-	-	1	-	-	1	-	1	3	2	-

Text Book:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edition, 1998, Benjamin Cummings.

Reference books:

- Fundamentals of Physics Electricity and Magnetism, Halliday and Resnick, tenth edition(published 2013).
- W. Saslow, Electricity, magnetism and light, 1st edition
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, TataMcGraw
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.

Course Code	**BSC 103**				
Category	**Basic Science Course**				
Course Title	**Mathematics - I** Calculus and Linear Algebra **(Option 1) for All Branch excluding CSE** Calculus and Linear Algebra **(Option 2) for CSE**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	**Pre-requisites:** High-school education				

MATHEMATICS 1
CALCULUS AND LINEAR ALGEBRA 40hrs
Option 1 (For all branches) excluding CSE

COURSE OBJECTIVES:

1. Understand and apply the concepts of evolutes and involutes, and evaluate definite and improper integrals, including the use of Beta and Gamma functions and their properties.
2. Apply calculus techniques such as Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders, and L'Hospital's rule to solve problems related to indeterminate forms and Maxima and minima.
3. Analyze sequences and series, including convergence tests, power series, Taylor's series, and Fourier series, and apply them to solve problems involving exponential, trigonometric, and logarithm functions, as well as evaluate surface areas and volumes of revolutions.
4. Understand and apply concepts of multivariable calculus, including limit continuity and partial derivatives, directional derivatives, total derivative, tangent planes and normal lines, and solve optimization problems using the method of Lagrange multipliers.
5. Analyze matrices, including the calculation of inverse and rank of a matrix, solving systems of linear equations, properties of symmetric, skew symmetric, and orthogonal matrices, determinants, eigenvalues and eigenvectors, diagonalization of matrices, and apply them to solve problems involving orthogonal transformations and the Cayley-Hamilton Theorem.

Module 1: Calculus- **I6**

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus-II **6**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L-Hospital's rule; Maxima and minima.

Module 3: Sequences and series **10**

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Multivariable Calculus (Differentiation) **8**

Limit continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5: Matrices **10**

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

COURSE OUTCOMES:

CO1 To Understand the idea of applying differential and integral calculus to notions ofcurvature and to improper integrals.

CO2 To apply the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3 To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.

CO4 the student will able to analyze with functions of several variables that isessential in most branches of Engineering.

CO5 To develop the essential tool of matrices and linear algebra in a comprehensive manner.

CO6 To solve various engineering problems

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	3	2	-	-	-	-	-	-	2	-	
CO2	2	3	2	2	1	2	1	-	-	-	-	-	2	-	-
CO3	2	-	-	2	3	1	-	1	-	1	-	-	2	-	-
CO4	1	3	2	2	1	2	1	1	-	1	1	-	2	-	-
CO5	1	-	2	-	1	1	-	-	-	-	-	-	2	-	-
CO6	3	3	2	-	2	2	-	-	-	-	-	-	2	-	-

Text books/References:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint,2002.
- Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11thReprint,2010.
- D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Code	**ESC 101**				
Category	**Engineering Science Course**				
Course Title	**Basic Electrical Engineering**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	**Intermediate level Electricity**				

BASIC ELECTRICAL ENGINEERING 40hrs

COURSE OBJECTIVES:

1. Understand electrical circuit elements (R, L, and C), voltage and current sources.
2. Calculate real power, reactive power, apparent power, and power factor in AC circuits.
3. Understand auto-transformer and three-phase transformer connections.
4. Analyze loss components and efficiency, starting, and speed control of induction motor.
5. Describe single-phase and three-phase voltage source inverters, and sinusoidal modulation.
6. Describe types of batteries, and important characteristics for batteries.

Module 1: DC Circuits **7**

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.

Module 2: AC Circuits **7**

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.

Module 3: Transformers **6**

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

Module 4: Electrical Machines **8**

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.

Module 5: Power Converters **6**

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

Module 6: Electrical Installations **6**

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 calculationsfor energy consumption, power factor improvement and battery backup.

Course Outcomes:

CO1: To understand and analyze basic electric and magnetic circuits.
CO2: To Understand the working principles of electrical machines and power converters.
CO3: To analyse the components of low voltage electrical installations.
CO4: Apply electric machine for industrial applications
CO5: Design power converters
CO6: Design and implementation of electrical installations

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	-	-	-	-	-	1	3	2	
CO2	2	1	1	2	-	-	1	2	-	-	-	1	2	2	1
CO3	1	2	1	1	2	1	-	-	-	1	-	1	1	1	1
CO4	3	3	-	-	-	-	2	-	-	-	-	1	3	3	3
CO5	2	2	-	1	2	1	-	-	3	1	-	1	-	-	-
CO6	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-

Text / Reference Books:

- D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”,Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, “Basic Electrical Engineering”, McGrawHill, 2009.
- L. S. Bobrow, “Fundamentals of Electrical Engineering”,Oxford University Press, 2011.
- E. Hughes, “Electrical and Electronics Technology”, Pearson,2010.
- V. D. Toro, “Electrical Engineering Fundamentals”, PrenticeHall India, 1989.

Course Code	**ESC 102**				
Category	**Engineering Science Course**				
Course Title	**Engineering Graphics & Design(Theory & Lab)**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	1	**0**	**4**	**3**	
Pre-requisites	**Basic knowledge of Computer and Solid Geometry**				

ENGINEERING GRAPHICS & DESIGN **Lecture – 10hrs & Lab – 60hrs**

COURSE OBJECTIVES:

1. Understand the principles of Engineering graphics and their significance.
2. Explain the principles of orthographic projections and conventions.
3. Create floor plans that include windows, doors, and fixtures such as WC, bath, sink, shower, etc.
4. Project right angular solids, including prism, cylinder, pyramid, cone, and their auxiliary views.
5. Convert isometric views to orthographic views and vice versa, following conventions.
6. Create isometric views of lines, planes, simple, and compound solids using CAD software.

Traditional Engineering and Computer Graphics **10**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance. Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Lab modules also include concurrent teaching)

Lab Module 1: Introduction to Engineering Drawing **5**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Lab Module 2: Orthographic Projections **5**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to

bothplanes; Projections of planes inclined Planes - Auxiliary Planes;

Lab Module 3: Projections of Regular Solids 5

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Lab Module 4: and Sectional Views of Right Angular Solids 5

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids -Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids,objects from industry and dwellings (foundation to slab only)

Lab Module 5: Isometric Projections 6

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views andVice-versa, Conventions.

Lab Module 6: Overview of Computer Graphics 8

Listing the computer technologies that impact on graphical communication, Demonstrating knowledgeof the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Lab Module 7: Customization & CAD Drawing 8

Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Lab Module 8: Annotations, layering & other functions 9

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command;

orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non- parametric solid, surface, and wireframe models.Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Lab Module 9: Demonstration of a simple team design project 9

Geometry and topology of engineered components: creation of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologiesfor Engineering analysis and tool-path generation for component manufacture; geometric dimensioningand tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

COURSE OUTCOMES:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a newstate-of-the-art computer designed CAD laboratory using Engineering software. This course is designed to address:

CO1 Able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health andsafety, manufacturability, and sustainability

CO2 Able to prepare to communicate effectively to use the techniques, skills, and modern Engineering tools necessary forEngineering practice.

CO3 Able to analyze Engineering design and its place in society Exposure to the visual aspects of Engineering design

CO4 analyze Engineering graphics standards and solid modelling

CO5 apply computer-aided geometric design for engineering problems

CO6 design and development of creating working drawings and Engineering communication

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	1	-	2	-	-	1	-	-	2	2	2	-
CO3	2	1	-	1	2	-	2	-	2	1	2	-	2	2	-
CO4	2	1	-	-	1	2	-	-	-	-	-	-	2	-	-
CO5	2	-	-	1	3	-	-	-	-	2	1	1	2	-	-
CO6	3	3	2	-	1	-	-	-	-	1	-	-	2	2	-

Suggested Text/Reference Books:

- Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engg Drawing, Charotar Pub House
- Shah, M.B. & Rana B.C. (2008), Engg Drawing & Comp. Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engg Drawing, Scitech Publishers
- Corresponding set of CAD Software Theory and User Manuals

PHYSICS LABORATORY
Code: BSC101P

Choice of 08-10 experiments from the following:

- Experiments on electromagnetic induction and electromagnetic breaking;
- LC circuit and LCR circuit
- Resonance phenomena in LCR circuits
- Magnetic field from Helmholtz coil
- Measurement of Lorentz force in a vacuum tube
- Coupled oscillators
- Experiments on an air-track
- Experiment on moment of inertia measurement
- Experiments with gyroscope
- Resonance phenomena in mechanical oscillators
- Frank-Hertz experiment
- Photoelectric effect experiment
- Recording hydrogen atom Spectrum
- Diffraction and interference experiments (from ordinary light or laser pointers)
- Measurement of speed of light on a table top using modulation
- Minimum deviation from a prism

LABROTARY OUTCOMES:

Students to have hands on experiences with experiments on the basic's laws and principles of Physics in the field of Mechanics, Optics, Electricity, Magnetism, Modern Physics, etc.

BASIC ELECTRICAL ENGINEERING LABORATORY
Code: ESC101P

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase -shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging -slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Controlof voltage through field excitation.
- 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:

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

Syllabus

For

B.Tech 2nd Semester

In

Civil Engineering

Course Code BSC 105

Category	**Basic Science Course**
Course Title	**Course contents in Physics** (i) Introduction to Quantum Mechanics for Engineers – For EEE, CSE (ii) Semiconductor Optoelectronics – For ECE (iii) Mechanics of Solid – For Civil, ME, MEMS (iv) Optics & Fiber Optics – For Chemical Engineering
Scheme & Credits	**L 2 T 1 P 0 Credit 3 Semester II**
Pre-requisites	Mathematics course on differential equations and linear algebra Introduction to Electromagnetic Theory Semiconductor Physics

Physics-II

MECHANICS OF SOLIDS 40hrs

COURSE OBJECTIVES:

1. Understand and apply free body diagrams for typical supports and joints.
2. Understand stress transformation and principal stresses using Mohr's circle.
3. Describe one-dimensional material behavior, including concepts of elasticity, plasticity, strain hardening, and failure
4. Calculate bending stress, shear stress, and analyze cases of combined stresses.
5. Analyze deflection due to bending and integrate the moment-curvature relationship for simple boundary conditions.

Module 1: Statics 10

Free body diagrams on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases; Force displacement relationship; Geometric compatibility for small deformations.

Module 2: Stress and Strain at a point 6

Concept of stress at a point; Planet stress: transformation of stresses at a point, principal stressesand Mohr’s circle; Displacement field; Concept of strain at a point; Planet strain: transformation of strain at a point, principal strains and Mohr’s circle

Module 3: Material behavior **7**

One-dimensional material behaviour; Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding); Idealization of one- dimensional stress-strain curve; Generalized Hooke's law withand without thermal strains for isotropic materials.

Module 4: Force analysis **8**

Force analysis — axial force, shear force, bending moment and twisting moment diagrams ofslender members (without using singularity functions); Moment curvature relationship for pure bending of beams with symmetric cross-section; Bending stress; Shear stress; Cases of combined stresses.

Module 5: Strain energy **9**

Concept of strain energy; Yield criteria; Deflection due to bending; Integration of the moment-curvature relationship for simple boundary conditions; Method of superposition (without using singularity functions); Strain energy and complementary strain energy for simple structural elements (i.e, those under axial load, shear force, bending moment and torsion).

COURSE OUTCOME:

CO1: To familiarize students of civil and mechanical Engineering with the understandingof the elasticand plastic behavior of solids.

CO2: To understand the importance of stress and strain at a point on solid.

CO3: To be able to do force analysis and understand strain energy of solid.CO4: Apply force analysis for engineering applications

CO5: Design sustainable engineering system

CO6: Implementation of engineering physics into complex system design for industrial applications

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	2	1	3	-	-	2		2		
CO2	2	2	2	3	2	2	-	3	-	2	-	-	-	-	-
CO3	2	2	-	3	2	3	2	3	2	3	2	-	-	-	-
CO4	3	3	3	3	2	3	-	-	3	3	2	-	-	-	-
CO5	2	2	-	-	2	3	2	2	2	2	2	-	-	-	-
CO6	3	3	2	-	-	3	2	-	2	-	-	-	-	-	-

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

Reference books(1)An Introduction to the Mechanics of Solids, 2nd ed. with SI Units – SH Crandall, NC Dahl & TJ Lardner (2) Engineering Mechanics: Statics, 7th ed. — JL Meriam (3)Engineering Mechanics of Solids — EP Popov

Course Code	**BSC 102**				
Category	**Basic Science Course**				
Course Title	**Chemistry-I**				
	Contents				
	(i) Chemistry-I (Concepts in chemistry for Engineering)				
	(ii) Chemistry Laboratory				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	**Knowledge of intermediate level chemistry**				

CHEMISTRY-I

CONCEPTS IN CHEMISTRY FOR ENGINEERING

COURSE OBJECTIVES:

1. Describe the forms of hydrogen atom wave functions and their spatial variations.
2. Analyze electronic spectroscopy, fluorescence, and their applications in medicine.
3. Explain equations of state of real gases and critical phenomena.
4. Estimate entropy and free energies, and their applications in chemical equilibria.
5. Describe effective nuclear charge, penetration of orbitals, and variations of s, p, d, and f orbital energies in theperiodic table.
6. Introduce reactions involving substitution, addition, elimination, oxidation, reduction, cyclization, and ring openings.

Module 1: Atomic and molecular structure **12**

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multi centre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of di-atomics. Pi-molecular orbitalsof butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Module 2: Spectroscopic techniques and applications **8**

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques.Diffraction and scattering.

Module 3: Intermolecular forces and potential energy surfaces 4

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

Module 4: Use of free energy in chemical equilibria 6

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations inmetallurgy through Ellingham diagram

Module 5: Periodic properties and Stereochemistry 8

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard softacids and bases, molecular geometries

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Module 6: Organic reactions and synthesis of a drug molecule 4

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

COURSE OUTCOMES:

CO1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.

CO2: Rationalise bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques

CO4: Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5: List major chemical reactions that are used in the synthesis of molecules.

CO6: Apply chemical reactions in industry applications

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	2	1	2	-	-	-	-	-	-
CO2	3	3	2	2	2	2	2	2	2	-	-	-	2	-	-
CO3	2	2	1	2	2	2	3	2	-	-	-	2	-	-	2
CO4	2	1	1	3	3	1	3	-	1	-	-	-	-	-	-
CO5	3	2	3	1	3	3	1	-	2	-	-	-	2	-	-
CO6	3	3	-	-	3	-	1	-	-	-	-	2	-	-	-

Textbooks:

- University chemistry, by B. H. Mahan
- Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
- Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- Engg Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- Physical Chemistry, by P. W. Atkins
- Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5thEditionhttp://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Code	**BSC 104**
Category	**Basic Science Course**
Course Title	**Mathematics – II**
	Contents
	Calculus, Ordinary Differential Equations and Complex Variable (Option 1) for All branches excluding CSE
	Probability and Statistics (Option I1) for CSE

Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester**
	3	**1**	**0**	**0**	**II**

Pre-requisites **Elementary Knowledge of calculus, Probability and Statistics**

MATHEMATICS – II
CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEXVARIABLE

COURSE OBJECTIVES:

1. Understand multiple integration, including double integrals in Cartesian coordinates, change of order of integration, and change of variables to polar coordinates.
2. Solve exact, linear, and Bernoulli's equations, as well as Euler's equations.
3. Solve Cauchy-Euler equations.
4. Understand elementary analytic functions such as exponential, trigonometric, and logarithmic functions and their properties.
5. Understand Taylor's series, zeros of analytic functions, singularities, and Laurent's series.

Module 1: **Multivariable Calculus (Integration):** **10**

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities);Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2: First order ordinary differential equations: **6**

Exact, linear and Bernoulli’s equations, Euler’s equations, Equations not of first degree: equations

solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 3: Ordinary differential equations of higher orders: 8

Second order linear differential equations with variable coefficients, method of variation of parameters,Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation 8

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonicconjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties;Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable - Integration: 8

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals usingthe Bromwich contour.

COURSE OUTCOME:

CO1: To familiarize the prospective engineers with techniques in multivariate integration,

ordinary and partial differential equations and complex variables.

CO2: To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

CO3: Analyze high order ordinary differential equation

CO4: Apply complex variables for differentiation

CO5: Apply Integration of complex variables for different problems.

C06: Design and implementation of mathematical analysis for problem solving in engineering application

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	-	2	-	-	-	-	-	-	-	-
CO2	2	2	3	1	2	1	3	2	-	-	-	-	1	-	-
CO3	1	3	1	2	3	2	2	1	-	-	-	-	-	-	2
CO4	1	3	2	2	3	2	-	2	1		-	-		2	
CO5	3	2	2	2	1	3	-	2	-	1	-	-	1	-	-
CO6	3	1	1	3	1	-	-	-	-		-	-		-	-

Textbooks/References:

- G.B. Thomas & R.L. Finney, Calculus & Analytic geometry, Pearson, Reprint, 2002.
- Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
- W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary ValueProblems, 9th Edition., Wiley India, 2009.
- S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
- E. A. Coddington, An Introduction to Ordinary Differential Equations, PHI, 1995.
- E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
- J. W. Brown & R. V. Churchill, Complex Variables & Appln, Mc-Graw Hill, 2004.
- N.P. Bali and Manish Goyal, Engineering Mathematics, Laxmi Pub, Reprint, 2008.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Code	**ESC 103**				
Category	**Engineering Science Course**				
Course Title	**Programming for Problem Solving**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	3	**0**	**0**	**3**	
Pre-requisites	Basic Knowledge of Computer and Mathematics				

PROGRAMMING FOR PROBLEM SOLVING

COURSE OBJECTIVES:

1. Define an algorithm and its representation using flowcharts or pseudo code.
2. Understand conditional branching and loops.
3. Define and utilize arrays, including 1-D and 2-D arrays.
4. Implement basic sorting algorithms such as Bubble, Insertion, and Selection sort.
5. Understand parameter passing in functions, including call by value.
6. Define structures and arrays of structures

Module 1: Introduction to Programming **6**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Module2: Arithmetic expressions and precedencies **12**

Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching**,** Iteration and loops.

Module 3: Arrays3

Arrays (1-D, 2-D), Character arrays and Strings

Module 4: Basic Algorithms, Searching, Basic Sorting Algorithms **4**

(Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 5: Function and Pointers **6**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing

arrays to functions: idea of call by reference Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation).

Module 6: Recursion and Structure **9**

Recursion, as a different way of solving problems. Example programs, such as Finding, Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort Structures, Defining structures and Array of Structures

COURSE OUTCOMES:

CO1: Able to formulate simple algorithms for arithmetic and logical problems

CO2: able to translate the algorithms to programs (in C language).

CO3: able to apply test and execute the programs and correct syntax and logical errors.

CO4: able to implement conditional branching, iteration and recursion.

CO5: To use arrays, pointers and structures to formulate algorithms and programs.

CO6: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	-	2	-	-	-	-	-	-	-	-
CO2	2	2	3	1	2	1	3	2	-	-	-	-	1	-	-
CO3	1	3	1	2	3	2	2	1	-	-	-	-	-	-	2
CO4	1	3	2	2	3	2	-	2	1		-	-		2	
CO5	3	2	2	2	1	3	-	2	-	1	-	-	1	-	-
CO6	3	3	3	3	1	-	-	-	-		-	-	2	2	2

Suggested Text Books:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books:

- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall ofIndia

Course Code	**HSMC 101**				
Category	**Humanities and Social Sciences including Management Courses**				
Course Title	**English**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	2	**0**	**2**	**3**	
Pre-requisites	**Basic Knowledge of English grammar and composition**				

ENGLISH

COURSE OBJECTIVES:

1. Learn synonyms, antonyms, and standard abbreviations.
2. Understand sentence structures and the use of phrases and clauses.
3. Identify and correct errors in subject-verb agreement, noun-pronoun agreement, misplaced modifiers, articles, prepositions, redundancies, and clichés.
4. Learn techniques for describing, defining, classifying, providing examples or evidence in writing.
5. Learn the art of précis writing and essay writing.
6. Improve pronunciation, intonation, stress, and rhythm in oral communication.

Module 1: Vocabulary Building **6**

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms and standard abbreviations.

Module 2: Basic Writing Skills **6**

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents, Techniques for writing precisely.

Module 3: Identifying Common Errors in Writing **7**

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.

Module 4: Nature and Style of sensible Writing **6**

Describing, Defining, Classifying, providing examples or evidence, Writing introduction and conclusion.

Module 5: Writing Practices **6**

Comprehension, Précis Writing, Essay Writing,

Module 6: Oral Communication **7**

(This unit involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday, Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations.

COURSE OUTCOMES:

CO1:The student will acquire basic proficiency in English

CO2: Apply proficiency in English for enhancing basic writing skills

CO3: Apply proficiency in English for identify common errors in writing.

CO4: analyze different nature and style of writing.

CO5: development of writing skill in individuals

CO6: enhance communication lead to draft engineering project proposals.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	-	2	-	-	-	-	-	-	-	-
CO2	2	2	3	1	2	1	3	2	-	-	-	-	1	-	-
CO3	1	3	1	2	3	2	2	1	-	-	-	-	-	-	2
CO4	1	3	2	2	3	2	-	2	1		-	-		2	
CO5	3	2	2	2	1	3	-	2	-	1	-	-	1	-	-
CO6	3	3	3	3	1	-	-	-	-		-	-	2	2	2

Suggested Textbooks:

- Practical English Usage. Michael Swan. OUP. 1995.
- Remedial English Grammar. F.T. Wood. Macmillan.2007
- On Writing Well. William Zinsser. Harper Resource Book. 2001
- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
- Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Code	**ESC 104**				
Category	**Engineering Science Course**				
Course Title	**Workshop/Manufacturing Practices (Theory & Lab)**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	1	**0**	**4**	**3**	
Pre-requisites	Basic Knowledge of Physics, Chemistry and Mathematics				

WORKSHOP/MANUFACTURING PRACTICES 10

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturingmethods **3hrs**
2. CNC machining, Additive manufacturing **1hr**
3. Fitting operations & power tools **1hr**
4. Electrical & Electronics **1hr**
5. Carpentry **1hr**
6. Plastic Moulding, glass cutting **1hr**
7. Metal casting **1hr**
8. Welding (arc welding & gas welding), brazing **1hr**

Suggested Text/Reference Books:

- Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
- Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition,Pearson Education India Edition, 2002.
- Gowri P. Hariharan & A. Suresh Babu, "Mfg. Tech- I" Pearson Education, 2008.
- Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, PHl, 1998.
- Rao P.N., "Manufacturing Technology", Vol. I & Vol. II, Tata McGrawHill House, 2017.

COURSE OUTCOMES:

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

WORKSHOP PRACTICE 60hrs

1. Machine shop	**10hrs**
2. Fitting shop	**8hrs**
3. Carpentry	**6hrs**
4. Electrical & Electronics	**8hrs**
5. Welding shop	**8hrs (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting	**8hrs**
7. Smithy	**6hrs**
8. Plastic Moulding & Glass Cutting	**6hrs**

LABORATORY OUTCOMES:

- Upon completion of this laboratory course, students will be able to fabricate componentswith their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensionaltolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of theirinterest.

CHEMISTRY LABORATORY
Code: BSC 102P

Choice of 08-10 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

LABORATORY OUTCOMES:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and Engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as afunction of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

LABORATORY - PROGRAMMING FOR PROBLEM SOLVING

Code: ESC103P

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

LABORATORY OUTCOMES:

- To formulate the algorithms for simple problems.
- To translate given algorithms to a working and correct program.
- To be able to correct syntax errors as reported by the compilers.
- To be able to identify and correct logical errors encountered at run time.
- To be able to write iterative as well as recursive programs.
- To be able to represent data in arrays, strings and structures and manipulate them through a program.
- To be able to declare pointers of different types and use them in defining self-referential structures.
- To be able to create, read and write to and from simple text files.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF CIVIL ENGINEERING

B. TECH (3rd) SEMESTER SYLLABUS

Civil Engineering

3rd semester course structure

Sl. No.	Course Code	Subject	L	T	P	Credit
01	CE301	Civil Engineering Materials And Construction	3	1	0	3
02	CE302	Surveying & Geomatics-I	3	1	0	3
03	ME303	Strength Of Materials	3	1	0	3
04	BSC301	Mathematics-III	3	1	0	4
05	BSC303	Engineering Geology	3	1	0	3
06	BSC302	Environmental Science	2	0	0	0
01	CE301P	Civil Engineering Material Testing Lab.	0	0	3	1
02	CE302P	Field Surveying Lab	0	0	3	1
03	CE303P	Engineering Geology Lab And Strength Of Materials Lab	0	0	3	1
04	EX301	Extra Activities(NSO/NSS/NCC/Yoga /Creative Arts/Mini Project)	0	0	2	1
05	HS301	Communication Skill Lab	0	0	2	1
Total credit						**21**

MATHEMATICS-III

Course code: BSC301

Objectives:

- Develop strong mathematical foundation this objective focuses on building a solid understanding of core mathematical.
- Enhance problem-solving skills the course aims to equip students with the ability to analyze and solve complex engineering problems using mathematical tools.
- Students will be better prepared to handle the mathematical rigor of subjects like structural analysis, fluid mechanics, and geotechnical engineering.

Module-1

Laplace Transformation: Laplace Transformation and its properties, Periodic function, Unit step function and impulse function .Inverse Laplace Transformation, Convolution Theorem, Applications of Laplace transforms in solving certain initial value problems & simultaneous differential equations**. (8L/1.5Q)**

Module-2

Numerical Method: Finite difference, Symbolic relations, Interpolation and Extrapolation, Newton-Gregory forward and backward formula, Lagrange's formula, Inverse Interpolation by Lagrange's formula. Numerical Differentiation and Numerical Integration, Newton Cotes Quadrature formula, Trapezoidal rule, Simpson's 1/3"rule, Simpson's3/8"rule. **(10Hr)**

Module-3

Z-Transform & Inverse Z-Transform- Properties - Initial and Final value theorems, Convolution theorem- Difference equations. Solution of difference equations using Z-Transformation. **(6Hr)**

Module-4

Fourier Series &Fourier Transform: Expansion of- Algebraic, Exponential & Trigonometric functions in Fourier series, Change of interval, Even and odd function, half ranges in e and cosine series, Complex form of Fourier series. Fourier Transformation and inverse Fourier Transformation, Fourier sine & cosine transforms. Convolution theorem for Fourier transforms with simple illustrations. **(8Hr)**

Module5

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations of first order, Lagrange's linear equation, Non-linear equations of first order, Charpit's method Solution of one-dimensional Wave equation & Heat equation by the method of separation of variables and its applications.**(8Hr)**

CO	COURSE OUTCOMES
CO 1	Intuitive meaning and Methods of finding integration definite integration and its properties.
CO 2	Application of Integration in finding Area, volume of irregular shapes.
CO 3	Methods of solving differential equation of first order and first degree.
CO 4	Methods for finding approximate roots by using bisection, Regula -falsi, Newton-Raphson method, Gauss elimination, Jacobi and Gauss-Seidal methods.
CO 5	Use of Binomial, Normal and Poisson distributions for solving different examples.
CO 6	Use of Laplace transform for solving problems of Differential Equations.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	L1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	L5	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	L4	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO6	L5	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Text Books

1. Irwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,
2. Ramana R.V, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2010.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,

Reference Books

1. R.J. Beerends. H. G. TerMorsche, J. C. Van Den Berg. L. M. Van De Vrie, Fourier and Laplace Transforms, Cambridge University Press.
2. Sastry S.S. Introductory Methods of Numerical Analysis, PHI

CIVIL ENGINEERING MATERIALS AND CONSTRUCTIONS

Course code –CE 301

Objectives:

- Equip students with knowledge of construction materials: behavior, and applications of various construction materials**.**
- Develop skills in material selection and construction practices: considering factors like strength, durability, sustainability, and cost.
- Lay the foundation for structural design and construction projects: By understanding material properties and construction techniques, students gain a strong foundation for future courses in structural design and analysis

Module I: Introduction to Engineering Materials covering, Cements, M Sand, Concrete (plain, reinforced and steel fibre /glass fibre- reinforced, light- weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these **(8Hours).**

Module II: Introduction to Material Testing covering, What is the "Material Engineering"?; Mechanical behavior and mechanical characteristics; Electricity-principle and characteristics; Plastic deformation of metals; Tensile test-standards for different material (brittle, quasi-brittle, elastic and soon) True stress-strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep-fundamentals and characteristics; Brittle fracture of steel-temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing-different materials; concepts of fatigue of materials; Structural integrity assessment procedure and fracture mechanics **(8Hours).**

Module III: Standard Testing & Evaluation Procedures covering, Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics-background; Fracture toughness- different materials; Fatigue of material; Creep. **(8Hours)**

Module IV: Constructions: Brick Masonry; Types of bond, construction of walls, partition wall,cavitywall,advantages,disadvantagesandconstructionprocedure.D.P.C.:Purpose,types,materials and procedures, Foundation: Function, types, their stability and foundation in black cotton soil, proportioning of footings, plastering and composition, method of plastering, types of plastering, pointing construction procedure, Washing: White washing, color washing, distemper and snowcem, Roof: Flat roof, inclined roof, shells and domes, various types of roof covering materials. Floor: Types i.e. wooden, IPS, Terrazzo, marbles, tiles, synthetic mats. Construction of IPS and Terrazzo floor. Door and Windows types and fixtures including ventilators and lintel. Door and windows from PVS material and MDF. Stairs: Types and proportioning, Lifts and escalators **(16Hours).**

CO	COURSE OUTCOMES
CO 1	Understand properties of different building materials.
CO 2	Study quality control tests on cement.
CO 3	Understand the importance of building components and building services.
CO 4	Understand masonry, finishing and form work standards.
CO 5	Study the prevalent building by laws.
CO 6	Understand the impact of building construction on society and demonstrate awareness of contemporary issues.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L3	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L2	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L3	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Suggested Readings

1. Chudley, R., Greeno (2006),'Building Construction Hand book' (6thed.), R. Butter worth Heinemann
2. Building Materials, S. Bhavikutti.
3. Building Materials, M.L. Gambhir.
4. Civil Engineering Materials, S.C. Rangwala, Charotar Publishing House. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications
5. Kyriakos Komvopolous (2011), Mechanical Testing of Engineering Materials, Cognella
6. E.N. Dowling (1993), Mechanical Behaviour of Materials, PHI
7. American Society for Testing and Materials (ASTM), Annual Books of ASTM Standards(post2000)
8. Civil Engineering Materials and Construction Practices, R.K. Gupta, Jain Brothers,

SURVEYING AND GEOMATICS-I

Course code–CE302

Objectives:

- Establish spatial data collection and analysis skills this may involve traditional surveying techniques using instruments like total stations and GPS, as well as modern.
- Prepare for construction planning and site layout.
- Support project documentation and monitoring Students will learn how to create maps and plans depicting the existing and proposed conditions of the site, as well as monitor changes

Module I

Introduction: Importance of Surveying, Types of Surveying, Principle, Scales, Plan and Map, Shrinkage of Maps, Mapping Concepts, Map Projections, Total Station uses and application, Chain Surveying: Purpose, Chaining, accessories, Ranging and its types, Error, Chaining on uneven ground, Tape corrections, Survey stations and lines, Well-conditioned triangle, basic problems, obstacle sin chaining, field book.**[7Hrs]**

Module II

Compass Surveying: Introduction and Purpose, True Meridian, Magnetic Meridian Geographical Meridian, True Bearing, Magnetic Bearing, Whole circle & Quadrantal Bearing, Prismatic Compass and Surveyors Compass, Magnetic Declination, Isogonic and Agonic Lines, Local Attraction and its adjustments. **[4Hrs]**

Module III

Plane Table Surveying: Equipment and uses, principle, methods of plane tabling, closing error and its adjustment, two point problem and three point problem. **[5Hrs]**

Module IV

Levelling: Types of levelling: Temporary Adjustment of Dumpy level, Methods of levelling, Level book and computation, missing data, curvature and refraction corrections, reciprocal leveling. Contouring: - Definition Methods of Contouring and plotting of contour. **[6 Hrs.]**

Module V

Theodolite traversing: Scope, Types, temporary adjustment of transit theodolite, measurement of horizontal & Vertical angles, Method of repetition & Direction, errors and its elimination, method of traversing, calculation of latitude and departure, balancing of traverse**[6 Hrs.]**

Module VI

Tacheometric Survey: Instruments used, Principle, determination of tacheometric constant, Methods of Tachometry: Stadia Method and Tangential Method. **[4Hrs]**

Module VII

Classification of Curves: Simple curve, Combined curve, Compound curve, reverse curve, transition curve, Methods of layout, offsets from chord produced, Rankine's Method, Transition Curve, super-elevation, length of transition curve, characteristics, equation, shift, tangent length, and curve length of combined curve, setting out of simple and transition curve.

[12Hrs]

CO	**COURSE OUTCOMES**
CO 1	Students are able to understand the surveying with advance instrument like remote sensing, GPS and GIS
CO 2	The students are able to understand the use of different surveying instruments and their use
CO 3	Students are able to calculate compute the area and earthwork for different works by using surveying instruments.
CO 4	Students are able to do the surveying of different civil engineering projects
CO 5	Students are able to do trigonometric and Geodetic Survey
CO 6	Students are able to understand the surveying with advance instrument like remote sensing, GPS and GIS.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book:

1. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2004.
2. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 1994.
3. Arora, K. R. Surveying Vol. I and II, Standard Book House, 1996
4. N.N Basak.. Surveying and levelling

STRENGTH OF MATERIALS

Course code-CE303

Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts cylinders and spheres for various types of simple loads.

- To calculate the elastic deformation n occurring in various simple geometries for different types of loading.

Contents:

Module-I

Deformation in solids- Hooks law, stress and strain-tension, compression and shear stresses– elastic constants and their relations-volumetric, linear and shear strains-principal stresses and principal planes-mohr's circle **(8Hrs)**

Module-II

Beams and types transverse loading on beams- shear force and bending moment diagrams-Types of beams supports, simply supported and overhanging beams, cantilevers. Theory of bending of beam, bending stresses distribution and neutral axis, shear stress distribution, point and distributed loads**. (8Hrs)**

Module-III

Moment of inertia about the axis and polar moment of inertia, deflection of beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorem**. (8Hrs)**

Module-IV

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical spring**.**

(8Hrs)

Module-V

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure**. (8Hrs)**

CO	COURSE OUTCOMES
CO 1	After completing this course, the students should able to recognize various type of load applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.
CO 2	The students will be able to evaluate the strains and deformations that will results due to the elastic stresses develop within the material for simple type of loading.
CO 3	Students are able to understand the behaviour of material under different loading
CO 4	Student are able to understand and calculate the different type of stress like, simple stress, shear stress, direct stress and bending stress in the material
CO 5	Students are able to understand and calculate the shear force and bending moment for beam of different loading
CO 6	Students are able to calculate the deflection of beam for different loading

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	2	3	1	-	-	1	-	1	1	-	-	-	-	3	1
CO2	L3	2	3	1	1	-	1	-	1	1	-	-	-	-	3	1
CO3	L2	1	3	1	2	-	1	-	1	1	-	-	-	-	3	1
CO4	L2	1	3	3	2	-	1	-	1	1	-	-	-	-	3	1
CO5	L3	2	3	3	1	-	1	-	1	1	-	-	-	-	3	1
CO6	L3	1	3	3	1	-	1	-	1	1	-	-	-	-	3	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Test Books:

1. Egor P. Popov, Engineering Mechanics of solids, Prentice Hall of india, New Delhi,2001.
2. R. Subramanian, Strength of Materials, Oxford University Press,2007.

Ferdinand P. Been, Russel Johnson Jr and Jhon J.Dewole, Mechanism of materials, TataMcGrawHill Publication Co. Ltd., New Delhi 2005

ENGINEERING GEOLOGY

Course code–BSC303

Objectives:

- Understand geological hazards and their impact on structures: landslides, earthquakes, faults, sinkholes, and erosion
- Characterize soil and rock properties for foundation design he course equips students to analyze soil and rock samples,
- Optimize construction practices based on geological conditions: This could involve decisions related to excavation techniques, slope stability analysis,

Module1:

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with his 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,(**6hours**)

Module II:

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 infield. Faults: Classification, recognition in field, effects on outcrops. Joints & enormity; 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 (**6hours**)

Module III:

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 land slide. 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. Previous & impervious rocks and groundwater. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Record of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India. (**6hours**)

Module IV: Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable and unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.(**4hours)**

Module V: Introduction and nature of soils: Soil problems in Civil Engineering, Types of soil, formation, structure and mineralogical and composition, Physical and Engineering Properties of soil, Atterberg Limit, Grain size analysis, by sieving and sedimentation, Activity of clay, All type of Classification of soil, Engineering properties of soil. **(6hours)**

Module VI: Soil hydraulic and seepage analysis: Darcy's law, Measurement of Permeability, Factors affecting permeability and neutral pressure and effective pressure. (**4hours**)
Seepage analysis: Laplace's equation, methods of obtaining flow nets, flow net for isotropic and anisotropic oil and their applications. (**3hours**)

Consolidation and compaction: Definition, measurement, mechanism and analysis of data. (**4hours)**
Shear strength of soil: Shear strength parameters of soil and laboratory methods for their determination of Liquefaction of soil. (**4hours)**

CO	**COURSE OUTCOMES**
CO 1	As a students in the Bachelor of Engineering (Civil Engineering) will undertake courses in geology Such as Rock and mineral.
CO 2	Students are able to understand the different geological structures and their impact on civil engineering structure.
CO 3	Students are able to decide the suitable site selection for civil engineering structures
CO 4	Students are able to know the different geological hazards and its mitigation
CO 5	Students are able to understand the different method of geological exploration
CO 6	Students are able to identify the different rocks and minerals based on their property

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	2	-	-	3	-	-	-	2	-	-	-	-	1	-	-
CO2	L3	2	-	2	-	-	-	-	3	-	-	-	-	1	-	-
CO3	L5	-	-	2	-	-	-	-	3	-	-	-	-	-	-	-
CO4	L4	1	3	3	-	-	-	-	3	-	-	-	-	-	2	2
CO5	LL2	2	2	2	-	-	-	-	2	-	-	-	-	-	2	2
CO6	L1	1	2	3	-	-	-	-	3	-	-	-	-	-	2	2

3-High, 2- Moderate, 1- Low, '-' for No correlation

Suggested Readings:

1. Engineering and General Geology, PrabinSingh,8th ed.(2010),SK Kataria and sons.
2. Text Books of Engineering Geology, N.CheenaKesavulu,2nd Edition(2009)
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press(1982)
4. Soil Mechanics and Foundation Engineering, B.C. Punmia, Laxmi Publication
5. Basic and Applied Soil Mechanics, Gopal Ranjan, A.S.R.Rao, New Age Publisher
6. Advanced Soil Mechanics, B.M.D as, Taylor and Francis.

ENVIRONMENTAL SCIENCE

Course code–CE302

(COMMON FOR ALL BRANCH)

Objectives:

- Integrate sustainability principles into civil engineering projects: This could involve understanding environmental regulations, incorporating sustainable materials and construction practices, and considering the environmental impact throughout the project life cycle
- Assess and mitigate environmental impacts of civil engineering projects Civil engineers need to be aware of the potential environmental consequences of their projects, such as pollution (air, water, noise), habitat disruption, and resource depletion
- Promote responsible resource management for infrastructure development

Module-1

Concept and scope of Environment science, components of environment, environmental segment and their importance.(2Hrs)

Module-II

Ecology: Ecosystem and its characteristics features, structure and function of forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem, ecological balance and consequences of imbalance. **(4Hrs)**

Module-III

Atmosphere: Atmospheric composition ,energy balance, climate, weather, depletion of ozone layer, greenhouse effect, acid rain, particles, ions and radicals in the atmosphere, chemical and photochemical reactions in the atmosphere.**(4Hrs)**

Module-IV

Air pollution and control: Air pollutants, sources and effect of air pollutants, primary and secondary pollutants, photochemical smog, fly ash, inorganic and organic particulate matter. Air quality standards, sampling, monitoring and control measures for pollutants.
(4Hrs)

Module-V

Water pollution and control: Aquatic environment, water pollution, sources and their effect, lake and ground water pollution, eutrophication, water quality standard and water pollution control measures, waste water treatment. **(4Hrs)**

Module-VI

Land pollution; Lithosphere, composition of soil, acid base and ion exchange reactions in soil, soil erosion, landslides, desertification, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes), origin and effects, collection and disposal of solid wastes, recovery and conversion methods.
(5Hrs)

Module-VII

Noise pollution; Noise classification and its sources, effects and measurement, noise pollution hazards, standards and noise pollution control. **(2Hrs)**

CO	COURSE OUTCOMES
CO 1	Students understood Sewage quantity and quality for better treatment so as to reduce scarcity by recycling waste water.
CO 2	Students understood industrial waste water quantity and quality for achieving better sanitation in society.
CO 3	Study of pollution control methods, mechanism and devices.
CO 4	Simple and complex modelling for point source, line source and area source.
CO 5	Develop the knowledge on various natural resources, their causes and their effects.
CO 6	Explain various environmental acts and disaster management.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	2	-	-	3	-	-	-	2	-	-	-	-	1	-	-
CO2	L2	2	-	2	-	-	-	-	3	-	-	-	-	1	-	-
CO3	L2	-	-	2	-	-	-	-	3	-	-	-	-	-	-	-
CO4	L2	1	3	3	-	-	-	-	3	-	-	-	-	-	2	2
CO5	L2	2	2	2	-	-	-	-	2	-	-	-	-	-	2	2
CO6	L1	1	2	3	-	-	-	-	3	-	-	-	-	-	2	2

3-High, 2- Moderate, 1- Low, '-' for No correlation

Books and References:

1. Master ,G. M Introduction to environment engineering and science, Pearson Education.
2. Nebel, B.J., Environment science, Prentice Hall Inc.
3. Odum, E.P. Ecology: The link between the natural and social sciences. IBH Publishing Company Delhi
4. De, A.K. Environmental Chemistry, Merrut.
5. Sharma B.K . Envrionmental Chemistry, Krishna Prakashan Media Merrut.
6. Kaushik, Aand Kaushik,C.P. Perspectives in Environmental studies, New Age International Publication.
7. Menon, S.E. Environmental Chemistry.

CIVIL ENGINEERING MATERIAL TESTING LAB

Course Code CE301P

List of Experiments:

1. Test on Bricks: Shape and size of supplied brick, Water absorption of brick, Compressive strength of bricks.

2. Test on Fine Aggregates: Moisture Content, Specific Gravity, Bulk Density, Sieve Analysis

3. Test on Course Aggregates: Fineness modulus, Crushing Values

4. Test on Cement: Fineness of cement, Soundness of given cement, Specific gravity of cement, Standard consistency of cement, Initial and final setting time of cement.

5. Test on Soil: Sieve Analysis, Specific Gravity, Liquid & Plastic Limits

FIELD SURVEYING LAB

Course code CE 302P

List of Experiments:

1. Study of different Levels and Levelling staff. Practice for temporary adjustment. To find out the reduced levels of given points using Dumpy level. (Reduction by Height of Collimation method)
2. Study of a Tilting (LOP.) Level and to find out the levels of given points (Reduction of data by Rise and Fall method).
3. Visit to Lab, For the study of:-
   (a) Map in the making p Survey of India publication
   (b) Conventional Symbol charts and different types of maps
4. To establish a Benchmark by Check Levelling with a LOP. level and 'closing the work at the staring Bench mark.
5. To perform Fly Levelling with a LO.P. Level.
6. To draw the longitudinal rid cross- sections profiles along a given route.
7. Practice for Temporary adjustments of a Vernier Theodolite and taking Horizontal the work at the starting measurements. By Reiteration method.
8. To plot the coordinates at a given scale on Plane Table and their field checking.
9. To solve two Point and Three Point Problems in Plane Tabling.
10. To carry out Triangulation and Trilateration of a given area (2-3 turns are needed).

ENGINEERING GEOLOGY LAB

List of Experiments

1. Study of rock forming and Economic minerals, study of different rocks
2. Methods of completing the out rop of rocks on a map
3. Drawing the geological sections of geological maps
4. Inter-relation of geological maps rind sections with respect to subsurface Structure.
5. Problems of locating sites of projects like Dams, Tunnels Highways et. In the geological sections.

STRENGTH OF MATERIAL LAB

List of Experiments:

1. Tensile Test: To prepare the tensile test upon the given specimen (Mild Steel).
2. Compression Test To determine the compressive strength of the given specimen.
3. Torsion Test: To perform the Torsion test on given specimen.
4. Impact Test: To determine the impact toughness of. The given material.
5. Brinell hardness Test: To determine the hardness of the given specimen.
6. Vicker'sHardness Test: To determine, the hardness of the given specimen.
7. Rockwell Hardness Test: To determine the hardness of the given specimen.

COMMUNICATION SKILL LAB

Course code: HS301

This lab paper involves interactive practice sessions in Language Lab along with some class lectures to enable the students to be confident enough in language and professional sphere of life.

Module I: Listening Comprehension

To comprehend spoken material in standard Indian English/British English & American English

- Current situation in India regarding English
- American English Vs. British English

Module II: Phonetics & Phonology

- Introduction to Phonetics & Phonology
- Organs of Speech/ Speech Mechanism
- Pronunciation, Intonation, Stress and Rhythm, Syllable division Consonants/Vowels/Diphthongs Classification

Module III: Common Everyday Situations: Conversations and Dialogues

Module IV: Communication at Workplace

Module V: Telephonic Conversation

- Introduction
- Listening/Speaking
- Telephonic Skills Required
- Problems of Telephonic Conversation Intensive Listening

Module VI: Interviews

- The Interview Process
- Purpose/Planning/Two-way Interaction/Informality
- Pre-interview Preparation Techniques
- Projecting a Positive Image
- Answering strategies

Module VII: Formal Presentations

- Introduction
- Nature/Importance of Presentation
- Planning
- Objective with central idea, main ideas ,role of supporting materials
- Handling Stage Fright

Module VIII: Forms of Technical Communication: Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Findings; C.V./Resume writing; Technical Proposal: Types ,Structure & Draft.

Module IX: Technical Presentation: Strategies & Techniques Presentation: Forms; interpersonal Communication; Class room presentation; style ;method; Individual conferencing: essentials: Public Speaking :method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Module X: Technical Communication Skills: Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and nonverbal means.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF CIVIL ENGINEERING
B. TECH (4th) SEMESTER SYLLABUS
CHOICE BASED CREDIT SYSTEM (CBCS)

Civil Engineering

4th semester course structure

Sl. No.	Course code.	Subject	L	T	P	Credit
01	CE401	Surveying & Geomatics–II	3	1	0	3
02	CE402	Fluid Mechanics &Fluid Machines	3	1	0	3
03	CE403	Structural Analysis–I	3	1	0	3
04	CE404	Concrete Structure–I	3	1	0	3
05	EC404	Electronics & Instrumentation Engineering	3	1	0	3
06	EN401/IT402/ CE405	Engineering Economics/Cyber Security/Disaster Preparedness& Planning	2	0	0	0
01	CE402P	Fluid Mechanics & Fluid Machines Lab	0	0	3	1
02	CE404P	Concrete Structure Lab	0	0	3	1
03	CE406P	CAD Building Drawing Lab	0	0	3	1
04	EX401	Extra Activities (NSO/NSS/NCC/Yoga /Creative Arts/ Mini Project)	0	0	2	1
05	IN401	Internship/Tour& Training/Industrial Training	0	0	0	2
Total credit						**21**

SURVEYING AND GEOMATICS II

Course Code: CE401

Objectives:

- Acquire spatial data for informed decision-making
- Support construction planning and execution
- Document project progress and ensure quality control

ModuleI:

Triangulation and Trilateration- Principle of Triangulation & trilateration, Types of Triangulations, Signals, selection of station & base line, base line measurement, choices instruments and accessories, extension of baseline, corrections, satellite station, reduction to centre, inter visibility, [**9hrs]**

ModuleII

Trigonometric levelling: Curvature & Refraction Correction, axis signalcorrections.MethodofSingle&reciprocalObservations&theirrelativeadvantage,(4hrs)

Module III

Theory of errors and adjustment of figures: Types of errors, theory of propagation of errors, law of weights, weighted observation, method to calculate most probable values, least square, normal equation, method to correlate, adjustment of plane and geodetic figures.[**7hrs**

Module IV:

Modern Field Survey Systems: Principle of EDM, types of EDM instruments, Distomat, Total station -parts, accessories, advantages and application, Measurement of distance using EDM, Types of waves, modulation of frequency, resolution of ambiguity, Errors in Total station survey, Introduction to GPS-segment, measurement, errors and biases**.[8hrs]**

Module V:

Photogrammetry Surveying: Introduction, basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photo grammetry, flight planning, stereoscopy, ground control extension for photographic mapping- aerial triangulation, No. of Photographs, mosaic**.[6hrs]**

Module VI:

Remote Sensing: Introduction and Definition of remote sensing terms, Remote sensing system, electromagnetic radiation and spectrum, atmospheric window, different types of platforms, sensor sand their characteristics, orbital parameters of a satellite, multi concept in remote sensing. {***Only Introductions of all above***}**[6hrs]**

CO	COURSE OUTCOMES
CO 1	The students are able to understand the use of different surveying instruments and their use
CO 2	Students are able to calculate compute the area and earthwork for different works by using surveying instruments.
CO 3	Students are able to do the surveying of different civil engineering projects
CO 4	Students are able to do trigonometric and Geodetic Survey
CO 5	Students are able to understand the surveying with advance instrument like remote sensing, GPS and GIS.
CO 6	Students are able to understand the hydro-graphic survey

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	L1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	L3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO6	L3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Text Books-

Elements of photo grammetry by P.R. wolf.
Introduction to remote sensing by J.B. campbell

FLUID MECHANICS & FLUID MACHINES COURSE

Courser Code: CE402

Objectives:

- Grasp the fundamentals of fluid behaviour and its application in civil engineering This objective focuses on understanding the basic properties of fluids (liquids and gases) relevant to civil engineering applications.
- Design and analyze hydraulic systems for civil engineering projects This could involve water supply networks, drainage systems, canals, and open channel flow
- Understand and apply principles of fluid machinery in civil engineering his might include pumps (lifting water), turbines (generating hydropower), and fluid meters (measuring flow rates)

Module I:
Basic concepts and Definitions- Distinction between a fluid and a solid Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity, variation of viscosity with temperature, Newton law of viscosity; vapor pressure, boiling point, cavitations; surface tension, capillarity, Bulk modulus of elasticity, compressibility**.(4hrs)**

Module II:
Fluid Statics- Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers, pressure gauges, Hydrostatic pressure and force: horizontal, vertical and Inclined surfaces. Buoyancy and stability of floating bodies (**6hrs)**

Module III:
Fluid Kinematics – Classification of fluid flow: steady and unsteady flow; uniform and non- uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line path line, streak line and stream tube; stream function. velocity potential function. One, two and three dimensional continuity equations in Cartesian coordinates **(6hrs)**

Module IV:
Fluid Dynamics – Surface and body forces: Equations of motion- Euler's equation; Bernoulli's equations-derivation; Energy Principle; Practical applications of Bernoulli's equation: venture meter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow–Free and Forced **(8hrs)**

Module V: Boundary layer theory, laminar and turbulent flow and flow through pipes **(6hrs)**

Module VI:
Dimensional Analysis and Dynamics Similitude-Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π- Theorem **.(4hrs)**

Module VII: Fluid machines; Impact of Jets; Introduction to Turbines and Pumps **(8hrs)**

CO	COURSE OUTCOMES
CO 1	Student are able to understand the fluid characteristics and their application in different material manufacturing industry
CO 2	Student are able to measure the pressures at various conditions with different types of pressure measuring devices
CO 3	Students are able to calculate the discharges of fluid
CO 4	Student are able to calculate the force acting on submerged bodies
CO 5	Understand the behaviour of fluid under various forces and at different atmospheric conditions, and to selects the proper fluid for various application.
CO 6	Identify importance of various fluid properties at rest and in transit.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	2	3	1	-	-	1	-	1	1	-	-	-	-	3	1
CO2	L5	2	3	1	1	-	1	-	1	1	-	-	-	-	3	1
CO3	L4	1	3	1	2	-	1	-	1	1	-	-	-	-	3	1
CO4	L4	1	3	3	2	-	1	-	1	1	-	-	-	-	3	1
CO5	L5	2	3	3	1	-	1	-	1	1	-	-	-	-	3	1
CO6	L3	1	3	3	1	-	1	-	1	1	-	-	-	-	3	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Text/Reference Books:

1. Fluid Mechanics and Machinery,C.S.P.Ojha,
2. 2. R.BerndtssonandP.N.Chandramouli,OxfordUniversityPress2010
3. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House.
4. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
5. Fluid Mechanics with Engineering Applications, R.L.Daugherty, J.B.Franzini and E.J.Finnemore, International Student Edition, McGraw Hill.
6. Elementary fluid mechanics, Dr. R .J. Garde.
7. Fluid Mechanics, R.K. Bansal.

STRUCTURAL ANALYSIS-I

Course Code: CE403

Objectives:

- Analyze the behavior of structures under loads This objective focuses on developing the ability to calculate internal forces, deformations (displacements), and stresses within a structure subjected to various loads
- Assess the safety and serviceability of structures The course equips students to compare the calculated internal forces and stresses with the material properties and design codes to ensure the structure meets safety requirements.
- Lay the foundation for structural design Structural analysis is the cornerstone for effective structural design. Through this course, students gain the knowledge and tools to analyze different structural systems (beams, columns, trusses, frames) and understand how to modify them to achieve the desired strength,

Module I:

Introduction concept of energy principles, safety, sustainable development in performance; what makes a structure; principles of stability, equilibrium; Materials and Structural Design. Introduction to the analysis and design of structural systems. Analyses of determinate and indeterminate trusses, beams and frames, and design philosophies for structural engineering. Laboratory experiments dealing with the analysis of determinate and indeterminate structures: **(8hrs)**

Module II:

Planning and Design Process; Materials, Loads and Design Safety; Behaviour and Properties of Concrete and Steel; Wind and Earthquake Loads System Design Concepts Design Project Discussions; Cable Structures; Pre stressed Concrete Bridges; Constructability and Structural Control; Fire Protection **(6hrs)**

Module III:

Trusses: General theory; Classification, solution of plane determinate trusses, principle of virtual work and their applications for determination of deflection of determinate plane trusses **(6hrs)**

Module IV: Three pinned structures, calculation of bending moment shear force axial force for three hinged arches and diagram of the same. Dead load, stress in three pinned determinate trusses **(6hrs)**

Module V:

Influence line, basic concepts of moving load and influence line, influence line for actions; shear force and bending moments of determinate beams; absolute maximum shearing forces and bending moment; influence lines for three hinged arches**. (6hrs)**

Module VI: Analysis of structure by unit load method and conjugate beam method; Continuous and fixed beam: Theorem of three moments; analysis of fixed beams; settlement
Of support**.(8hrs)**

CO	COURSE OUTCOMES
CO 1	Students are able to do the mathematical/computational methods for the analysis of basic structural elements to make
CO 2	Students are able to do the suitable approximations so that an indeterminate structure is reduced to a determinate structure
CO 3	Design the various structural steel members and connection.
CO 4	Apply the principles, procedures and codal requirements to the analysis and design of tension members, compression members, bases, beams, and connections.
CO 5	To produce a structure capable of resisting all applied loads without failure during its intended life.
CO 6	To identify potential problems and make necessary changes to the design to ensure that the structure will perform as intended.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	2	3	1	-	-	1	-	1	1	-	-	-	-	3	1
CO2	L5	2	3	1	1	-	1	-	1	1	-	-	-	-	3	1
CO3	L4	1	3	1	2	-	1	-	1	1	-	-	-	-	3	1
CO4	L4	1	3	3	2	-	1	-	1	1	-	-	-	-	3	1
CO5	L5	2	3	3	1	-	1	-	1	1	-	-	-	-	3	1
CO6	L3	1	3	3	1	-	1	-	1	1	-	-	-	-	3	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Suggested Readings:

1. Smith, J.C., Structural Analysis, Harpor and Row, Publishers, New York.
2. Structural Analysis I and IIS.S. Bhavikatti, S. Chand Publishers
3. Theory and Problem in Structural Analysis, L. S .Negi, Tata Mc Graw Hills.
4. Structural Analysis, Ramon, v. Jarquio, CRC Press.
5. Structural Analysis, A. Ghali and A.M. Neville, CRC Press

CONCRETE STRUCTURE-I

Course Code:CE404

Objectives:

- Develop an understanding of concrete behavior: This objective focuses on equipping students with knowledge of the properties, behavior, and performance of concrete as a structural material.
- Design reinforced concrete elements:This course equips students with the ability to design various structural elements made from reinforced concrete.
- Introduce precast and prestressed concrete techniques**:**The course may also provide an introduction to precast and prestressed concrete techniques used in modern construction

Module I:

Study of the strength, behavior, and design of indeterminate reinforced concrete structures, Load and stresses, load combinations, working stress and limit state approach.**4hours)**

Module II:

Analysis and design of sections in bending–working stress and limit state method. Rectangular and T-sections, Beams with reinforcement in compression .One-way slab. Design for shear and bond, Mechanism of shear and bond failure, Design of shear using limit state concept. Development length of bars; Design of sections in torsion. Design of two- Way slabs; staircase, Placement of reinforcement in slabs; **(16hours)**

Module III: Design of stairs and staircase **(6hours)**

Module IV: Design of compression members, Short column, Columns with uni-axial and biaxial bending; Long columns , use of design charts **(8hours)**

Module V: Design of foundation; Wall footing, isolated and combined footing for columns. All designs to be as per the most recent BIS standards as applicable **(8hours)**

CO	**COURSE OUTCOMES**
CO 1	Identify and compute the main mechanical properties of concrete and steel.
CO 2	Identify and calculate the design loads and distribution.
CO 3	To design the structure for stability, strength and serviceability.
CO 4	Perform various tests on fresh and hardened concrete and also on its ingredients.
CO 5	Understand the basic behaviours of concrete , its application in varied environment.
CO 6	To design the structural for stability, strength and serviceability.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	L2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	L1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	L5	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	L4	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO6	L5	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Suggested Readings:

1. IS456: 2000 and IS3370 (Part IV), BIS 2000
2. Design of Reinforced Concrete Structure (Limit State), A.K Jain, Nemchand Bros.
3. Limit state design of Reinforced Concrete (II) P.C.Verghese, PHI publisher
4. Limit state Design, B.C. Punmia, Laxmi Publications

ELECTRONICS AND INSTRUMENTATION ENGINEERING

Course code– EC404

(For Civil, Mech. & Production Engineering)

Objectives:

- Enhance data monitoring and control systems**:** Civil engineering projects often involve monitoring systems for factors like strain, pressure, and temperature in structures or surrounding environments.
- Facilitate integration with smart infrastructure technologies: The field of civil engineering is increasingly incorporating smart technologies for infrastructure management.
- Gain familiarity with automation and control systems in construction**:** Modern construction projects may utilize some level of automation or control systems in equipment operation or environmental control.

Module1:Basic Electronic Components

Active and Passive Components, Types of resistors and Colour coding, Capacitors, Inductors applications of Resistor, Capacitor and Inductor, Relay, LDR, Basic Integrated Circuits (IC 7805,7809,7812, 555etc.). Measuring Instruments like CRO, Power supply, multi-meters etc.

Module II: Semiconductors, Diode and Transistors:

Difference between Insulators, Semi conductors and Conductors, Mobility and Conductivity, Intrinsic and Extrinsic Semiconductors, Fermi Level, Energy band, P-N Junction Diode, construction, working, characteristics and diode equation Application of Diode, Rectifier: Half Wave, Full Wave and Bridge Rectifier, Zener Diode and its Applications, Varactor Diode, Schottky Diode, Regulated Power Supply using Zener Diode and Regulated ICs, LED, Photo detector, Construction, Working, Modes and Configuration of BJT, Input and Output Characteristics of all Configurations, Comparison of all Configuration & Modes, BJT as a Switch and as an Amplifier. JFET Construction, working and characteristics. MOSFET Construction, working and Characteristics, Types of MOSFET,

Module III : Digital Electronics Fundamentals:

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/sub tractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of micro processor/microcontroller and their applications.

Module IV: Electronic Instruments:

Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors. Electronic Display Device, Digital Voltmeters, Digital Energy meter, CRO, measurement of voltage and frequency,

Lissajous Patterns, Plotting B-H curve of a magnetic material, Wave Analysers, Harmonic Distortion Analyzer. Digital Energy Meter. Measurements of R, Land C. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers. Digital Storage Oscilloscope.

Module V: Electronic Communication Systems:

The elements of communication system, IEEE frequency spectrum and Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system, Ultrasonic wave & its application in distance measurement.

CO	COURSE OUTCOMES
CO 1	Recognize the evolution and history of units and standards in measurements.
CO 2	Identify the various parameters that are measurable in electronic instrumentation.
CO 3	Employ appropriate instruments to measure given sets of parameters.
CO 4	Practice the construction of testing and measuring set up for electronic systems .
CO 5	To have a deep understanding about instrumentation concepts which can be applied to control systems.
CO 6	Related the usage of various instrumentation standars.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Text Books:

1. Basic Electronics and Linear Circuits by N.N. Bhargava, D.C. Kulshreshtha and S.C.Gupta, TMH Publications.
2. Op-Amps and Linear Integrated Circuits by Ramakant A.Gayakwad, PHI Publications.
3. Electronic Devices and Circuits by Godse and Bakshi Technical,Vol-1 Technical Publication Pune.
4. Floyd, "Electronic Devices "Pearson Education 9th edition, 2012.
5. R.P. Jain, "Modern Digital Electronics ", Tata Mc GrawHill,3rdEdition,2007.
6. Frenzel, "Communication Electronics: Principles and Applications ", Tata Mc Graw Hill, 3rd Edition,2001

Reference Books:

1. Integrated Devices & Circuits by Millman & Halkias, TMH Publications.
2. Electronics Devices and Circuit Theory by R. Boylestad & L.Nashelsky, Pearson Publication
3. Electronic Communication System by G. Kennedy, TMH Publications.
4. Basic Electronics by Sanjeev Kumar & Vandana Sachdeva, Paragaon International Publication

CYBER SECURITY

Course code–IT402

Objectives:

- Protect critical infrastructure from cyber attacks**:** Civil engineers design and manage critical infrastructure like bridges, dams, and power grids.
- Safeguard sensitive project data and information**:** Civil engineering projects involve a significant amount of sensitive data, including design plans, construction specifications, and financial information.
- Promote secure communication and collaboration**:** Civil engineering projects often involve collaboration between various stakeholders - engineers, contractors, and government agencies.

Module I: Introduction to Cyber crime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, and Cybercrime: The legal Perspectives and Indian Perspective, Cyber crime and the Indian ITA2000, A Global Perspective on Cyber crimes.

Module II: Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cyber crime, Attack Vector, Cloud Computing.

Module III: Cybercrime : Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policiesan Measures in Mobile Computing Era, Laptops.

Module–IV: Tools and Methods Used in Cybercrime : Introduction, Proxy Servers and Anony mizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Module V: Cyber Security: Organizational Implications Introduction, Cost of Cyber crimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

CO	COURSE OUTCOMES
CO 1	Protect and defend computer systems and networks from cyber security attacks
CO 2	Diagnose and investigate cyber security events or crimes related to computer systems and digital evidence.
CO 3	Effectively communicate in a professional setting to address information security issues.
CO 4	Apply business principles to analyze and interpret data for planning , decision- making, and problem solving in an information security environment.
CO 5	Propose solution including development, modification and execution of incident response plans.
CO 6	Describe the Modification and execution of incident response plans.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

TEXTBOOK:

Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina God bole and Sunil Bela pure, Wiley INDIA.

REFERENCEBOOK:

Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
Introduction to Cyber Security, Chwan -Hwa (john) Wu,J. David Irwin. CRC Press T & F Group

ENGINEERING ECONOMICS

Course code–EN401

Objectives:

- Evaluate the economic feasibility of civil engineering projects**:** This objective focuses on equipping civil engineers with the ability to assess the economic viability of proposed infrastructure projects.
- Optimize decision-making for cost-effective infrastructure development**:** Engineering Economics teaches civil engineers to consider the economic implications of their decisions throughout a project's lifecycle

COURSE OUTLINE:

The basic purpose of this course is to provide a sound understanding of concepts and principles of engineering economy and to develop proficiency with methods for making rational decisions regarding problems likely to been countered in professional practice.

Module-1

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of Economics, Relation between science, engineering, technology and economics; Nature of Economic problem, Production possibility curve, Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility–its practical application and importance.

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, practical importance & applications of the concept of elasticity of demand.

Module-II

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale. Various concepts of cost–Fixed cost, variable cost, average cost, marginal cost, money cost, real cost, opportunity cost. Shape of average cost, marginal cost, total cost, Cost curves.

Module III

Meaning of Market, Types of Market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets)

Pricing Policies Entry Deterring policies, Predatory Pricing, Peak load Pricing. Product Life cycle

Firm as an organization - Objective of the Firm, Type of the Firm, Vertical and Horizontal Integration, Diversification, Mergers and Takeovers.

Module -IV

Nature and characteristics of Indian economy (brief and elementary introduction), Privatization – meaning, merits and demerits. Globalisation of Indian economy–merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement, Business cycle, Inflation

CO	COURSE OUTCOMES
CO 1	Describe and determine the effect of financial analysis and its impact on budgeting of projects and their outcomes.
CO 2	The course enable students to acquire the ability to work individually and on multi - disciplinary teams to identify, formulate and analyze financial problems.
CO 3	Use modern computer-based tools such a spread sheets in performing engineering economic analysis.
CO 4	Quantify and include elements of uncertainty and risk into an economic analysis.
CO 5	Identify the characteristics of various methods used for the generation of financial management decisions..
CO 6	Develop and analysis information on investment planning and cost controls, and conduct cost/benefit analysis.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

RECOMMENDED BOOKS:-

1. R. Paneer Seelvan: Engineering Economics, PHI

2. Managerial Economics, D.N. Dwivedi, Vikash Publication
3. Managerial Economics, H.L. Ahuja, S.Chandand Co. Ltd.
4. Managerial Economics, Suma Damodaran, Oxford.

5. R.mol rishnd Ro T.V S 'Theory of firms: Economics and Managerial Aspects'. Affiliated East West Press Pvt. Ltd. New Delhi
6. Managerial Economics, H. Craig Petersen & W. Cris Lewis, Pearson Edu

DISASTER PREPAREDNESS & PLANNING

Course Code: CE405

Objectives:

- Mitigate the impact of disasters on infrastructure**:** This objective focuses on equipping civil engineers with the knowledge and tools to design, construct, and maintain infrastructure that is more resilient to natural disasters like earthquakes, floods, and hurricanes
- Develop emergency response plans for civil engineering projects**:** The course equips students to plan and implement emergency response protocols for civil engineering projects in case of a disaster.
- Support post-disaster recovery and reconstruction**:** Civil engineers play a vital role in recovery and reconstruction efforts following a disaster

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

Module2: Disasters-Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

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

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

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

CO	COURSE OUTCOMES
CO 1	Understand disasters, disaster preparedness and apply the mitigation measures.
CO 2	Understand role of IT , remote sensing, GIS and GPS in risk reduction.
CO 3	Apply knowledge of disaster management acts and guidelines.
CO 4	To impart knowledge of causes of various disaster and its impact.
CO 5	To understand the concept of disaster management cycle and framework.
CO 6	To explain the applications of science and technology for disaster management & mitigation.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L1	3	2	3	-	-	1	2	1	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Text/Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni,2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K.,2008, Hand book of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. GhoshG.K.,2006, Disaster Management, APH Publishing Corporation
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June2003
7. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

FLUID MECHANICS & FLUID MACHINES LAB

Course Code: CE402P

List of Experiments

1. To determine experimentally the meta centric height of a ship model
2. To verify the momentum equation experimentally.
3. To determine the coefficient of discharge of an orifice (or a month piece) of a given shape.
4. Determine the coefficient of velocity and the coefficient and the contraction of the orifice (orthe mouth piece).
5. To verify Darcy's law and to find out the coefficient of permeability of the given medium
6. To study the transition from laminar to turbulent flow and to determine the lower criticalReynolds number,
7. To study the velocity distribution in a pipe and also compute the discharge by integrating thevelocity profile.
8. To calibrate a venturi meter and to study the variation of coefficient of discharge with theReynolds number.
9. To calibrate an orifice meter and study the variation of the coefficient of discharge with theReynolds number.
10. To study the variation of friction factor “F” for turbulent flow in smooth and rough commercialpipes

CONCRETE STRUCTURE LAB

Course Code: CE404P

List of Experiments:

1. Initial drying shrinkage, moisture movement, and coefficient of expansion of concrete.
2. Stress strain curve of concrete.
3. Behaviour of under reinforced and over reinforced R.C. beams in flexure.
4. Behaviour of R.C. beams, with and without shear reinforcement in shear.
5. Bond strength between steel bar and concrete
   a) In a beam specimen and
   b) By pull-out test.
6. a) Fineness of cement by Air Permeability method.
   b) Soundness of cement by Le- Chatalier's Apparatus
   c) Compressive strength of cement.
7. a) water content for standard consistency of cement.
   b) Initial and final setting times of cement.
8. Moisture content and bulking of fine aggregate
9. Fineness modulus of coarse and fine aggregates.
10. Workability of cement concrete by
    a) Slump test, and b) compaction factor test.
11. Concrete mix design for a given concrete strength and slump by LS. Code method----------

CAD BUILDING DRAWING LAB

Course Code: CE406P

List of Experiments:

1. Introduction to Auto CAD basic commands, Code provision of IS-696 regarding Lines, Lettering and Dimensioning.
2. Drawing of Scales (Plane Scales, Diagonal Scales, Vernier Scales and Scales of Chords),
3. Construction of simple geometrical figures and Engineering curves.
4. Orthographic Projections: Projection of a point situated in various quadrants, projections of straight lines, true length, true inclinations and traces of a straight lines, auxiliary projections, auxiliary inclined and Auxiliary vertical planes, projection of plane figures.
5. Projection of simple solids, Auxiliary projection of solids, section of solids, true shape of section.
6. Development of surfaces: prisms, pyramids, cylinders, cones, spheres, pipe bends.
7. Isometric projection: Principles, Isometric scales, Isometric projection of plane figures and simple solids.
8. Function and types of building (Residential, Industrial and Institutional) Line plan. Development of plan from a line plan

NOTE: At least Ten Experiments are To Be performed, minimum seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & Set by The Concerned Institution. As Per Scope of the syllabus.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF CIVIL ENGINEERING

B. TECH (5th) SEMESTER SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

Sl. no.	Course no.	Subject	L	T	P	Credit
1	CEC501	PC-I–Steel Structure &Design	3	1	0	4
2	CEC502	PC-II-Geotechnical Engineering-I	2	1	0	3
3	CEC503	PC-III-Environmental Engineering	2	1	0	3
4	CEP(504-510)	PE-I-	2	1	0	3
5	CEO(511-516	OE-I-	2	1	0	3
Laboratory/ Sessional						
1	CE501P	Sessional-Steel Design Lab	0	0	2	1
2	CE502P	Sessional-Geotechnical Engineering Lab	0	0	2	1
3	CE503P	Sessional-Environmental Engineering Lab	0	0	2	1
4	CE504P	Field Survey	0	0	2	1
5	CE505G	General Proficiency/Seminar	0	0	2	2
TOTALCREDIT						**22**

Sl. no.	Course no.	Subject	L	T	P	Credit
1	CEC501	PC-I–Steel Structure &Design	3	1	0	4
2	CEC502	PC-II-Geotechnical Engineering-I	2	1	0	3
3	CEC503	PC-III-Environmental Engineering	2	1	0	3
4	CEP(504-510)	PE-I-	2	1	0	3
5	CEO(511-516	OE-I-	2	1	0	3
Laboratory/ Sessional						
1	CE501P	Sessional-Steel Design Lab	0	0	2	1
2	CE502P	Sessional-Geotechnical Engineering Lab	0	0	2	1
3	CE503P	Sessional-Environmental Engineering Lab	0	0	2	1
4	CE504P	Field Survey	0	0	2	1
5	CE505G	General Proficiency/Seminar	0	0	2	2
TOTALCREDIT						**22**

Sl. no.	Course no.	Subject	L	T	P	Credit
1	CEC501	PC-I–Steel Structure &Design	3	1	0	4
2	CEC502	PC-II-Geotechnical Engineering-I	2	1	0	3
3	CEC503	PC-III-Environmental Engineering	2	1	0	3
4	CEP(504-510)	PE-I-	2	1	0	3
5	CEO(511-516	OE-I-	2	1	0	3
Laboratory/ Sessional						
1	CE501P	Sessional-Steel Design Lab	0	0	2	1
2	CE502P	Sessional-Geotechnical Engineering Lab	0	0	2	1
3	CE503P	Sessional-Environmental Engineering Lab	0	0	2	1
4	CE504P	Field Survey	0	0	2	1
5	CE505G	General Proficiency/Seminar	0	0	2	2
TOTALCREDIT						**22**

Civil Engineering

5th semester course structure

PROFESSIONAL ELECTIVE–I

[CEP504]Water Resources Engineering-I
[CEP505] Earthquake Engineering
[CEP506] Environmental Geo-technology
[CEP507] Advance Surveying
[CEP508] Water resources system
[CEP509] Industrial Structure
[CEP510] Design of Structural System

OPENELECTIVE–I

[CEO511] Environmental Impact Assessment
[CEO512]Reliability Engineering
[CEO513]Global Positioning System
[CEO514] Disaster Management
[CEO515] Environmental Management System
[CEO516] Advanced Engineering System
[HMO501] Human Resource Development and Organizational Behavior
[HMO502] Cyber Law and Ethics

STEEL STRUCTURE & DESIGN

Course code CEC501

OBJECTIVES:

- This course is designed to introduce the behavior and design of structural steel members according to the limit states design concepts. Students are expected to obtain basic knowledge about the design and failure mode of structural steel members after finishing this course.
- Analyze the effects of forces on steel sections**:** Understand how axial forces and shear affect the plastic moment capacity of steel sections.
- Differentiate between design philosophies**:** Distinguish between permissible stress, working stress, and limit state design philosophies.

MODULE-I

Introduction to steel structures and IS800 -2007-Materialspecifications - Rolled sections – Section classifications – Design approach; design philosophy, i.e. loading load combination, factor of safety, permissible and working stress elastic method, Limit state of design, plastic design, Elements of plastic theory: Plastic hinge, shape factor, collapse load for beams & portal frame. Uniqueness, upper & lower bound theorem. Effect of axial force & shear in plastic moment of sections.(**12Hr)**

MODULE-II

Connections: Riveted, bolted and welded connections, strength and efficiency, Eccentric connection **(12Hr)**

MODULE-III

Tension member: Rolled section sand built-up sections, **(8Hr)**

MODULE-IV

Compression members -Slenderness ratio–Design-Simple and built-up sections-lacing sand battens-Tension members. **(10Hr)**

MODULE-V

Flexural members–Rolled sections-built-up beams-Design For strength and serviceability, web crippling, web yielding, bearing stiffeners, **(10Hr)**

MODULE-VI

BEAM column: stability consideration, interaction formulae and Column bases: stability of base, gusseted base and grillage footing. **(8Hr)**

CO	COURSE OUTCOME
CO1	Design of bolted and welded connections; concentric and eccentric.
CO2	Design of rolled and built-up tension members.
CO3	Design of rolled and built-up compression members.
CO4	Design of laterally supported and unsupported flexural members.
CO5	Design of plate girders.
CO6	Understanding failure modes and application of limit states design philosophies of steel designing. Plate Girder, Gantry Girder, Reading:

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PS O1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L1	3	2	3	-	-	1	2	1	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. Subramanian N, Design of Steel Structures, Oxford University Press, NewDelhi2008.
2. Dayaratnam P: Design of Steel Structures, S. Chand &Co. New Delhi,2003.
3. Arya, A. S. and Ajmani, A.L., Design of Steel Structures, Nemchand and brothers, Roorkee, 1992..
4. Punmia, B.C.Ashok Kumar Jain and Arun Kumar Jain. Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., NewDelhi2000.
5. IS800-2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.

Geotechnical Engineering-I
Course code: CEC502

COURSE OBJECTIVES:

- To develop analytical and experimental skills to determine various stresses acting on soil material.
- Master fundamental soil characterization techniques: Gain proficiency in performing various laboratory and field tests to determine essential soil properties like water content, specific gravity, particle size distribution.
- Classify soils using a standardized system: Understand the importance of soil classification and learn to effectively classify soils according to the Indian Standard (IS) classification system using the plasticity chart.
- Analyze stress distribution in soil layers**:** Become familiar with Boussinesq's and Westergaard's equations for calculating vertical stress caused by point and uniformly distributed loads, including their limitations and assumptions.
- Differentiate between soil consolidation and compaction**:** Grasp the key concepts of consolidation (coefficient of compressibility, coefficient of volume change, compression index, e-log(p) curves,

Pre-requisites: None
Detailed Syllabus:

MODULE-I Engineering Properties and Classifications
Laboratory and field identification of soils :Determination of water content by oven drying –specific gravity using Pycnometer and specific gravity bottle – grain size analysis by sieve analysis, hydrometer analysis and pipette analysis– Atterberg limit and indices, sensitivity & thixotropy field density by core cutter, sand replacement and wax coating methods. Permeability: Definition - Darcy's law - factors affecting permeability – laboratory determination – permeability of stratified soils. Classification of Soils: Necessity–Principle so of classification–I.S. classification–plasticity chart. **(10Hr)**

MODULE-II Stress Distribution in Soils
Stress distribution: Boussinesques and Westergaard equations for vertical pressure due to point loads and uniformly distributed loads - assumptions and limitations, pressure bulb- Newmarks` chart sand their use.(**4Hr)**

MODULE-III Compressibility of Soils
Consolidation: definition-concepts of coefficient of compressibility- coefficient of volume change and compression index e-log(p) curves pre-consolidation, pressure-Terzaghi theory of one-dimensional consolidation– determination of coefficient of consolidation -difference between consolidation and compaction. Compaction: definition and objectives of compaction- proctor test and modified proctor test-concept of OMC and maximum dry density - zero air voids line- factors influencing compaction – field compaction methods-Proctor need Le for field control. **(12Hr)**

MODULE-IV Shear Strength and Stability of Slopes:

Shear Strength: definition - Mohr's strength and stress circles – Mohr envelope – Mohr Coulomb strength theory- direct, tri-axial and UCC tests - drainage conditions-UU, CU and CD tests -vane shear tests - total and effective stress - strength parameters Stability of slopes: slope failure, base failure and toe failure –Swedish circle method-friction circle method-Taylor stability Number-stability charts. **(8Hr)**

MODULE-V Retaining Walls:

Retaining walls, Active, neutral and Passive earth pressures and their distributions, rigid and flexible retaining walls, Coulomb and Rankine earth pressure distribution, Tension cracks, depth of tension cracks, Critical depth of excavation.**(6Hr)**

MODULE-VI Sub-surface Exploration:

Subsurface exploration and investigation: Preliminary and detailed investigation, Soil sampling and various terms such as clear acne and recovery ratio, auguring and boring, Penetration Tests such as SPT,CPT, SCPT.**(4Hr)**

CO	COURSE OUTCOME
CO1	To understand the earth pressure analysis for sloping backfill, proportioning of retaining walls and stability checks.
CO2	To understand the analysis and design of pile foundations, raft foundations.
CO3	To understand the various aspects of environmental geo-techniques, including the basics and design of landfills.
CO4	To learn the advanced methods of slope stability analysis.
CO5	To learn the basics of soil dynamics.
CO6	To classify soils and understand their properties.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Principles of Geotechnical Engineering" by Braja M. Das:

2. "Soil Mechanics in Engineering Practice" by Karl Terzaghi and Ralph B. Peck

3. "Foundation Design: Principles and Practices" by Donald P. Coduto, William A. Kitch, and Man-chu Ronald Yeung:

ENVIROMENTAL ENGINEERING

Course code: CEC503

COURSE OBJECTIVES:

- To impart training to the student of various aspects related to water quality, quantity, storage and distribution in addition to sanitation of buildings**.**
- Understand population forecasting for water demand: Learn methods for forecasting population growth and its impact on water demand over a design period.
- Identify factors affecting water demand: Analyze the various factors that influence water demand, including population growth, per capita consumption variations, and fluctuations in demand rates.
- Calculate water demand: Develop the skills to calculate water demand for a given population and design period, considering relevant factors.
- Apply water demand concepts in design**:** Gain the ability to apply water demand calculations to the planning and design of water supply systems.

MODULE-I

Water demand:- Population- forecast, design period, factors
Affecting populations 'growth, water demand, factors affecting rate of demand, variations in rate of demand**.(8Hr)**

MODULE-II

Quality of water: sources of impurities, common impurities in water and their effect, water analysis, physical, chemical and biological characteristics, water borne diseases, Indian and WHO Drinking standard **.(8Hr)**

MODULE-III

Purification: Sedimentation, flocculation, coagulation, filtration, disinfection, water softening, aeration, miscellaneous treatment method. **(8Hr)**

MODULE-IV

Distribution of water:- Introductions, Methods of distribution, pressure in distribution mains, system of water supply, storage and distribution reservoir, layout and design of distribution system and Distribution reservoir**.(12Hr)**

MODULE-V

Waste water treatment: Sewage characteristics. Sewerage system - Type, design, construction and maintenance. Treatment-Primary and secondary treatments, screens, grit chamber, sedimentation chamber, principle and design of activated sludge digestion, final disposal of sludge and effluents, Disposal of sewage by dilution, self-purification of streams, sewage disposal by irrigation, waste water reuse, solid waste collection, re-utilization/ disposal, B.O.D,C.O.D. **(12Hr)**

CO	COURSE OUTCOME
CO1	To be able to assess the water demand for various uses based on population estimation.
CO2	To be able to identify the sources of water and assesses it's water quality parameters.
CO3	To able to design various components of water supply distribution system which includes reservoirs, pipe networks, pumps.
CO4	To able to understand various processes involved in water treatment.
CO5	To able to understand various aspects of water and sanitation in buildings including plumbing fixtures.
CO6	Environmental effects of various types of wastes.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L1	3	2	3	-	-	1	2	1	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Text/Reference Books:

1. G.B. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 2013.
2. Gerard Kiely, Environmental Engineering, McGraw Hill Education Pvt Ltd, Special Indian Edition,2007.
3. W P Cunningham, M A Cunningham, Principles of Environmental Science, Inquiry and Applications, Tata McGraw Hill, Eighth Edition,2016.
4. M. Chandrasekhar, Environmental science, HiTech Publishers,2009

WATER RESOURCES ENGINERING-1

Course code: CEP504

COURSE OBJECTIVES:

- The student is exposed to different phases in Water Resources Management and National Water Policy.
- Further they will be imparted required knowledge on Reservoir planning, management and economic analysis including Irrigation and Irrigation management practices.

Detailed Syllabus:

MODULE-I

Introduction-Hydrologic cycle, water-budget equation, history of hydrology, world water budget, Water budget of India, Organization preserving hydrological data**.(4Hr)**

MODULE-II

Precipitation –types and forms of precipitation, different characteristics of rainfall and their representation, measurement of rainfall , rain gauge network, mean precipitation over an area, depth area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India. **(8Hr)**

MODULE-III

Abstractions from precipitation-evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapo-transpiration, measurement of evapo-transpiration, evapo-transpiration equations, potential evapo-transpiration, actual evapo-transpiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, infiltration capacity curve, classification of infiltration capacities, infiltration indices. **(10Hr)**

MODULE-IV

Runoff–Estimation of runoff, SCS-CN method of component so of runoff estimating runoff, flow duration curve, flow-mass curve, Different types of indices**.(4Hr)**

MODULE-V

Hydrograph: Elements of storm hydrograph, simple and complex storm hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph, Derivation of unit hydrograph from S-Curve technique, SUH and IUH.(**10Hr)**

MODULE-VI

Floods estimation and Flood Routing: Estimation of peak discharge, rational method, SCS method and unit hydrograph method, Design flood, return period, flood frequency analysis, concepts of flow routing, Different method so of routing, PMF,SPF.(**8Hr)**

CO	COURSE OUTCOME
CO1	To appreciate various methods of irrigation and application to agricultural fields
CO2	To appreciate the soil-water-plant relationship and understand the crop water requirements
CO3	To determine the technical, social and economic aspects of water resources planning and management.
CO4	To carry out Hydraulic design of irrigation canals, diversion headwork and cross drainage works.
CO5	To understand various aspects of water logging of agricultural lands.
CO6	To appreciate the concept of integrated water resources management.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. K. Subramanya, Engineering Hydrology, McGraw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. K. Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.

EARTH QUAKE ENGINEERING

Course code: CEP505

COURSE OBJECTIVES:

- To impart the basic understanding of earthquakes, physics of the earth's interior from a practical side, to foresee the potential consequences of strong earthquakes on urban areas and civil infrastructure and how to do more efficient hazard management and mitigation.
- This module will communicate how science can enhance community resilience and has relevance far beyond any site for earth sciences, earthquake engineering, preparedness, mitigation, emergency response, decision making, and public policy.

Detailed Syllabus:

MODULE-I

Elements of Seismology, Definitions of Magnitude, Intensity, Epicenter etc. General features of tectonic of seismic regions, Seismographs. Theory of Vibrations.(**8Hr)**

MODULE-II

Free vibrations of single degree, two degree and multiple degree free , Dom systems. Computation of dynamic response to time dependent forces. Vibration isolation, Vibration absorbers. (**8Hr)**

MODULE-III

Principles of Earth quake Resistant Design, Response spectrum theory. Brief introduction to accelerate graph sand S.R.R.'s. (**8Hr)**

MODULE-IV

Nature of dynamic loading resulting from earthquakes. Application of Response spectrum, Theory to a seismic design to structures. Resistance of structural elements and structures for dynamic loads, design criteria-strength and deflection, Ductility and absorption of energy. (**8Hr)**

MODULE-V

Nature of dynamic loading resulting from earthquakes, Application of Response spectrum. Theory to a seismic design to structures. Resistance of structural elements and structures for dynamic loads, design criteria- strength and deflection. Ductility and absorption of energy. (**8Hr)**

MODULE-VI

Dynamic Properties of Soils, Remedial measures and management of earthquake disaster, Introduction to Indian Standard Codes IS:1893–1984andIS:4326–1993. (**8Hr)**

CO	COURSE OUTCOME
CO1	Properties of the Earth's interior, physical characteristics of seismic sources, Estimation of seismic hazard and risk
CO2	Effects of earthquakes on humans, objects and surroundings.
CO3	Information on the soil structure and properties at the construction site, as well as on the path between epicenter and the site
CO4	Parameters needed in order to construct seismically safe and sound structures.
CO5	To understand different aspects of earthquake and their impacts on the Civil Engineering Structures and control and mitigation measures thereof

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PS O3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Fundamentals of Earthquake Engineering" by Amr S. Elnashai and Luigi Di Sarno

2. "Earthquake Engineering: From Engineering Seismology to Performance-Based Engineering" by Yousef Bozorgnia and Vitelmo V. Bertero:

3. "Earthquake Resistant Design of Structures" by Pankaj Agarwal and Manish Shrikhande

ENVIRONMENTAL GEO-TECHNOLOGY

Course code: CEP506

Objectives:

- **Understand key geo-societal issues:** This objective focuses on the scientific and technical aspects of pressing environmental challenges.
- **Analyze environmental data:** Module II equips students to analyze case studies using real-world data on climate change, energy, pollution, and health risks.
- **Evaluate waste impact:** Module III explores the influence of industrial and construction waste on the geological environment.

Detailed syllabus:

MODULE-I
A consideration of technical and scientific aspects of key geo-societal issues.**(8Hr)**

MODULE-II
Case studies and analysis of current and historic databases will be used to illustrate topics including impact of climate change, energy resources, water and soil pollution, and health risks Posed by heavy metals and emerging pollutants. **(16Hr)**

MODULE-III
Influence of disposal of industrial and construction waste on the Geo-environment. (**12Hr)**

MODULE-IV
Effect and impact of effluent from chemical and mining
Industries on ground water, Design of clay liners. (**8Hr)**

CO	COURSE OUTCOME
CO1	To understand the earth pressure analysis for sloping backfill, proportioning of retaining walls and stability checks.
CO2	To understand the analysis and design of pile foundations, Raft foundations.
CO3	To understand the various aspects of environmental geo-techniques, including the basics and design of landfills.
CO4	To learn the advanced methods of slope stability analysis
C05	To learn the basics of soil dynamics

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L3	3	1	1			-	-	3	-	-	2	-	-	-	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books:

Introduction to Environmental Geotechnology by Hsai–Yang Fang

CDEEP, IIT B video lectures on course CE488 and CE641 by Prof. D.N.Sin

ADVANCE SURVEYING

Course code: CEP507

COURSE OBJECTIVES:

- To impart basic understanding of various aspects related to system of Geometrics and other physical measurements in the field of Civil Engineering**.**
- Master Field Astronomy Fundamentals **:** Grasp astronomical concepts like coordinate systems, timekeeping (LMT, ST, GMT), and the equation of time. (12 hrs)
- Apply Aerial Photogrammetry Techniques **:** Learn the principles and applications of aerial photogrammetry, including photo scaling, map creation using prints and instruments, and generating mosaics. (10 hrs)
- Utilize Remote Sensing & GIS **:** Gain an understanding of remote sensing principles, image interpretation, and satellite data analysis.

Pre-requisites: Detailed Syllabus:

MODULE-I

Field Astronomy: Introduction, purposes, astronomical terms, Astronomical coordinate system, astronomical triangle, determination of azimuth, declination & hour angle, different types of time, LMT, ST & GMT and inter dependencies. Equation of time. **.(12Hr)**

MODULE-II

Aerial photogrammetric: Introduction, Principle, Uses, Aerial & terrestrial photographs, Scale of vertical and tilted photograph, photographic mapping-mapping using paper prints, mapping using stereo plotting instruments, mosaics, map Substitutes. **(10Hr)**

MODULE-III

Remote Sensing And Geographical Information System: Introduction, Electromagnetic spectrum, Principles of energy interaction in atmosphere and earth surface, Image interpretation techniques, digital satellite data; Global Positioning system: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system, Geo-spatial analysis, Integration of Remote sensing & GIS and Applications in Civil Engineering. **(12Hr)**

MODULE-IV

Hydrographic surveying: Introduction, shoreline survey, sounding method of locating sounding, Three point problem. **(10Hr)**

CO	COURSE OUTCOME
CO1	To understand traversing and numerical aspects of traversing
CO2	To understand trigonometric leveling and geodetic surveying.
CO3	To understand curves and setting out works.
CO4	To understand tachometric surveying involving angular measurements.
CO5	To develop a complete understanding of total station surveying.
CO6	To get a hands-on training on the use of Theodolite and its applications in traversing, angular measurements, etc.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L1	3	2	3	-	-	1	2	1	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. Surveying Vol. II and III by Dr.B.C. Punamia, Laxmi Publishers. New Delhi
2. Surveying Vol. II and III by Dr.K.R. Arora, Standard Book House. New Delhi
3. Advanced Surveying by R. Agor, Khanna Publishers, New Delhi
4. Remote Sensing and GIS by B. Bhatia, Oxford University Press, New Delhi.
5. Remote sensing and Image interpretation by T.M Lilles and, R.W Kiefer, and J.W Chipman, 5th edition, John Wiley and Sons India

WATER RESOURCE SYSTEM

Course code: CEP508

Objectives:

- Grasp Water Resource Systems Management Understand core concepts, system components, planning strategies, advantages/limitations of a systems approach, and modeling techniques.
- Optimize Water Resource Allocation Master linear programming (LP) for water resource problems. Learn to formulate LP models, solve them using graphical and simplex methods, and perform sensitivity analysis
- Simulate Water Resource Systems Gain an understanding of simulation techniques for water resource systems, including river basin and reservoir operation simulations

Pre-requisites:

Detailed Syllabus:

MODULE-I

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

MODULE-II

Linear Programming and Applications: General form of LP, Standard and Canonical forms of LP, Elementary transformations, Graphical method, Feasible and in feasible solutions, Simplex method, Dual and sensitivity analysis, L P problem formulation, Reservoirs using and Reservoir operation Using LP

MODULE-III

Simulation: Introduction, River basin simulation, Reservoir Operation simulation, Perform an see valuation-Reliability, Resiliency and Vulnerability, Some simulation models

MODULE-IV

Water Resources Systems Modeling : River basin planning and management, Water distribution systems, Ground water systems, Water quality modeling, Flood plain management, Urban storm water management

CO	COURSE OUTCOME
CO1	To perform studies related to watershed management
CO2	To prepare pre-feasibility and detailed project reports, etc.
CO3	To appreciate the concept of integrated water resources management.
CO4	To understand the concepts of renewable energy, biomass, etc.
CO5	To equip with the rural technological delivery systems and low cost technology that can be used in the farm.
CO6	To carry out hydraulic design of irrigation canals, diversion headwork and cross-drainage works.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L1	3	2	3	-	-	1	2	1	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. Loucks D. P, Stedinger J. Rand Haith D.A 'Water Resources Systems Planning and Analysis ', Prentice Hall, USA, 19

INDUSTRIAL STRUCTURES

Course code: CEP509

Objectives:

- Design Industrial Steel Buildings**:** Understand different frame types, bracing systems, crane girders, columns, and design workshop sheds and trussed bents. (6
- Analyze and Design Towers & Chimneys Learn about transmission and communication tower types and configurations, analyze and design them.
- Design Silos and Bunkers Grasp Jessen's and Airy's theories for silo design.

Detailed Syllabus:

MODULE-I

Industrial steel building frames: Types of frames, bracing, crane girder sand columns, workshop shed, trussed bents**.(6Hr)**

MODULE-II

Transmission and Communication towers: Types and configuration, Analysis and design; Chimneys; Loads and stresses in chimney shaft, Earthquake and wind effect, Stresses due to temperature difference, combined effect of load sand Temperature. **(10Hr)**

MODULE-III

Silos and Bunkers; Jassen's theory, Airy's theory, Shallow and deep bins, Rectangular bunkers with slopping bottom, Rectangular bunkers with high side walls, Steel stacks; introduction, force acting on a steel stack, design consideration, Design example of stacks**.(12Hr)**

MODULE-IV

Concrete Shell Structures: Folded plate and cylindrical shell structures; Introduction, structural behavior of long and short shells, beam and arch action, analysis and design of cylindrical Shell structures.(**10Hr)**

MODULE-IV

Machine foundations; introduction, machine vibration, structural design of foundation to rotary machines, impact machines, vibration characteristics, design consideration of foundation to impact machine, grillage, pile and raft foundation.(**10Hr)**

CO	COURSE OUTCOME
CO1	To understand the concepts of bearing capacity and foundations.
CO2	To understand the practical aspects of earth pressure and retaining structures
CO3	Determine consolidation characteristics of a given soil sample
CO4	To equip the knowledge of strength and mechanical behavior of soils.
CO5	To understand the concepts of slope stability along with its practical application
CO6	Determine allowable soil pressure of soil foundation system by vertical plate load test

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PS O1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. Design of Steel Structures, Arya and Azmani, Nem Chand Brothers, Roorkee,2004
2. Punmia B.C, Ashok Kr. Jain, Arun Kr. Jain,RCC Designs (Reinforced Concrete Design),10th Edition, Lakshmi Publishers, 2006.
3. Ramachandra, Design of SteelStructures,12thEdition,Standard Publishers, 2009

DESIGN OF STRUCTURAL SYSTEMS

Course code:-CEP510

Objectives:

- Master Structural Fundamentals **:** Understand different structural systems, various types of loads acting on structures, and assumptions and idealizations made during analysis

- Develop Structural Design Methodology **:** Learn the entire structural design process, encompassing defining functional requirements, selecting the most suitable structural scheme based on the project.
- Apply Design Criteria & Analysis Techniques **:** Grasp design criteria formulation, perform preliminary and computer-aided member proportioning, and analyze the structural response considering factors like cost and value.

MODULE-I

Classification of structural systems, Loads, assumptions and Idealizations.**(10Hr)**

MODULE-II

The whole Structural design process including definition of functional requirements, selection of structural scheme. **(18Hr)**

MODULE-III

Formulation of design criteria, preliminary and computer-aided proportioning, and analysis of response, cost, and value **(18Hr)**

CO	COURSE OUTCOME
CO1	Introduction to some important definitions/ concepts, terminology, etc. about Engineering seismology such as origin of earthquakes, propagation of seismic waves, key ground motion characteristics in the form of response spectrum and Design response spectrum.
CO2	Response of building structures under ground motion followed by computation of seismic forces on buildings based on various methods (equivalent static method, dynamic analysis (i.e. Modal analysis) also called response spectrum method) as per IS 1893 code.
CO3	Seismic design and detailing of RCC elements as per IS 13920 code.
CO4	Seismic design of brick masonry buildings as per IS- 4326 code and repair of buildings as per IS13935.
CO5	Students will be able to analyze and design various structural elements for different types of loads.
CO6	This includes learning how to use finite element analysis (FEA) software to model and analyze the behavior of structures under load.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. Structural Stability-Theory and Implementation by W.F. Chenand E.M. Luiby Elsevier.
2. Reeve, D. Chadwick,A.and Fleming, C. Coastal Engineering - Processes, theory and design practice, Spon Press, Taylor & Francis Group, London & Paris, 2004.

ENVIRONMENT IMPACT ASSESSMENT

Course code: CEO511

Objectives:

- Understand the historical development of Environmental Impact Assessment (EIA) methodologies.
- Grasp the concepts of screening and scoping processes used in EIA.
- Apply knowledge of these processes to identify projects requiring EIA and define their assessment boundaries.

Detailed Syllabus:

MODULE-I

Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; **(8Hr)**

MODULE-II

Rapid EIA and Comprehensive EIA; General Frame work for
Environmental Impact Assessment, Characterization and site assessment. Environmental Risk Analysis.**(8Hr)**

MODULE-III

Definition of Risk, Matrix Method. Checklist method, Fault tree analysis, Consequence Analysis; Socio-economic aspects, measures of effectiveness of pollution control Activities.**(12Hr)**

MODULE-IV

Environmental Legislation; Introduction to Environmental Management Systems; Environmental Statement-procedures; Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance & Management Review; Operational Control; **(14Hr)**

MODULE-IV

Case Studies on EIA.**(2Hr)**

Prerequisites: Environmental Engineering

CO	COURSE OUTCOMES
CO1	Importance and objective of rate analysis
CO2	Importance of road estimate and its cost analysis
CO3	To develop the skill for the management of construction projects.
CO4	To develop the concept of works accounting and leadership organization.
CO5	To be able to carry out all the requisite quality tests on water from the point of view of Drinking water standards.
CO6	To be able to develop an understanding of various reagents used in water testing.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L2	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3
CO6	L1	3	2	3	-	-	1	2	1	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book:

1. Environment Impact Assessment: A Practical Guide by Betty bowers Marriott.
2. Environment Impact Assessment for Civil Engineering Project by R.K.Singal, M.k Singal and Ravi Gupta.
3. Environment Impact Assessment: Theory and Practical By peter wathern

RELIABILITY ENGINEERING

Course code: CEO512

Objectives:

- Grasp fundamental concepts: Define key terms in reliability engineering, including reliability, probability, and failure. Recognize the difference between impossible, certain, and random events.
- Analyze failure data**:** Comprehend how to analyze failure data to understand failure rates and densities (hazard rate).
- Relate reliability to failure metrics**:** Establish the connection between reliability, hazard rate, and failure density.
- Apply concepts in various scenarios**:** Learn how to interpret failure density in different situations beyond basic applications.

Detailed Syllabus:

MODULE-I

Introduction: Definitions and concepts, Reliability, Probability, Impossible and certain events. Failure-data and its Analysis, Hazard Rate and Failure density, Reliability interns of hazard rate, Failure density in other situations. **(10Hr)**

MODULE-II

Hazard Models: Type of distribution and standard deviation and variance, Expectations, Conditional probabilities.**(8Hr)**

MODULE-III

System Reliability: Series, Parallel and mixed configurations. Methods of solving Complex systems.

Reliability improvement: Types of redundancies, Reliability. **(8Hr)**

MODULE-IV

Allocation for a series of system, Optimization Reliability – cost trade-off.**(8Hr)**

CO	COURSE OUTCOMES
CO1	Importance and objective of rate analysis
CO2	Importance of road estimate and its cost analysis
CO3	To develop the skill for the management of construction projects.
CO4	To develop the concept of works accounting and leadership organization.
CO5	To be able to carry out all the requisite quality tests on water from the point of view of Drinking water standards.
CO6	To be able to develop an understanding of various reagents used in water testing.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	L2	3	3	3	-3	-	-	2	-	-	-	-	-	-	-	-
CO3	L3	3	3	3	-	1	-	2	-	-	-	2	-	-	-	-
CO4	L2	3	3	3	3	-	-	2	2	1	-	2	-	-	1	-
CO5	L2	3	3	3	-	-	-	2	-	-	1	-	-	-	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Reliability Engineering by L.S Srinath.
2. Reliability Engineering and Risk Analysis: A Practical Guide by Mohanmmad Modarres, Mark Kaminskiy and Vasiliy Krivtsov
3. Introduction to Reliability Engineering by E.E.lewis.

GLOBAL POSITIONING SYSTEM

Course code: CEO513

Objective:

- Understand the Fundamentals**:** Gain a comprehensive understanding of GPS, including its development, history, new satellite constellations, and the basic concepts of space, control, and user segments.
- Grasp GPS Signals**:** Demystify the structure of GPS signals, including frequency, P-code, C/A code, data format, C/A code generation, navigation data bits, pseudo-range and phase measurements, system accuracy characteristics (DOP), and overall data format.

Pre-requisites: NA

Detailed Syllabus

MODULE-I

Overview of GPS–Development of Global Surveying Techniques, History of GPS, New Satellite Navigations constellations, Basic concept of GPS, Space, Control and User segments. **(8Hr)**

MODULE-II

GPS Observables– Structure of GPS Signal, Frequency, P -Code, C/A code and data format, Generation of C/A code, Navigation data bits Pseudo range measurements, Phase measurements, system accuracy characteristics, DOP, Data format. **(8Hr)**

MODULE-III

Surveying with GPS–Planning a GPS Survey, Positioning methods–point positioning, relative positioning, Static, Fast static, RTK, Differential Positioning, Post processing ,real-time processing. **(8Hr)**

MODULE-IV

Accuracy measures, software modules, Network adjustments, Dilution of Precision. **(8Hr)**

MODULE-V

Applications of GPS – General Uses of GPS, Attitude determination, Interoperability of GPS Future of GPS–Modernization plans of navigational satellites, Hardware and software improvements. **(8Hr)**

CO	COURSE OUTCOME
CO1	To understand the basic principles and various stages of disaster management and develop a knowhow about regional, national and international level regulatory authorities.
CO2	To have an understanding of various aspects of floods as disasters and various planning and mitigation measures.
CO3	To develop an understanding about Droughts and their socio-economic impacts - drought management.
CO4	To be able to understand different aspects of landslides and their mitigation
CO5	To understand different aspects of earthquake and their impacts on the Civil Engineering Structures and control and mitigation measures thereof.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO2	L3	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L3	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reading:

1. Bradford W. Parkinson, James Spilker, Global Positioning System: Theory and Applications,Vol.I,1996.
2. Gunter Seeber, Satellite Geodesy Foundations, Methods and Applications, Walter de Gruyter Pub.,2003.
3. Hofmann W.B, Lichtenegger, H, Collins, J Global Positioning System–Theory and Practice, Springer-VerlagWein, 2001

DISASTER MANAGEMENT

Course code: CEO514

COURSE OBJECTIVES:

- To Impart Knowledge for Understanding of Various Aspects of Disaster Management Cycle. Control and mitigation measures for disasters like: floods, droughts, landslides, and earthquakes.
- Define and differentiate key disaster concepts: Grasp the concepts of disaster, risk, and vulnerability, along with different approaches to understanding disasters and their levels of impact.
- Analyze vulnerability factors**:** Understand the various dimensions of vulnerability and how they contribute to disaster risk. Students will also learn to conduct vulnerability assessments, particularly for flood and earthquake hazards.
- Apply disaster concepts to practical applications: Be able to apply their understanding of hazards, vulnerabilities, and disaster risk to real-world scenarios, such as floods and earthquakes.

Detailed Syllabus:

MODULE-I

Understanding Disaster: Concept of Disaster – Different approaches- Concept of Risk– Levels of Disasters –Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards– Characteristics and damage potential ornatural hazards; hazard assessment– Dimensions of vulnerability factors; vulnerability assessment–Vulnerability and disaster risk– Vulnerabilities to flood and earthquake hazards. **(8Hr)**

MODULE-II

Disaster Management Mechanism: Concepts of risk management and crisis managements – Disaster Management Cycle– Response and Recovery–Development, Prevention, Mitigation and Preparedness–Planning for Relief. **(8Hr)**

MODULE-III

Capacity Building: Capacity Building: Concept– Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk– Counter- Disaster Resources and their utility in Disaster Management – Legislative Support at the state and national levels. **(8Hr)**

MODULE-IV

Coping with Disaster: Coping Strategies; alternative adjustment processes- Changing Concepts of disaster management Industrial Safety Plan; Safety norms and survival kits Mass media and disaster management. **(8Hr)**

MODULE-IV

Planning for disaster management: Strategies for disaster management planning–Steps for formulating a disaster risk reduction plan– Disaster management Act and Policy in India– Organizational structure for Disaster management in India–Preparation of state and district disaster management plans. **(8Hr)**

CO	COURSE OUTCOME
CO1	To understand the basic principles and various stages of disaster management and develop a knowhow about regional, national and international level regulatory authorities.
CO2	To have an understanding of various aspects of floods as disasters and various planning and mitigation measures.
CO3	To develop an understanding about Droughts and their socio-economic impacts - drought management.
CO4	To be able to understand different aspects of landslides and their mitigation
CO5	To understand different aspects of earthquake and their impacts on the Civil Engineering Structures and control and mitigation measures thereof.
CO6	Improve Preparedness and Response Develop the skills necessary for civil engineers to prepare for disasters, including planning emergency response

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO2	PSO3
CO1	L2	2	3	1	-	-	1	-	1	1	-	-	-	-	3	1
CO2	L5	2	3	1	1	-	1	-	1	1	-	-	-	-	3	1
CO3	L4	1	3	1	2	-	1	-	1	1	-	-	-	-	3	1
CO4	L4	1	3	3	2	-	1	-	1	1	-	-	-	-	3	1
CO5	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

TEXTBOOKS:

Manual on Disaster Management, National Disaster Management, Agency Govt of India. Disaster Management by Mrinalini, Pandey Wiley2014.

Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt. Ltd Wiley2015

ENVIRONMENTAL MANAGEMENT SYSTEM

Course code: CEO515

Course Objectives:

- Gain a thorough understanding of the ISO 14000 series environmental management standards and apply them to establish and operate an Environmental Management System (EMS) within an industrial setting.
- Mitigate Environmental Pollution**:** Develop the skills to identify and address various types of environmental pollution, including air, water, and land pollution.
- Manage Hazardous Waste: Grasp the principles of hazardous waste management systems, including landfill and incineration methods.
- Conduct Environmental Assessments and Audits: Master the fundamental concepts of Environmental Impact Assessment (EIA) and its importance.

Pre-requisites: NA

Detailed Syllabus:

MODULE-I

Environmental Management System in Industry: Quality of environment. ISO14000 Environment standards, EMS model. Policy planning process, Implementation and operation in industry. **(8Hr)**

MODULE-II

Environmental Pollution & Control Techniques: Definition of pollution, pollutant and significance of pollution of pollution control. Types of environment pollution: air, water and land pollution and control. **(8Hr)**

MODULE-III

Hazardous waste management system: landfill as incineration, environment problems and solution Concept of Restoration Ecology and Reclamation of degraded land. **(8Hr)**

MODULE-IV

Environment Impact Assessment and Audits: Basic concept of EIA, Needs for EIA and Methods. Introduction and Significance of Environment Audit. Audit regulations, standards and protocols, Setting up EIA and Audit Division in Industry. **(8Hr)**

MODULE-V

Disasters and their management: Introduction of disasters, Classification and sub types of disasters. Industrial disasters and related case studies. Precautions of SHE in disaster management. Role of SHE in disaster management.**(8Hr)**

CO	COURSE OUTCOME
CO1	To perform studies related to watershed management.
CO2	prepare pre-feasibility and detailed project reports, etc.
CO3	Appreciate the concept of integrated water resources management.
CO4	To understand the concepts of renewable energy, biomass, etc.
CO5	To equip with the rural technological delivery systems and low cost technology that can be used in the farm.
CO6	Romote Sustainable Practices: Gain the knowledge and tools to promote sustainable practices within civil engineering projects,

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO2	PSO3
CO1	L3	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO2	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO3	L1	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO4	L2	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L3	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Environmental Management System: A step by Step Guide to implementation and Maintenance by Christopher Sheldon and Mark yoxon.
2. ISO 14001 environment System Handbook by Ken Whitelaw.
3. Environment Management Systems: A tool to Help Water Utilities Manage More Effectively by U.S. Environmental protection Agency.

ADVANCE ENGINEERING SYSTEMS

Course code: CEO516

Course Objective:

Formulate equations of motion:

- Gain the ability to express the mathematical relationships between forces, masses, and accelerations for basic mechanical, electrical, and electro-mechanical systems.
- Analyze system dynamics: Develop the skills to analyze the dynamic behavior of simple systems using the derived equations of motion.
- Identify analogies: Learn to recognize and apply analogies between different physical systems (mechanical, electrical, etc.) to simplify analysis.
- Understand multi-dimensional motion: Be introduced to formulating equations of motion for mechanical systems in both two and three dimensions.

Detailed Syllabus:

MODULE-I

Equations of motion for simple physical system. mechanical, electrical and electro-mechanical systems

MODULE-II

Equations of motion for simple heat, conduction and fluid system, Analogies. Equations of motion for mechanical system in two and three dimension. Dynamic response of first order and Second order systems.

MODULE-III

Forced oscillations of elementary systems, Dynamic stability of compound system. Total response of compound system, Fundamentals of compound system analysis.

CO	COURSE OUTCOME
CO1	Design RCC footings(Isolated footings and various types of combined footings) and Design of masonry foundations
CO2	To understand behavior of compression members. CO6: To understand behavior of two-way slabs using moment coefficients.
CO3	Design cantilever and counter fort type RCC retaining walls. Design masonry retaining walls.
CO4	Design underground, circular and rectangular water tanks with reference to IS: 3370. Design of domes and ring beams.
CO5	Design Rectangular, T and I section beams of pre stressed concrete.
CO6	To understand behavior of two-way slabs using moment coefficients.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PS O1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. ISO 14001 Environment Systems Handbook by Ken Whitelaw.
2. The ISO 14001 Implementation Guide: Creating an integrated Management System by Suzan L. Jackson and Robert W. Jackson.
3. Environment Management Systems: An Implementation guide for small and Medium Sized Organisation by John S. Quarterman.

Steel design lab(CE501P)

List of Experiments

1. Design and Drawing the different types of riveted joints and Bolted joints.
2. Design and Drawing the different types of welded joints.
3. Design and drawing the tension members.
4. Design and drawing the compression members.
5. Design and Drawing the Eccentric connection of Bolted joints.
6. Design and Drawing the Eccentric connection of Welded Joints.
7. Design and Drawing the Plate Girder.
8. Design and Drawing the Grillage footing.
9. Design and Drawing the slab base and Gusset Base.
10. Design and Drawing the Beams.

Geotechnical Engineering I

LIST OF EXPERIMENTS:

1. Determination of Water content of a soil sample.
2. Determination of Specific gravity of soil solids
3. To determine the in-situ density of soil using "Sand Replacement Method"
4. To determine the in-situ density of soil using "Core-Cutter Technique"
5. To obtain the gradation curve of coarse-grained soil using Sieve analysis (dry and wet)
6. To obtain the gradation curve of fine-grained soils using hydrometer analysis.
7. Determination of co-efficient of permeability of a soil sample using constant and falling head test apparatus.
8. Determination of Plastic and Liquid limit of a soil sample.
9. Determination of Shrinkage limit of a soil sample
10. Determination of maximum dry density and optimum moisture content of a soil sample using IS light compaction test
11. To obtain the shear strength parameters of a soil sample using Direct Shear Test apparatus

Environmental Engineering Laboratory(CE503P)

Name of the Experiment:

1. To determine the alkalinity of a given water sample
2. To determine the acidity of a given water sample
3. To determine the pH value of the given samples of Water
4. To determine the hardness of the given water samples
5. To determine the chloride content of a given water sample
6. To determine the residual chlorine of given water sample
7. To determine the total solids of a given sample of water
8. To determine the turbidity of the given water sample
9. To determine the color of the given water sample
10. To determine the odor of the given water sample

Field survey

List of Experiments:

1. Study of theodolite in detail-practice for measurement of horizontal and vertical angles.
2. Triangulation survey of a given area by theodolite
3. Trigonometric Levelling-elevation and distance measurements when Base accessible.
4. Trigonometric Levelling- elevation and distance measurements when Base in accessible.
5. Heights and distance using principles of tachometric surveying
6. Setting out a transition curve.
7. Draw contour map of a given area.
8. Determination of area using Total station.
9. Measurement of horizontal and vertical angle using Total station.
10. Determination of remote height using Total station.

RADHA GOVIND UNIVERSITY
RAMGARH, JHARKHAND

DEPARTMENT OF CIVIL ENGINEERING
B. TECH (6th) SEMESTER SYLLABUS
CHOICE BASED CREDIT SYSTEM (CBCS)

Sl. no.	Course no.	Subject	L	T	P	Credit
1	CEC601	PC-I-Concrete Structure-II	3	1	0	4
2	CEC602	PC-II-Structural Analysis-II	2	1	0	3
3	CEC603	PC-III-Highway Engineering	2	1	0	3
4	CEP(604-609)	PE-I-	2	1	0	3
5	CEO(610-615	OE-I-	2	1	0	3
Laboratory/ Sessional						
1	CE601P	Sessional- Concrete Design Lab	0	0	2	1
2	CE602P	Sessional-Structural Engineering Lab	0	0	2	1
3	CE603P	Sessional-Transportation Engineering Lab	0	0	2	1
4	CE604P	C.S.Q.A.	0	0	2	1
5	CE605I	Tour &Training/Internship	0	0	2	2
TOTALCREDIT						**22**

Civil Engineering

– 6th semester-Course Structure

PROFESSIONAL ELECTIVE–I

[CEP604] Water Resources Engineering-II

[CEP605] Pavement Design

[CEP606] Bridge engineering

[CEP607] Structural Dynamics

[CEP608] System Engineering &Economics

[CEP609] Masonry Structure

OPEN ELECTIVE–I

[CEO610] Industrial Waste Treatment

[CEO611] Composite Material

[CEO612] Environmental Laws and Policy

[CEO613] Operational Research Technique

[CEO614] Value and Ethics in engineering

[CEO615] Decision and Risk Analysis

CONCRETE STRUCTURE-II

Course code: CEC601

COURSE OBJECTIVES:

- Understand concrete properties and their influence on structural design.
- Learn design principles and analysis techniques for concrete structures.
- Explore reinforcement concepts and detailing for structural integrity.
- Master modern construction techniques for concrete elements.
- Develop skills in quality control and adherence to standards.
- Investigate sustainability and innovation in concrete construction.

Pre-requisites:

Detailed Syllabus:

MODULE-I

Design of Residential Buildings: fundamentals of multi–storey buildings, analysis of various loads: gravity, wind, earthquake loads, method of substitute frames, design examples, bending Moments in columns, analysis of multistory frames subjected to horizontal loads.**(12Hr)**

MODULE-II

Design of RCC water tanks: Un-cracked Structures and determination of basic parameters, Revision of working stress design philosophies. Introduction to water tanks and their classifications, Important IS Codes And Its provisions, Analysis and design of Circular water tanks with flexible base and restrained base. Analysis and design of Rectangular water tanks, Analysis of Overhead tanks, Intel tank-basic geometrical Configurations; analysis methods; design of top domes, cylindrical walls, Ring beam.**(12Hr)**

MODULE-III

Design of Silos and Bunkers: Introduction, difference between bunker and silo, design of square or rectangular bunkers, design of circular bunkers, design examples, silos for storage of cement, design examples.**(10Hr)**

MODULE-IV

Design of Simple Bridges: Bridges– basic definition, importance, classification, Site investigations for design of a bridge, Various loads and their combinations, Relevant IRC codes and its provisions, Introduction to RC bridge- design of Culvert and T-beam bridge.**(12Hr)**

CO	COURSE OUTCOME
CO1	Design RCC footings(Isolated footings and various types of combined footings) and Design of masonry foundations
CO2	To understand behavior of compression members. CO6: To understand behavior of two-way slabs using moment coefficients.
CO3	Design cantilever and counter fort type RCC retaining walls. Design masonry retaining walls.
CO4	Design underground, circular and rectangular water tanks with reference to IS: 3370.Design of domes and ring beams.
CO5	Design Rectangular, T and I section beams of pre stressed concrete.
CO6	To understand behavior of two-way slabs using moment coefficients.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO2	PSO3
CO1	L3	3	2	3	3	3	-	-	1	-	-	-	2	3	3	1
CO2	L2	3	3	3	1	3	-	-	1	-	-	-	2	3	1	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	2
CO4	L1	3	1	3	2	3	-	-	1	-	-	-	2	3	3	3
CO5	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	2	3	3	-	-	1	-	-	-	2	3	1	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Reinforced Concrete: Mechanics and Design by James K. Wight and James G. MacGregor.
2. Limit State Design of Reinforcement Concrete by P.C.Varghese.
3. Advanced Concrete Technology by John Newman and Ben Seng Choo

STRUCTURAL ANALYSIS – II

Course code: CEC602

Detailed Syllabus:

COURSE OBJECTIVES:

- Deepen understanding of advanced structural analysis methods.
- Apply matrix structural analysis techniques to complex structures.
- Explore numerical methods for analyzing indeterminate structures.
- Learn about dynamic analysis and its applications in structural engineering.
- Investigate the behavior of structures under different loading conditions.
- Enhance skills in interpreting and utilizing analysis results for practical design solutions.

MODULE-I

Analysis of fixed beams, continuous beam, simple frames ,and redundant frames with and without translation of points. Method Of consistent deformation, Strain energy method, Slope deflection method, Moment distribution method.**(12Hr)**

MODULE-II

Analysis of two hinged arches. Suspension bridges with two hinged stiffening girder. **(10Hr)**

MODULE-III

Structural theorems: Linearity principle of superposition,
Virtual work, energy theorems, reciprocal theorems, Muller's Breslau's principles. **(6Hr)**

MODULE-IV

Basics of force and displacement matrix methods for beams, plane frame (rigid and pin-pointed) **(10Hr)**

MODULE-V

Influence lines: Influence lines for propped cantilevers, continuous beams and two hinged arches**(10Hr)**

CO	COURSE OUTCOME
CO1	To impart understanding of various aspects related to matrix element methods of structural analysis.
CO2	Apply the principles, procedures and code requirements to the analysis and design of tension members, compression members, bases, beams, and connections
CO3	To produce a structure capable of resisting all applied loads without failure during its intended life.
CO4	To identify potential problems and make necessary changes to the design to ensure that the structure will perform as intended.
CO5	Introduction to Finite Element Analysis of Structural Analysis
CO6	To impart understanding of plane stress and plain strain problems

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO2	PSO3
CO1	L2	2	3	1	-	-	1	-	1	1	-	-	-	-	3	1
CO2	L5	2	3	1	1	-	1	-	1	1	-	-	-	-	3	1
CO3	L4	1	3	1	2	-	1	-	1	1	-	-	-	-	3	1
CO4	L4	1	3	3	2	-	1	-	1	1	-	-	-	-	3	1
CO5	L5	2	3	3	1	-	1	-	1	1	-	-	-	-	3	1
CO6	L3	1	3	3	1	-	1	-	1	1	-	-	-	-	3	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Structural Analysis by Russell C.Hibbeler.
2. Structural Analysis by Aslam Kassimali
3. Advance Structural Analysis by Ashok K.Jain
4. Matrix Methods of Structural Analysis by Pandit and Gupta.

HIGHWAY ENGINEERING

Course code: CEC603

COURSE OBJECTIVES:

- Understand the principles of highway planning and design.
- Learn about geometric design considerations for safe and efficient highways.
- Explore pavement materials and design methods for durability and performance.
- Study traffic engineering concepts including flow analysis and capacity estimation.
- Develop skills in highway drainage and environmental considerations.
- Gain insights into highway construction, maintenance, and safety management practices.

Pre requisites: None
Detailed Syllabus:

MODULE-I
Highway development and planning- Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation. **(6Hr)**

MODULE-II
Geometric design of highways: Introduction; highway cross section elements; sight distance, design of horizontal and vertical alignment; Grade compensation. **(12Hr)**

MODULE-III
Traffic engineering& control-Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation. And control; Design of signals, design of road intersections; design of parking facilities; highway lighting; problems.**(10Hr)**

MODULE-IV
Design of pavements-Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design And performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems. **(12Hr)**

MODULE-V
Pavement materials- Materials used in Highway Construction -Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems.**(8Hr)**

CO	COURSE OUTCOME
CO1	Mastery in planning, designing, and managing highway infrastructure projects.
CO2	Competence in analyzing traffic flow and geometric design principles for highways.
CO3	Proficiency in applying highway engineering standards and regulations.
CO4	Skill in evaluating environmental and socioeconomic impacts of highway projects.
CO5	Ability to design and implement effective highway safety measures and traffic control systems.
CO6	Capacity to integrate sustainable practices and innovative technologies into highway engineering solutions.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO2	PSO3
CO1	L2	2	3	1	-	-	1	-	1	2	-	-	-	-	3	1
CO2	L3	2	3	1	1	-	1	-	1	1	-	-	-	-	3	1
CO3	L2	1	3	1	2	-	1	-	1	1	-	-	-	-	3	1
CO4	L3	1	3	3	2	-	1	-	1	1	-	-	-	-	3	1
CO5	L1	2	3	3	1	-	1	-	3	1	-	-	-	-	3	1
CO6	L3	4	5	3	1	-	1	-	2	1	-	-	-	-	2	3

3-High, 2- Moderate, 1- Low, '-' for

Reference book

1. "Principles of Pavement Engineering" by Rajib B. Mallick and Tahar El-Korchi
2. "Pavement Analysis and Design" by Yang H. Huang
3. "Bituminous Materials: Asphalt Mixtures and Pavements" by Irving Kett

WATER RESOURCE ENGINEERING-II

Course code: CEP604

COURSE OBJECTIVES:

- Comprehend advanced principles of water resources management.
- Apply hydraulic engineering techniques to analyze water flow in natural and engineered systems.
- Explore flood hydrology and hydraulic modeling for flood risk assessment.
- Investigate groundwater flow and its interaction with surface water systems.
- Understand principles of water quality management and pollution control in water resources.
- Develop skills in the design and operation of hydraulic structures for water control and management.

Pre requisites: Water Resources Engineering-I
Detailed Syllabus:

MODULE-I

Irrigation Principles and planning Definition of Irrigation, development of irrigation in India. Benefits and ill effects of Irrigation. Types of method of irrigation system. Quality of irrigation, water, water requirements and Irrigation scheduling, duty and data & base periods and the relationship, improvements of duty. **(8Hr)**

MODULE-II

Canal design and layouts, types of canal, Canal alignment–Canal design–Kennedy's Silt theory method, Lacey regime theory. Ranga Raju and Misri Method. Basak Method, tractive hear approach, layout of canals. Conveyance losses. **(8Hr)**

MODULE-III

Diversion head Works, Layout of diversion head works,
Components of head works, Bligh's and lane's theories, Khosla's theory, Design of weir & Barrage. **(8Hr)**

MODULE-IV

Canal Regulation Works: Different types of regulation works, Types and Design of falls. Types and design of regulators, Cross regulator, head regulator, canal escapes, canal modulus etc. **(8Hr)**

MODULE-V

Cross– Drainage Works Types of cross- drainage works and design of aqueducts. River Training Works Meandering of rivers, cutoff, spurs, guide banks, marginal embankment. Channel Improvements. **(8Hr)**

CO	COURSE OUTCOME
CO1	To perform multiple analysis on precipitation data.
CO2	To estimate various components of hydrological cycle such as stream flow, runoff, evapo-transpiration and infiltration.
CO3	To measure components of hydrological water balance in field. CO4:
CO4	To determine reservoir capacity and sedimentation and To perform steady state analysis of groundwater movement.
CO5	To perform hydrograph analysis and estimate magnitude of flood.
CO6	To determine the technical, social and economic aspects of water resources planning and management.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L2	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L3	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L2	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Water Resources Engineering" by Larry W. Mays:
2. "Hydraulic Structures" by P. Novak, A.I.B. Moffat, C. Nalluri, and R. Narayanan
3. "Groundwater Hydrology" by David Keith Todd and Larry W. Mays:

PAVEMENT DESIGN

COURSE OBJECTIVES:

Course code: CEP605

- Understand the principles of pavement design and their applications.
- Learn about pavement materials and their properties relevant to design considerations.
- Explore different pavement design methods and their suitability for various traffic and environmental conditions.
- Gain proficiency in analyzing traffic loads and their impact on pavement performance.
- Develop skills in pavement design software and tools for accurate analysis and modeling.
- Apply knowledge of pavement design standards and guidelines to develop sustainable and cost-effective pavement solutions.

Detailed Syllabus:

MODULE-I

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. **(6Hr)**

MODULE-II

Stresses and Deflection sin Flexible Pavements: Stresses and deflection sin homogeneous masses. Burmister's two layer theory, three layer and ,multilayer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behavior under transient traffic loads. **(10Hr)**

MODULE-III

Flexible Pavement Design Methods For Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC; Stresses in Rigid Pavements: Types of stresses and causes, factors in Fluencing the stresses; general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses. **(10Hr)**

MODULE-IV

Rigid Pavement Design: Types of joint sin cement concrete pavements and their functions, joint spacings; design of CC pavement for roads and run ways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints. IRC method of design by stress ratio method. **(10Hr)**

MODULE-IV

Design of continuously reinforced, concrete pavements; Maintenance, repair and rehabilitation of pavements including design, of bituminous and concrete over lays as per IRC. **(8Hr)**

CO	COURSE OUTCOME
CO1	Proficiency in designing pavements for different traffic loads and environmental conditions.
CO2	Mastery in selecting appropriate materials and thicknesses for pavement layers.
CO3	Competence in analyzing pavement performance and durability.
CO4	Skill in applying design methodologies and standards for various pavement types.
CO5	Ability to assess the economic and environmental sustainability of pavement designs.
CO6	Capacity to innovate and optimize pavement designs to meet specific project requirements.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	2	3	3	2	-	-	1	-	-	-	2	3	3	3
CO2	L1	3	3	3	2	3	-	-	1	-	-	-	2	3	1	3
CO3	L3	3	1	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L2	3	3	3	3	3	-	-	1	-	-	-	2	3	3	2
CO5	L3	2	3	3	1	3	-	-	2	-	-	-	2	3	2	3
CO6	L2	3	3	1	3	2	-	-	1	-	-	-	3	3	2	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Principles of Pavement Design" by E.J. Yoder and M.W. Witczak
2. "Pavement Analysis and Design" by Yang H. Huang
3. "Pavement Engineering: Principles and Practice" by Rajib B. Mallick and Tahar El-Korchi

BRIDGE ENGINEERING

Course code: CEP606

COURSE OBJECTIVES:

- Gain an understanding of the fundamental principles of bridge engineering.
- Learn about various types of bridges and their structural characteristics.
- Explore analysis and design methodologies for bridge structures.
- Understand the behavior of bridge components under different loading conditions.
- Develop skills in the application of codes and standards for bridge design and construction.
- Gain insight into the construction, maintenance, and rehabilitation of bridges to ensure their longevity and safety.

Detailed Syllabus:

MODULE-I
General; classification of bridges, site selection, geometric and hydraulic design consideration. **(6Hr)**

MODULE-II
Loading standard for highway and railway bridge, general design consideration; optimum spans; Concrete bridge; culverts; slab, T- beam , Box girder bridges, balanced cantilever bridge, cable stayed bridge, extrados bridge; arch bridge; **(12 Hr)**

MODULE-III
Special requirements for Prestressed Concrete bridges; Steel bridges: plate girder bridge, truss bridge, suspension cable.**(12Hr)**

MODULE-IV
bridge, cable stayed bridge; Substructures: design of pier sand abutments, pile and well foundations, bearings and expansion joints, special wearing coats.**(12Hr)**

MODULE-V
Seismic design considerations; Aero dynamic stability considerations; special durability measures; provisions for inspection and maintenance**(10Hr)**

CO	COURSE OUTCOMES
CO1	Mastery in designing and analyzing bridge structures for various spans and loads.
CO2	Competence in assessing the structural integrity and safety of bridges.
CO3	Proficiency in applying bridge engineering codes and standards.
CO4	Skill in selecting appropriate materials and construction techniques for bridge projects.
CO5	Ability to evaluate environmental and societal impacts of bridge construction and maintenance.
CO6	Capacity to innovate and optimize bridge designs for efficiency and longevity.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Bridge Engineering Handbook" edited by Wai-Fah Chen and Lian Duan
2. "Bridge Engineering: Design, Rehabilitation, and Maintenance of Modern Highway Bridges" by Demetrios E. Tonias and Jim J. Zhao
3. "Bridge Engineering" by Jim J. Zhao, Demetrios E. Tonias, and Yunsheng Tian

STRUCTURAL DYNAMICS

Course code: CEP607

COURSE OBJECTIVES:

1. Grasp fundamental principles of structural dynamics.
2. Develop analytical skills for dynamic response analysis.
3. Learn modeling techniques for structural systems.
4. Predict dynamic response characteristics accurately.
5. Explore design considerations for dynamic loading.
6. Apply theory to real-world engineering challenges.

Detailed Syllabus:

MODULE-I

THEORYOFVIBRATIONS

Difference between static loading and dynamic loading – Degree of freedom– idealization of structure as single degree of freedom–Formulation of Equations of motion of SDOF system-D'Alemberts principles–effect of damping–free and forced Vibration of damped and undammed structures–Response to harmonic and periodic forces**. (9Hr)**

MODULE-II

Two degree of freedom system–modes of vibrations–formulation of equations of motion of multi degree of freedom(MDOF) system–Eigen values and Eigenvectors–Response to free and forced vibrations – damped and undammed MDOF system–Modal super position methods.**(9Hr)**

MODULE-III

Elements of Engineering Seismology – Causes of Earthquake –Plate Tectonic theory – Elastic rebound Theory – Characteristicofearthquake–Estimationofearthquakeparameters–Magnitudeandintensityofearthquakes–Spectral Acceleration.**(9Hr)**

MODULE-IV

Effect of earth quake on different type of structures– Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earth quake loading– Pinching effect– Bouchinger Effects– Evaluation of earth quake forces as per IS:1893–2002–Response Spectra–Lessons learnt from past earthquakes.**(9Hr)**

MODULE-V

Causes of damage –Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earth quake resistant design–Earth quake resistant design for masonry and Reinforced Cement Concrete buildings – Lateral load analysis–Design and detailing as per IS:13920–1993.**(9Hr)**

CO	COURSE OUTCOME
CO1	Proficiency in analyzing dynamic behavior of structures under various loading conditions.
CO2	Ability to predict and interpret natural frequencies, mode shapes, and damping ratios.
CO3	Competence in assessing structural response to dynamic loads and vibrations.
CO4	Understanding of the implications of dynamic loading on structural design and safety.
CO5	Skill in applying dynamic analysis techniques to real-world engineering problems.
CO6	Capacity to design structures to withstand dynamic forces and minimize dynamic response.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO2	L2	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO3	L3	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO4	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1
CO5	L3	1	1	2	2	3	3	2	2	2	1	1	-	2	-	2
CO6	L5	2	3	3	1	3	1	3	3	2	3	2	-	3	2	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Dynamics of Structures" by Anil K. Chopra:
2. "Structural Dynamics: Theory and Computation" by Mario Paz and William Leigh:
3. "Introduction to Structural Dynamics" by Bruce K. Donaldson:
4. "Dynamic Analysis of Skeletal Structures" by R.W. Clough and Joseph Penzien:

SYSTEM ENGINEERING AND ECONOMICS

Course code: CEP608

COURSE OBJECTIVES:

1. Understand the principles and concepts of system engineering.
2. Learn economic theories and models relevant to engineering decision-making.
3. Explore methods for optimizing system performance while considering economic constraints.
4. Develop skills in cost-benefit analysis and financial evaluation of engineering projects.
5. Identify factors influencing the economic viability and sustainability of engineering systems.
6. Apply system engineering and economic principles to design and manage efficient and cost-effective engineering solutions.

Pre-requisites: None
Detailed Syllabus:

MODULE-I
Introduction to the formulation and solution of
Civil engineering problems. Engineering economy, mathematical modeling, and optimization.**(12Hr)**

MODULE-II
Techniques, including classical optimization, linear and non line a programming, network theory, critical path
methods, simulation, decision theory.**(14Hr)**

MODULE-III
Dynamic programming applied to a variety of civil**(12Hr)**
Engineering problems.

CO	COURSE OUTCOME
CO1	Develop the ability to explain economic terms and concepts
CO2	Understand and explain the function of market, its types and determination of price under various competencies.
CO3	Demonstrate the ability to employ the economic way of thinking like application of marginal analysis, use of benefit/cost analysis, utility and demand forecasting techniques.
CO4	Demonstrate the ability to recognize when change is needed, adapt to change as it occurs, and lead the change as effective managers.
CO5	Practice the process of management's four functions: planning, organizing, directing and controlling. make an appropriate staffing decision which includes recruitment and selection design, implement and evaluate training programmes
CO6	Understand an organization’s characteristics and how they might impact on management practices and analyze both qualitative and quantitative information to isolate issues and formulate best control methods.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L3	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L2	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L3	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Dynamics of Structures" by Anil K. Chopra
2. "Structural Dynamics: Theory and Computation" by Mario Paz and William Leigh:
3. "Introduction to Structural Dynamics" by Bruce K. Donaldson:
4. "Dynamic Analysis of Skeletal Structures" by R.W. Clough and Joseph Penzien:

MASONRY STRUCTURES

Course code: CEP609

COURSE OBJECTIVES:

1. Grasp the fundamentals of masonry materials and construction techniques.
2. Understand the structural behavior and load distribution in masonry structures.
3. Identify various types of masonry elements and their applications.
4. Learn about the design principles and codes governing masonry construction.
5. Explore methods for assessing the stability and safety of masonry buildings.
6. Apply knowledge to analyze, design, and maintain resilient masonry structures.

Prerequisites: None

Detailed Syllabus:

MODULE-I
Introduction to analysis, design and construction of Masonry structures.**(8Hr)**

MODULE-II
Mechanical properties of clay and concrete masonry units, mortar, and grout.**(8Hr)**

MODULE-III
Compressive, tensile, flexural, and shear behaviour of Masonry structural components.**(8Hr)**

MODULE-IV
Strength and behaviour of unreinforced bearing walls.Detailed design n of reinforced masonry beams, columns, structural walls with and without openings.**(8Hr)**

MODULE-V
Complete lateral-force resisting building systems.**(8Hr)**

CO	COURSE OBJECTIVES
CO1	Understand the properties and behavior of masonry materials.
CO2	Learn principles of masonry construction and structural design.
CO3	Identify different types of masonry structures and their applications.
CO4	Analyze stability and load-carrying capacity of masonry elements.
CO5	Explore seismic considerations and retrofitting techniques for masonry structures.
CO6	Apply knowledge to assess, design, and maintain safe and efficient masonry buildings.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Masonry Structures: Behavior and Design" by Robert G. Drysdale, Ahmad A. Hamid, and Lawrie R. Baker:

2. "Reinforced Masonry Engineering Handbook: Clay and Concrete Masonry" by James E. Amrhein and John M. Hochwalt:

3. Design of Reinforced Masonary Structure by Narendra Taly

INDUSTRIALWASTE TREATMENT

Course code: CEO610

COURSE OBJECTIVES:

1. Understand the sources, types, and characteristics of industrial waste.
2. Learn various treatment methods and technologies for industrial waste management.
3. Explore the environmental and regulatory aspects related to industrial waste treatment.
4. Develop skills in selecting appropriate treatment strategies based on waste composition and regulations.
5. Gain knowledge of waste minimization techniques and resource recovery options.
6. Apply theoretical understanding to design effective industrial waste

Detailed Syllabus:

MODULE-I

INTRODUCTION

Types of industries and industrial, pollution– Characteristics of industrial wastes– Population equivalent– Bioassay studies–effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control of industrial effluents and hazardous wastes. **(8Hr)**

MODULE-II

CLEANER PRODUCTION

Waste management Approach– Waste Audit– Volume and strength reduction–Material and process modifications–

Recycle, reuse and byproduct recovery– Applications. **(8Hr)**

MODULE-III

POLLUTIONFROMMAJORINDUSTRIES

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles,Tanneries,Pharmaceuticals,Electroplatingindustries,Dairy,Sugar,Paper,distilleries,Steelplants, Refineries,fertilizer,thermalpowerplants–Wastewaterreclamationconcepts. **(9Hr)**

MODULE-IV

TREATMENT TECHNOLOGIES equalization–Neutralization–Removal of suspended and dissolved organic solids–Chemical oxidation–Adsorption–Removal of dissolved inorganic–Combined treatment of industrial and municipal wastes–Residue management–Dewatering–Disposal. **(11Hr)**

CO	COURSE OUTCOME
CO1	Understand the sources and characteristics of industrial waste.
CO2	Learn various treatment methods for different types of industrial waste.
CO3	Explore regulations and environmental standards related to industrial waste management.
CO4	Develop skills in assessing and selecting appropriate treatment technologies.
CO5	Understand the importance of waste minimization and resource recovery.
CO6	Apply knowledge to design effective industrial waste treatment systems.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO2	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO3	L2	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO4	L3	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L2	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. "Handbook of Industrial and Hazardous Wastes Treatment" by Lawrence K. Wang, Yung-Tse Hung, and Howard H. Lo:

2. "Industrial Waste Treatment: Contemporary Practice and Vision for the Future" by Nelson L. Nemerow and Franklin J. Agardy

3. "Industrial Waste Treatment: Theory and Practice" by Patwardhan, A.V. and Aniruddha B. Pandit:

COMPOSITE MATERIALS

Course code: CEO611

COURSE OBJECTIVES:

1. Understand the composition and properties of composite materials.
2. Learn manufacturing processes for composite fabrication.
3. Identify applications and advantages of composite materials in various industries.
4. Analyze mechanical behavior and performance of composite structures.
5. Explore design principles for composite components and systems.
6. Apply knowledge to optimize material selection and design composite structures for specific purposes.

Detailed Syllabus:

MODULE-I

Introduction:

Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Function of a Matrix , desired Properties of a Matrix , polymer Matrix (Thermosets and Thermoplastics) Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc. Types of reinforcements/ Fibers role and Selection or reinforment in for cement material, Types of fibers, Glass fibers, Glass fibers, Carbon fibers, Aramid fibers, Metal fibers, alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multi phSE FIBERS, Whiskers, Flakes etc. Mechanical properties of fiber.**(14 Hr)**

MODULE-II

Various types of composites: Classification based on Matrix Material :Organic Matrix composites, Polymer matrix composites(PMC), Carbon matrix Composites or Carbon -Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber reinforced Composites, Fiber Reinforced Polymer(FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites. **(10Hr)**

MODULE-III

Fabrication methods: Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin –transplant method, pultrusion, pre-peglayer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films. **(8Hr)**

MODULE-IV

Mechanical testing of composites, tensile testing, Compressive
testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc. **(8Hr)**

CO	COURSE OUTCOME
CO1	Demonstrate understanding of composite material composition and properties.
CO2	Exhibit proficiency in composite fabrication techniques.
CO3	Apply knowledge to identify and evaluate suitable applications for composite materials.
CO4	Analyze and predict mechanical behavior and performance of composite structures.
CO5	Utilize design principles to create efficient and reliable composite components.
CO6	Implement composite materials effectively in engineering projects to achieve desired outcomes.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO2	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO3	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO4	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Composite Material Fabrication Handbook by John Wanberg.
2. Composite Materials: Engineering and Science by Fazil Erdogan and Stephen W. Tsai:
3. Introduction to Composite Materials Design by Ever J. Barbero

ENVIRONMENTAL LAWS AND POLICY

Course code: CEO612

COURSE OBJECTIVES:

1. Understand the foundational principles of environmental law and policy.
2. Learn about the regulatory frameworks governing environmental protection at local, national, and international levels.
3. Identify key environmental issues and challenges addressed by legislation and policy.
4. Analyze the roles and responsibilities of governmental and non-governmental entities in environmental governance.
5. Explore mechanisms for enforcement, compliance, and dispute resolution in environmental law.
6. Apply knowledge to critically assess and advocate for effective environmental policies and practices.

Prerequisites:

Detailed Syllabus:

MODULE-I

Overview of environment, nature and ecosystem, Concept Of laws and policies, Origin of environmental law,**(14Hr)**

MODULE-II

Introduction to environmental laws and policies, Environment and Governance, sustainable development and environment, understanding climate change, carbon crediting, carbon foot print etc. **(12Hr)**

MODULE-III

Introduction to trade and environment. International environmental laws, Right to Environment as Human Right International Humanitarian Law and Environment, environment and conflicts management, Famous International protocols like Kyoto.**(14Hr)**

CO	COURSE OUTCOME
CO1	Comprehensive understanding of environmental laws and policies at local, national, and international levels.
CO2	Ability to analyze and interpret complex regulatory frameworks governing environmental protection.
CO3	Proficiency in identifying key environmental issues and assessing their legal implications.
CO4	Skill in evaluating the effectiveness of environmental laws and policies in addressing environmental challenges.
CO5	Capacity to navigate regulatory compliance requirements and enforcement mechanisms.
CO6	Aptitude for advocating for environmentally sustainable practices and policies in various contexts.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO2	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO3	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO4	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Environmental Law Handbook by Christopher Bell and Richard Macrory.
2. Environment Law: A Conceptual and Progmatic Approch by David M. Driesen.
3. Environment Policy: New Directions for the Twenty- First Century by Norman J,Vig and Michael E. Kraft.

OPERATIONAL RESEARCH TECHNIQUE

Course code: CEO613

COURSE OBJECTIVES:

1. Gain an understanding of fundamental operational research (OR) concepts and techniques.
2. Learn various mathematical modeling approaches used in OR, including linear programming, integer programming, and network optimization.
3. Develop skills in problem formulation and solution techniques for optimization problems.
4. Explore applications of OR in areas such as logistics, supply chain management, and resource allocation.
5. Analyze real-world case studies to understand the practical implications and limitations of OR techniques.
6. Apply OR methods to solve complex decision-making problems and improve operational efficiency in various domains.

Pre-requisites: None

Detailed Syllabus:

MODULE-I

Introduction: History of operation research, nature and scope of operations research, allocation.**(10Hr)**

MODULE-II

Linear programming: Mathematical formulations of the problem, Graphical solution methods, mathematical solution of L-P problems, matrix formulation of general linear programming.**(10Hr)**

MODULE-III

Simplex Method: Algorithm and computational procedures, Two phase Simplex method, Problems of degeneracy, Principles of duality in simplex method, Sensitivity analysis, Transportation.**(10Hr)**
problem.

MODULE-IV

Game Theory: Introduction, Two persons zero sum games, themax mini and minimax principles. Integer Programming: Formulation and solution of integer programming g problems**(10Hr)**

CO	COURSE OUTCOMES
CO1	Proficiency in applying operational research concepts and techniques.
CO2	Ability to formulate and solve optimization problems using mathematical models.
CO3	Competence in analyzing and interpreting results of operational research analyses.
CO4	Aptitude for identifying and addressing complex decision-making challenges.
CO5	Capacity to utilize operational research methods to enhance organizational efficiency and effectiveness.
CO6	Skill in applying operational research techniques to diverse practical scenarios for informed decision-making.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L5	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO2	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO3	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO4	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Suggested Reading:

1. Taha,HA,"OperationsResearch-AnIntroduction",SixthEdition,PrenticeHallofIndiaPrivateLimited,N.Delhi,2004.
2. Hillier,FS,"OperationsResearch",FirstIndianEdition,CBSPublishers&Distributors,Delhi,1994.

VALUES AND ETHICS IN ENGINEERING

Course code: CEO614

COURSE OBJECTIVES:

1. Understand the ethical responsibilities of engineers in professional practice.
2. Learn about key ethical theories and principles relevant to engineering ethics.
3. Explore ethical dilemmas and case studies specific to the engineering profession.
4. Develop critical thinking skills to evaluate ethical issues and make ethically informed decisions.
5. Identify strategies for promoting integrity, honesty, and accountability in engineering practice.
6. Apply ethical frameworks to navigate complex situations and uphold

Pre requisites: None
Detailed Syllabus:

MODULE-I
Development of modern statistical decision theory and Courage–Valuing, time– Cooperation – Commitment–Empathy–Selfconfidence–Character–Spirituality–Introduction to Yoga and meditation for professional, Excellence and stress management. **(10Hr)**

MODULE-II
Engineering Ethics: Senses of 'Engineering Ethics'–Variety of moral issues–Types of inquiry–Moral dilemmas–Moral Autonomy–Kohlberg's theory–Gilligan's theory– Consensus and Controversy– Models of professional roles–Theories about right action–Self-interest– Customs and Religion–Uses of Ethical Theories**(10Hr)**

MODULE-III
ENGINEERING ASSOCIAL EXPERIMENTATION Engineering as Experimentation–Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. **(10Hr)**

ODULE-IV
SAFETY, RESPONSIBILITIES AND RIGHTS
Safety and Risk– Assessment of Safety and Risk– Risk Benefit Analysis and Reducing Risk– Respect for Authority– Collective Bargaining– Confidentiality– Conflicts of Interest – Occupational Crime– Professional Rights–Employee Rights–Intellectual Property Rights(IPR)– Discrimination.**(10Hr)**

MODULE-V
GLOBAL ISSUES Multinational Corporations–Environmental Ethics– Computer Ethics– Weapons Development– Engineers as Managers– Consulting Engineers–Engineers as Expert Witnesses and Advisors–Moral Leadership–Code of Conduct–Corporate Social
Responsibility **(8Hr)**

CO	COURSE OBJECTIVES
CO1	Demonstrate awareness of ethical responsibilities in engineering practice.
CO2	Apply ethical principles to evaluate and address ethical dilemmas.
CO3	Develop the ability to recognize and analyze ethical issues in engineering contexts.
CO4	Cultivate ethical decision-making skills for professional conduct.
CO5	Advocate for integrity and ethical behavior in engineering endeavors.
CO6	Incorporate ethical considerations into engineering projects to promote social responsibility and public welfare.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO2	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO3	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO4	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO5	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Book

1. Ethics for the information Age by Michael J. Quinn.
2. Engineering Ethics: Concepts and Cases by Charles E. Harris Jr. , Michael S. Pritchard and Michael J. Rabins.
3. Ethics in Engineering Practice and Research by Caroline Whitebeck

DECISION AND RISK ANALYSIS

Course code: CEO615

COURSE OBJECTIVES:

1. Understand the principles of decision theory and risk analysis.
2. Learn various decision-making models and techniques for risk assessment.
3. Develop skills in probabilistic analysis and sensitivity analysis.
4. Identify sources of uncertainty and quantify risk in decision-making processes.
5. Explore methods for evaluating and comparing alternative courses of action.
6. Apply decision and risk analysis tools to real-world scenarios to make informed and optimal decisions under uncertainty.

Prerequisites: None
Detailed Syllabus:

MODULE-I
Development of modern statistical decision theory and risk analysis, and application of the se concepts in civil engineering design and decision making;**(10Hr)**

MODULE-II
Bayesian statistical decision theory, decision tree, utility Concepts,and multi-objective decision problems;**(8Hr)**

MODULE-III
Modelling and analysis of uncertainties, practical risk evaluation, and formulation of risk-based design criteria,**(12Hr)**

MODULE-IV
Risk benefit trade-offs,and optimal decisions.**(10Hr)**

CE601P Concrete Design Lab

List of Experiments:

1. Design a class room for a capacity of 100 students and sketch there enforcement detailing of different components such as Beam, slab, column and footing.
2. Design the under ground water tank and sketch the reinforcement detailing.
3. Designacircularwatertankrestingongroundandsketchthereinforcement detailing.
4. Design an Intz –type water tank and sketch the reinforcement detailing.
5. Design and detailing the reinforcement of a side walls and hoppe rbottom of a rectangular bunker.
6. Design and detailing the reinforcement of a Silousing Janssen's theory.
7. Design an abutment in concrete for 6.5m span solid slab bridge and sketch the reinforcement detailing.
8. Design and reinforcement detailing of reinforced concrete slab culvert for a national highway.

(CE602P) Structural Engineering Lab

List of Experiments:

1. Determination of young's modulus of elasticity of steel, wood and aluminum.
2. Determination of horizontal thrust of a three hinged arch.
3. Determination of Influence Line Diagram of continuous beam.
4. Modern analysis of the different end condition of the column.
5. Verification of Maxwell reciprocal theorem.
6. Determination of Fixed end moment of the Beam.
7. Determination of tensile strength of steel.
8. To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally.
9. Experimental and analytical study of deflection and unsymmetrical bending of a cantilever beam.
10. Experiment on a 2-hinged arch for horizontal thrust and influence line for horizontal thrust.

TRANSPORTATION ENGINEERING LABORATORY

EXPERIMENTALLISTS:

AGGREGATETESTING

1. GRADATIONOFAGGREGATE
2. IMPACTTEST
3. ABRASIONTEST
4. ELONGATIONANDFLAKINESSINDEX
5. CRUSHINGVALUETEST
6. SPECIFICGRAVITYANDWATERABSORPTIONTEST

BITUMENTESTING

1. Penetration Value Test
2. Softening Point(Ring and Ball Test)
3. Ductility test
4. Viscosity Test

(CE604P) CSQA

C S Q A Aims to be done:

1. Estimating and Costing–Meaning, purpose, Administrative Approval, Technical Sanction and Budget provision.
2. Types of estimates–Approximate estimate and detailed estimate.
3. Detailed Estimate-Definition and Purpose, Data required for detailed estimate
4. Procedure of preparation of detailed estimate-Taking out quantities and Abstracting
5. Modes of measurement and Desired accuracy in measurements of different items of work as perIS:1200
6. Long wall and Short wall method (out to out and ing to in method or PW D method),Centre line method
7. Description/ specification of items of building work as per PWD/DSR
8. Rate Analysis: Definition, purpose, importance and factors affecting
9. Preparing rate analysis of different items of work- PCC, RCC workin (column, beam, lintel, slab), brick masonry, stone masonry, Vitrified tile flooring, plastering,, Wood work for doors
10. Standard formats of Measurement sheet, Abstract sheet, Face sheet.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF CIVIL ENGINEERING

B. TECH (7th) SEMESTER SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

Semester -VII

Branch: Civil Engineering

S.No.	Code	Course title	Lecture	Tutorial	Practical	Credits
1	CEC701	Advanced Steel Design	3	0	0	3
2	PEC-III	**Professional Elective -III**	3	0	0	3
3	PEC-IV	**Professional Elective -IV**	3	0	0	3
4	OEC III	**Open Elective – III**	3	0	0	3
5	OEC IV	**Open Elective – IV**	3	0	0	3
6	CE701P	Advance Steel Str . DETAILING	0	0	2	1
7	CE702D	Project-I	0	0	4	2
8	CE703I	Internship Assessment	0	0	2	2
Total Credits						**20**

Code	**Professional Elective-III (Any one)**	**Code**	**Professional Elective-IV (Any one)**
CEP702	Hydraulic structures	CEP707	Construction Planning AndManagement
CEP703	Composite Materials	CEP708	Industrial waste treatment
CEP704	Pre stressed Concrete	CEP709	Sustainable Construction Methods
CEP705	Ground Water Hydrology	CEP710	Elements of fluivial hydraulics
CEP706	Earthquake Engineering	CEP711	Railway Engineering
Code	**Open Elective-III (Any one)**	**Code**	**Open Elective-IV (Any one)**
CEO712	Reliability Engineering	CEO717	Basics of computational hydraulics
CEO713	Geographical Information System	CEO718	Urban Hydrology and Hydraulics
CEO714	Quality Control and Management	CEO719	Intelligent Transportation Systems
CEO715	Repairs & Rehabilitation of Structure	CEO720	Structural geology
CEO716	Engineering Economics and Accounts	CEO721	Environmental Health and SafetyManagement

Advanced Steel Design

Course code: CEC701

COURSE

OBJECTIVES:

- Understand advanced concepts in steel design beyond basic structural analysis.
- Learn about the behaviour of steel structures under complex loading conditions.
- Explore advanced topics such as stability, fatigue, and plastic design of steel members.
- Develop skills in utilizing advanced analysis and design software for steel structures.
- Gain knowledge of current codes, standards, and industry best practices in advanced steel design.
- Apply advanced steel design principles to solve real-world engineering challenges effectively.

MODULE-I
Moment resistant connections:- framed connection, eccentric connections brackets. **(08 Hrs)**

MODULE-II
Industrial building:- loads, General arrangement and stability considerations design

of purlins,roof trusses, gantry girder and bracings. **(08 Hrs)**

MODULE-III
Bridge:- Steel footbridge with rankers and Lateral restraining including end bearings**.(08Hrs)**

MODULE-IV
Tanks :- pressed steel water tank, Staging for tanks **(06 Hrs)**

MODULE-V
Towers:- Transmission line Towers, microwave Towers,
design loadsclassification, design procedure and
specifications. **(08 Hrs)**

MODULE-VI
Tubular structures:- Introduction to tubular structures. **(04 Hrs**)

CO	COURSE OUTCOME
CO1	Design of bolted and welded connections; concentric and eccentric
CO2	Design of rolled and built-up tension members.
CO3	Design of rolled and built-up compression members.
CO4	Design of laterally supported and unsupported flexural members
CO5	Design of plate girders
CO6	Understanding failure modes and application of Limit States Design philosophies of steel Designof laterally supported and unsupported flexural members design.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO5	L4	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3

3- High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. Design of steel structure by S. Duggal
2. Design of steel structure by S. Subrahmaniam
3. Design of steel structure by P. Daya Ratnam
4. Design of steel structure by S.S. Bhavikatti
5. Design of steel structure by L.S. Negi

HYDRAULIC STRUCTURES

Course Code: CEP702

COURSE OBJECTIVES:

- Understand the principles governing the behavior of water in hydraulic structures.
- Learn about different types of hydraulic structures and their functions.
- Explore hydraulic design methodologies for structures like dams, spillways, and channels.
- Develop skills in analyzing and designing hydraulic structures to meet specified criteria.
- Gain knowledge of hydraulic modeling techniques for predicting flow behavior and performance.
- Apply hydraulic principles to design safe, efficient, and sustainable hydraulic structures.

Pre-requisites: WRE-I, WRE-IICourse Articulation Matrix:

MODULE-I

Reservoir: Reservoir planning types of reservoirs elements of a Reservoir, mass curve and demand curve, yield ofReservoir, lifeof Reservoir. **(6Hrs)**

MODULE-II

Types of dams and stability. Gravity dam, forces acting on gravity dam, load combination for stability analysis,elementary profile and practical profile, Foundation treatments, joint and Seal, galleries **(8Hrs)**

MODULE-III

Arch dam: types of Arch dams, constant radium and constant Central angle, using thin and thick cylindrical theories,USSR guidelines for designing arch dam. **(8Hrs)**

MODULE-IV

Buttress: Types of buttress dam, design of flat slab buttress Dam, advantages and disadvantages of buttress dam. **(8Hrs)**

MODULE-V

Embankment dams: Earth and rock fill Dam, types of embankment dam, causes of failure, design principles, method of construction, seepage through dams and foundation and remedial measurement. Spillway and energy dissipation device: types of spillways, requirement, serviceability, design of straight drop and **(8Hrs)**

MODULE-VI

Ogee spillways, energy dissipation past spillways, types of stilling basin and design, of stilling basin. **(8Hrs)**

Course Outcomes: At the end of the course, the students will be able to

CO1	Integrate the hydraulics and water resources background by involving the students in water structures design applications.
CO2	Encourage class discussions for formulating and solving multi-variable hydraulic design problems in an open-ended solution space.
CO3	To develop understanding of the basic principles and concepts of analysis and designof hydraulic structures.
CO4	Students will grasp fundamental principles governing fluid behavior, including continuity, momentum, and energy principles as applied to hydraulic structures.
CO5	learn to assess and manage risks associated with hydraulic structures, including flood risk analysis, environmental impact assessment, and structural safety protocols.
CO6	understand regulatory frameworks governing hydraulic structures, including local, national, and international standards, codes, and guidelines

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	3	2	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	2	-	-	1	-	-	-	3	3	3	2
CO3	L1	3	3	1	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L6	3	3	3	3	3	-	-	1	-	-	-	2	3	1	3
CO5	L4	2	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO6	L1	3	3	1	3	3	-	-	1	-	-	-	2	3	3	2

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Hydraulic Structures" by P. Novak, A.I.B. Moffat, C. Nalluri, and R. Narayanan
2. "Hydraulic Structures" by Sheng-Hong Chen and Chyan-Deng Jan
3. "Design of Hydraulic Structures" by R. S. Varshney and N. P. Jaya
4. "Hydraulic Structures: A Textbook for Engineering Students" by M. Aslam Chaudhry
5. "Hydraulic Structures: A Mechanistic Approach" by P. M. Pulko

Composite Materials

Course code: CEP703

COURSE OBJECTIVES:

- Define composite materials and their constituents.
- Explain the manufacturing processes involved in creating composite materials.
- Analyze the mechanical properties of composite materials.
- Identify the applications of composite materials in various industries.
- Design composite structures for specific performance requirements.
- Stay updated on advancements and innovations in composite materials technology.

MODULE-I

Introduction: Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermo sets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc. Types of Reinforcements/Fibers: Role and Selection or reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. **(14Hrs)**

MODULE-II

Various types of composites: Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites. **(10Hrs)**

MODULE-III

Fabrication methods: Processing of Composite Materials:

Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin- transplant method, pultrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films. **(8Hrs)**

MODULE-IV

Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminarshear testing, Fracture testing etc. **(8Hrs)**

Course Outcomes: At the end of the course, the students will be able to:

CO1	Explain the mechanical behavior of layered composites compared to isotropic materials.
CO2	Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels.
CO3	Determine stresses and strains relation in composites materials.
CO4	Development of problem-solving skills through hands-on experimentation and case studies.
CO5	Knowledge of manufacturing processes and techniques for composite materials.
CO6	Proficiency in designing composite structures for specific applications.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Composite Materials: Fabrication Handbook #1" by John Wanberg
2. "Introduction to Composite Materials Design" by Ever J. Barbero
3. "Composite Materials: Science and Engineering" by Krishan K. Chawla
4. "Analysis and Performance of Fiber Composites" by Bhagwan D. Agarwal and Lawrence J. Broutman
5. "Mechanics of Composite Materials" by Autar K. Kaw

Pre-stressed Concrete

Course code: CEP704

COURSE OBJECTIVES:

- Define pre-stressed concrete and its applications in construction.
- Explore the principles and theories behind pre-stressing techniques.
- Master the practical methods of pre-tensioning and post-tensioning concrete elements.
- Analyze the structural behavior and performance of pre-stressed concrete under various loads.
- Develop skills in designing pre-stressed concrete structures for efficiency and durability.
- Stay updated on industry standards, codes, and emerging trends in pre-stressed concrete technology.

DETAILED SYLLABUS:

MODULE-I

Introduction: Fundamentals of pre-stressing- Classification and types of pre-stressing Concrete Strength and straincharacteristics- Steel mechanical properties–Auxiliary Materials like duct formers. **(8Hrs)**

MODULE-II

Pre-stressing Systems: Principles of pre-tensioning and post-tensioning- study of common systems of pre-stressing for wires strands and bars and Losses of Pre-stress: Losses of pre-stress in Pre-tensioned and post-tensioned members, I.S. code provisions. **(8Hrs)**

MODULE-III

Analysis of Sections: In flexure, simple sections in flexure, kern distance- cable profile- limiting zones-compositesections cracking moment of rectangular sections. **(8Hrs)**

MODULE-IV

Design of Simply Supported Beams: Allowable stress as per I.S.1343- elastic design of rectangular and I-sections.
(8Hrs)

MODULE-V

Shear and Bond: Shear and bond is pre-stressed concrete beams- conventional design of shear reinforcement- Ultimate shear strength of a section-Pre-stress transfer in pre-tensioned beams-Principles often block design.**(8Hrs)**

CO	COURSE OUTCOME
CO1	Understandtheconceptsofpre-stressinginconcretestructuresandidentifythe Materials for pre-stressing.
CO2	Analyses a Pre-stressed Concrete section and Estimate losses of pre-stressing.
CO3	Design pre-tensioned and post tensioned girders for flexure and shear.
CO4	Awareness of durability and maintenance considerations in pre-stressed concrete applications.
CO5	Development of problem-solving skills through practical applications and case studies.
CO6	Knowledge of construction techniques and materials specific to pre-stressed concrete.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Prestressed Concrete: Analysis and Design" by Antoine E. Naaman
2. "Prestressed Concrete Structures" by N. Krishna Raju
3. "Prestressed Concrete" by Edward G. Nawy
4. "Design of Prestressed Concrete Structures" by T.Y. Lin and Ned H. Burns
5. "Prestressed Concrete Design" by M.K. Hurst

Ground Water Hydrology

Course code: CEP705

COURSE OBJECTIVES:

- Grasp groundwater basics.
- Understand aquifer properties.
- Learn groundwater flow principles.
- Explore groundwater monitoring methods.
- Study surface water-groundwater interactions.
- Apply groundwater knowledge practically.

DETAILED SYLLABUS:

MODULE-I

INTRODUCTION: Ground water utilization & historical back ground, groundwater in hydrological cycle, ground water budget, ground water level fluctuations & environmental influence, occurrence and movement of ground water: Origin & age of groundwater, rock properties affecting ground water, ground water column, zones of aeration & saturation, aquifers and their characteristics/ classification, groundwater basins & springs, Darcy's Law, permeability & its determination, Dupuit assumptions, heterogeneity & anisotropy, Ground water flow rates & flow directions, generalflow equations through porous media. **(10Hrs)**

MODULE-II

ADVANCED WELL HYDRAULICS: steady/ unsteady, uniform/ radial flow to a well in a confined/ unconfined/ leaky aquifer, well flow near aquifer boundaries/ for special conditions, partially penetrating/ horizontal wells & multiple well systems, well completion/ development/ protection/ rehabilitation/ testing for yield. **(8Hrs)**

MODULE-III

POLLUTION AND QUALITY ANALYSIS OF GROUND WATER: Municipal /industrial /agricultural
/miscellaneous sources &cause of pollution, attenuation/ underground distribution/ potential evaluation of pollution, physical/ chemical/ biological analysis of ground water quality, criteria & measures of groundwater quality, groundwater salinity & samples, graphical representations of ground water quality. **(8Hrs)**

MODULE-IV

SURFACE/SUB-SURFACE INVESTIGATION OF GROUND WATER: Geological/ geophysical exploration/ remote sensing /electric resistivity/ seismic refraction based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation through geophysical/ resistivity/ spontaneous potential/ radiation/ temperature/ caliper/ fluid conductivity/ fluid velocity/ miscellaneous logging. **(8Hrs)**

MODULE-V

MODELING AND MANAGEMENT OF GROUND WATER:

Ground water modeling through porous media/ analog/ electric analog/ digital computer models, ground water basin management concept, hydrologic equilibrium equation, ground water basin investigations, data collection & fieldwork, dynamic equilibrium in natural aquifers, management potential & safe yield of aquifers, stream- aquifer interaction. **(8Hrs)**

CO	**COURSE OUTCOME**
CO1	Listanddescribethepropertiesofaquifersthatcontrolthemovementandstorageof Groundwater
CO2	Use Darcy's Law to explain the roles of aquifer properties and driving for casing Governing the rate of groundwater flow
CO3	Interpret the current and historical balance between ground water recharge and water Extraction from well hydrographs
CO4	To perform steady state analysis of groundwater movement.
CO5	To determine the technical, social and economic aspects of water resources planning and management.
CO6	To perform hydrograph analysis and estimate magnitude of flood.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	**BL**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	L3	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO2	L5	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO3	L1	3	3	3	3	3	-	-	1	-	-	-	2	3	3	3
CO4	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO5	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO6	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Applied Groundwater Modeling: Simulation of Flow and Advective Transport" by Mary P. Anderson andWilliam W. Woessner
2. "Principles of Groundwater Engineering" by Jacob Bear and Alexander H.-D. Cheng
3. "Groundwater Hydrology" by David Keith Todd and Larry W. Mays
4. "Groundwater" by R. Allan Freeze and John A. Cherry
5. "Groundwater Science" by Charles R. Fitts

Earthquake Engineering

Course code: CEP706

COURSE OBJECTIVES:

- Grasp the basics of seismic forces and their impact on buildings.
- Learn to assess structural vulnerabilities to earthquakes.
- Acquire skills to design earthquake-resistant structures.
- Explore retrofitting techniques to enhance existing structures' resilience.
- Understand seismic risk management strategies.
- Stay informed about emerging trends and research in earthquake engineering.

DETAILED SYLLABUS:

MODULE-I
Elements of Seismology, Definitions of Magnitude, Intensity, Epicenter etc. General features of tectonic of seismicregions, Seismic graphs. Theory of Vibrations.**(8Hrs)**

MODULE-II
Free vibrations of single degree, two degree and multiple degree freedom systems. Computation of dynamic response totime dependent forces. Vibration isolation. Vibration absorbers.**(8Hrs)**

MODULE-III
Principles of Earthquake Resistant Design Response spectrum theory. Brief introduction to accelero graphs and S.R.R.'s.
(8Hrs)

MODULE-IV
Nature of dynamic loading resulting from earthquakes, Application of Response spectrum. Theory to a seismic design to structures, Resistance of structural elements and structures for dynamic loads, design criteria strength and deflection.Ductility and absorption of energy.**(8Hrs)**

MODULE-V
Dynamic Properties of Soils, Remedial measures and Management of earthquake disaster, Introduction to IndianStandard Codes IS: 1893– 1984and IS: 4326– 1993. **(8Hrs)**

CO	COURSE OUTCOME
CO1	To explain the concept of earthquakes and knowledge of earthquake engineering practicesapplied to Civil Engineering problems
CO2	To determine different design parameter under different degree of freedom.
CO3	To identify the remedial measures of earthquake disaster
CO4	Practice of Earthquake code and application
CO5	Seismic design of brick masonry buildings as per IS- 4326 code and repair of buildings as perIS13935.
C06	Seismic design and detailing of RCC elements as per IS 13920 code.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Earthquake Engineering: From Engineering Seismology to Performance-Based Engineering" by Yousef Bozorgnia and Vitelmo V. Bertero
2. "Fundamentals of Earthquake Engineering" by Amr S. Elnashai and Luigi Di Sarno
3. "Introduction to Earthquake Engineering" by Peter Shearer
4. "Earthquake Resistant Design of Structures" by Shashikant K. Duggal
5. "Dynamic Analysis and Earthquake Resistant Design: Dams, Nuclear Power Plants, and Lifeline Structures" by Shiba Anand Das and Sandip Kumar Saha

Construction Planning and Management

Course code: CEP707

COURSE OBJECTIVES:

- Comprehend the principles of construction project planning and scheduling.
- Learn techniques for resource allocation and optimization in construction projects.
- Understand cost estimation and budget management in construction.
- Acquire skills in risk identification and mitigation strategies in construction planning.
- Explore procurement methods and contract management in construction projects.
- Stay updated on industry standards and best practices in construction planning and management.

DETAILED SYLLABUS:

MODULE-I

Management: Introduction, development of management and its recent trends, principle of management, function of management, administration of management and organization. **(6Hrs)**

MODULE-II

Constructional planning: Need for construction planning, construction resources, stages in construction Job Lay- Out, preparation of construction schedule preparatory work for project, Inspection and quality control. Objective of C.P.M\.and PERT, elements of network, network rules, constraint serrors in network. **(6Hrs)**

MODULE-III

CPM: Critical path analysis, activity times and floats optimization through CPM Technique. **PERT:** PERT and three Estimates, critical path and analysis of PERT network. Probability ofcompletion of project, controlling and monitoring. **(12Hrs)**

MODULE-III

MASS HAUL DIAGRAM: Characteristics of mass Haul diagram, Earth work calculation by mass haul diagram, objective of motion study, objective/uses of time study, motion/time study procedure. **(6Hrs)**

MODULE-IV

SAFETY IN CONSTRUCTION: Hazards in construction projects, causes of accidents, costs of an accident, safety program for construction, protective equipment, safety measures, construction elementof a building. **(6Hrs)**

MODULE-V

PREFABRICATION: Need for prefabrication, classification of pre fabrication, scope of prefabrication in India, advantages and disadvantages of pre fabrication design principle of prefabricate system. **(4Hrs)**

CO	COURSE OUTCOME
CO1	To describe different planning stages for any project.
CO2	To distinguish between CPM and PERT and its elements.
CO3	To create network diagram using CPM and PERT
CO4	To estimate earthwork using Mass Haul diagram
CO5	To develop the concept of works accounting and leadership organization.
CO6	To understand the various aspects of construction equipment's. CO3- To develop the skill for the management of construction projects.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3- High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Construction Planning and Management" by P. S. Gahlot
2. "Construction Planning and Management" by U.K. Srivastava
3. "Construction Planning and Management" by S. Seetharaman
4. "Construction Planning and Management" by S. K. Sharma
5. "Construction Project Management: Planning, Scheduling, and Controlling" by Frederick Gould and Nancy Joyce

Industrial Waste Treatment

Course code: CEP708

COURSE OBJECTIVES:

- Learn Understand the types and sources of industrial waste.
- methods for characterization and quantification of industrial waste.
- Explore various treatment technologies for industrial wastewater and solid waste.
- Acquire skills in designing and operating treatment systems for industrial waste.
- Understand the regulatory framework and compliance requirements for industrial waste management.
- Gain knowledge on monitoring and assessing the effectiveness of industrial waste treatment processes.

DETAILED SYLLABUS:

MODULE-I

INTRODUCTION: Types of industries and industrial pollution –Characteristics of industrial wastes– Population equivalent–Bio assay studies– effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control ofindustrial effluents And hazardous wastes. **(8Hrs)**

MODULE-II

CLEANER PRODUCTION: Waste management Approach–Waste Audit- Volume and strength reduction– Material and process modifications–Recycle, reuse and by product recovery– Applications**(8Hrs)**

MODULE-III

POLLUTION FROM MAJOR INDUSTRIES: Sources, Characteristics, waste treatment flow sheetsfor selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants–Waste water reclamation concepts. **(9Hrs)**

MODULE-IV

TREATMENT TECHNOLOGIES: Equalization– Neutralization –Removal of suspended and dissolved organic solids–Chemical oxidation–Adsorption–Removal of dissolved in organics Combinedtreatment of industrial and municipal wastes–Residue management–Dewatering–Disposal. **(11Hrs)**

CO	COURSE OUTCOME
CO1	Ability tool and minimization of industrial wastes.
CO2	Ability to design facilities for the processing and reclamation of industrial waste Water
CO3	Awareness of sustainable practices and resource recovery techniques in waste treatment.
CO4	Understanding of industrial waste characteristics and sources.
CO5	Proficiency in designing treatment processes for diverse industrial effluents.
CO6	Ability to analyze and optimize treatment system performance.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Industrial Waste Treatment: Contemporary Practice and Vision for the Future" by Nelson L. Nemerow and Franklin J. Agardy
2. "Industrial Waste Treatment Handbook" by Frank Woodard
3. "Industrial Water Pollution Control" by W. Wesley Eckenfelder Jr. and Davis L. Parkin
4. "Handbook of Industrial and Hazardous Wastes Treatment" by Lawrence K. Wang, Yung-Tse Hung, and Howard H. Lo
5. "Wastewater Engineering: Treatment and Resource Recovery" by Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton, H. David Stensel, Ryujiro Tsuchihashi, and Takashi Asano

Sustainable Construction Methods

Course code: CEP709

COURSE OBJECTIVES:

- Understand sustainability in construction.
- Learn green building techniques.
- Implement energy-efficient design.
- Explore water conservation methods.
- Integrate renewable energy.
- Comply with sustainable construction standards.

DETAILED SYLLABUS

MODULE-I

Introduction: Sustainability in the Built Environment, Environmental/Resources Issues & Industrial/Construction Metabolism. **(8Hrs)**

MODULE-II

Environmental Economics and Life Cycle Costing, Life Cycle Assessment, Embodied Energy, Energy,and Materials. **(8Hrs)**

MODULE-III

Building Assessment and Eco-labels, Sustainability Frameworks And Sustainable Communities and Sustainability Indicators. **(8Hrs)**

MODULE-IV

Energy Systems, Energy, Entropy, Energy Conservation, and Renewable Energy, Water Resources, Wastewater, and Storm-water and Urban Planning, Land Development, New Urbanism, And Landscaping. **(8Hrs)**

MODULE-V

Design for the Environment, Ecological Principles, Passive Design, and Climatic Design and Construction Operations, Advanced Construction Waste Management and Demolition, Building Health, Building Commissioning and Facility Management, Industrial Ecology and Construction Ecology. **(8Hrs)**

CO	COURSE OUTCOME
CO1	Understand rating systems and compares key features such as cost, ease of use, and Building performance
CO2	Known rating system sin detail, including its evolution, objectives, criteria, levels ofCertification benefits, and short comings
CO3	Know a series of case studies representing diverse project types, sizes, certification levels, and climate regions
CO4	Know what are “lessons learned ”of sustainable construction through case studies
CO5	Development of problem-solving skills to address sustainability challenges in construction projects.
CO6	Ability to design buildings with minimal environmental impact throughout their lifecycle.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3- High, 2- Moderate, 1- Low, ‘-’ for No correlation

Reference Books

1. "Sustainable Construction: Green Building Design and Delivery" by Charles J. Kibert
2. "Sustainable Construction Techniques: From Structural Design to Interior Fit-Out" by Daniel W. Halpin, Michael P. McCartney, and Balbir S. Mathur
3. "Sustainable Construction: Building Performance Simulation and Asset and Maintenance Management" by Sandy Halliday
4. "Introduction to Sustainable Engineering" by Roger D. Roger
5. "Green Building: Guidebook for Sustainable Architecture" by Jason F. McLennan

Elements of Fluvial Hydraulics

Course code: CEP710

COURSE OBJECTIVES:

- Understand the fundamental principles governing flow dynamics in natural watercourses.
- Analyze and interpret river morphology and sediment transport phenomena.
- Apply hydraulic principles to design and optimize structures for river management and restoration.
- Evaluate and mitigate flood risks through hydraulic modeling and hazard assessment.
- Recognize the ecological significance of fluvial systems and integrate environmental considerations into engineering practices.
- Develop problem-solving skills through practical applications and case studies in fluvial hydraulics.

DETAILED SYLLABUS:

MODULE-I

Introduction, Definition, Historical Development of Native Problem Origin and Properties of sedimentIntroduction, Origin and Formation of sediment, Fundamental properties, **(8Hrs)**

MODULE-II

Incipient motion , Introduction, competent, life concept, critical, tractive Force, Critical attractive stressof cohesion-less, cohesive material. **(8Hrs)**

MODULE-III

Regime of flow: Introduction, Description ripple dune, Anti dune, Importance of regime flow predictionof regime flow. **(8Hrs)**

MODULE-IV

Bed load transport: Introduction, Mechanism, suspended saltation & total load transport. Semi-theoretical approach, Einstein's theory. **(8Hrs)**

MODULE-V

Bed level variation in Alluvial channel Introduction, Mechanism, Aggradations, Degradation, scour,local scour, scour causes & protection. **(8Hrs)**

CO	COURSE OUTCOME
CO1	To develop an understanding about the origin and properties of Sediments.
CO2	To be able to understand the establishment of threshold of particle transport and formation of various bed forms.
CO3	To be able to understand the different aspects of channel roughness and resistance to flow in rigid and mobile boundary channels.
CO4	To be able to understand various features of bed load, suspended load and total load transport.
CO5	To be able to perform calculations leading to stable channel design.
CO6	Understanding of ecological considerations in fluvial systems and their integration into engineering practices.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Open Channel Hydraulics" by Ven Te Chow, David R. Maidment, and Larry W. Mays
2. "River Hydraulics" by Pierre Y. Julien
3. "Fluvial Hydrodynamics: Hydrodynamic and Sediment Transport Phenomena" by Subhasish Dey
4. "Fluvial Processes in River Engineering" by David Knighton
5. "Principles of River Hydraulics" by Hubert Chanson

Railway Engineering

Course code: CEP711

COURSE OBJECTIVES:

- Grasp fundamentals of railway infrastructure.
- Learn about track design and maintenance.
- Understand signaling and control systems.
- Explore rolling stock technology.
- Study railway operations and logistics.
- Implement safety protocols and regulations.

DETAILED SYLLABUS:

MODULE-I

Introduction: Alignment of Railway Lines Rails, Track Fittings and Track Stresses. Describe history and recent developments in railways. Explain Components of Railway Track, different Railway Gauges. Discuss requirements of any deal alignment. Comprehend the Standard Rail Sections. Explain Causes and effects of Creep and Measures to Reduce Creep. Explain Fittings and Fastening and their Requirements. Discuss Forces Acting on Track and Coning of Wheels History of Indian Railways, Importance of Railways For Environment. Recent Developments. Role of Civil Engineers In Construction And Maintenance. Components of Railway Track. Definition of Railway Gauges, Types, Uniformity of Gauge. Different Gauges on Indian Railways, Cross-Section of Permanent Way as Per IRS. Problems Caused By Change of Gauge. Basic Requirements and selection of An Ideal Alignment. Functions and, Types Of Rails. Standard Rail Sections. Causes and Effects Of Creep, Measures To Reduce Creep. Fittings and Fastening and their requirements. Forces Acting On Track. Coning Of Wheels. **(8Hrs)**

MODULE-II

Sleeper & Geometric Design of Track: Describe Functions &Requirements of sleepers. Explain Method of Fixing Rails with Pre stressed Concrete and Wooden Sleepers. Explain the necessity and details of geometric design. Design track Gradients as per given requirements. Functions & Requirements of sleepers

2.2 Types and Spacing of Sleepers,

2.3 Method Of Fixing Rails With Pre-stressed Concrete And Wooden Sleepers,

2.4 Function and Specifications of Track Ballast

2.5 Necessity and Details of geometric design of track

2.6 Design of track Gradients,

2.7 Grade compensation on curves.

2.8 Curves and Super elevation. **(8Hrs)**

MODULE-III

Resistance to Traction, Points And Crossings:

3a. Describe resistance to friction

3b. Explain stress in rails

3 c. Explain Necessity of Points & Crossing

3d. Draw Track Layouts And Sketches of Turn Out,

3e. Discuss various Types of Track Turnouts

3.1 Resistance to friction, wave action, speed, track irregularity, wind.

3.2 Resistance to gradient, curvature, starting and accelerating.

3.3 Stress in rails, sleepers, ballast and formation

3.4 Necessity of Points & Crossing

3.5 Track Layouts And Sketches of Turn Out,

3.6 Types Of Crossing

3.7 Types of Track Turnouts. **(8Hrs)**

MODULE-IV

Railway Stations and Yards:

4a. Describe purposes and facilities at Railway Stations.

4b. Explain Station Yard

4.1. Purposes

4.2. Facilities Required at Railway Stations.

4.3. Requirements Of Station Yard

4.4 Classifications Of Railway Stations,

4.5. Types Of Yards. **(8Hrs)**

MODULE-V

Signaling And Interlocking:

5 a. Describe objectives of signaling

5b. Explain Interlocking and modern signal system

5.1 Objectives of signaling

5.2 Classification of signals

5.3 Types And working of Interlocking

5.4 Modern signal system. **(6Hrs)**

MODULE-VI

Maintenance Of Railway Track:

6a. Explain various types of railway track Maintenance

6b. Describe Surface Defects and Their Remedial Measures

6.1. Introduction of Maintenance Program.

6.2. Monsoon, Pre-Monsoon & Post-Monsoon Maintenance.

6.3. Causes For Maintenance,

6.4. Routine Maintenance

6.5. Tools For Railway Track Maintenance &Their Functions.

6.6. Surface Defects And Their Remedial Measure. **(6Hrs)**

CO	COURSE OUTCOMES
CO1	Explain Components of Railway Track, different Railway Gauges and design track Gradients as per given requirements.
CO2	Discuss various Types of Track Turnouts and describe purposes and facilities at Railway Stations.
CO3	Explain Interlocking and modern signal system and describe Surface Defects on Railway Track and Their Remedial Measures.
CO4	Able to understand the transport system of the country.
CO5	Knowledge about various aspects of railway design
CO6	Understanding of Railway planning, design, construction and maintenance and planning and design principles of Airports

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Fundamentals of Railway Engineering" by John F. Unsworth and Elisa C. D'Angelo
2. "Railway Engineering" by Satish Chandra and M.M. Agarwal
3. "Railway Engineering" by C. Venkatramaiah
4. "Principles and Practices of Railway Engineering" by J. F. Gairns
5. "Modern Railway Track" by Coenraad Esveld

Reliability Engineering

Course code: CEO712

COURSE OBJECTIVES:

- Understand the principles of reliability and its importance in engineering systems.
- Learn methods for reliability analysis and prediction.
- Explore techniques for failure mode and effects analysis (FMEA) to identify potential failure points.
- Acquire skills in designing reliability into systems through redundancy and fault tolerance.
- Study maintenance strategies such as preventive and predictive maintenance to improve reliability.
- Apply statistical tools and software for reliability modeling and optimization.

DETAILED SYLLABUS:

MODULE-I
Introduction: Definitions and concepts, Reliability, Probability, Impossible and certain events. Failure-data and its Analysis, Hazard rate and Failure density, Reliability in terms of hazard rate, Failure density in other situations. **(10Hrs)**

MODULE-II
Hazard Models: Type of distribution and standard deviation And variance, Expectations,Conditional probabilities. **(8Hrs)**

MODULE-III
System Reliability: Series, Parallel and mixed configurations. Methods of solving Complexsystems. **(8Hrs)**

MODULE-IV
Reliability improvement: Types of redundancies, Reliability Allocation for a series of system, Optimization Reliability-cost trade-off. **(8Hrs)**

CO	COURSE OUTCOME
CO1	Introduce concepts and methods in the field of reliability engineering and use of TQM (Total Quality Management) tools to measure and evaluate the quality of products.
CO2	Perform reliability analysis of a system and designing the same and apply the Acquired knowledge in a practical operational problems or research projects.
CO3	Evaluate the use of reliability engineering for industrial activities.
CO4	Proficiency in reliability analysis techniques such as fault tree analysis and reliability block diagrams.
CO4	Development of problem-solving skills through case studies and real-world applications in reliability engineering.
CO5	Application of reliability-centered maintenance strategies to optimize system performance and minimize downtime.
CO6	Knowledge of probabilistic models and statistical methods for reliability prediction and assessment.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Fundamentals of Railway Engineering" by John F. Unsworth and Elisa C. D'Angelo
2. "Railway Engineering" by Satish Chandra and M.M. Agarwal
3. "Railway Engineering" by C. Venkatramaiah
4. "Principles and Practices of Railway Engineering" by J. F. Gairns
5. "Modern Railway Track" by Coenraad Esveld

Geographical Information System

Course code: CEO713

COURSE OBJECTIVES:

- Understand the fundamentals of Geographic Information Systems (GIS) technology.
- Learn to collect, store, and manage spatial data efficiently.
- Explore techniques for spatial analysis and visualization.
- Acquire skills in using GIS software for mapping and decision-making.
- Understand the applications of GIS in various fields such as urban planning, environmental management, and disaster response.
- Develop proficiency in integrating GIS with other technologies for interdisciplinary projects.

DETAILED SYLLABUS:

MODULE-I

Basic concepts of GIS Introduction-Information Systems, spatial and non-spatial information, geographical concepts and terminology, Advantages of GIS. Basic components of GIS. Commercially available GIS hardware and software, organization of Data in GIS. **(12Hrs)**

MODULE-II

GIS Data: Input data-field data, statiatical data, Maps, Aerial photographs, Satellite data, points, lines and areas features, Vector and Raster data, Advantages and Disadvantages, Data entry through key board, digitizers and scanners, digital data. Pre-processing of data-Rectification and Registration.
Inter polation techniques. **(12Hrs)**

MODULE-III

Data management: Data base Management System (DBMS).Various data models. Run length encoding, Quad trees, Data Analysis-Data Layers, analysis of spatial and non-spatial data, Data overlay modeling, Data Presentation-Hard copy devices, soft copy devices. **(8Hrs)**

MODULE-IV

Application of GIS. **(8Hrs)**

CO	COURSE OUTCOME
CO1	Describe the functional basis of a GIS AND appreciate the potential uses of GIS in ICM.
CO2	Consider the benefits and short comings of using GIS for ICM
CO3	Outline the key data quality issues involved isusing GISAND develop a strategy to implement an effective GIS
CO4	Development of cartographic skills for effective data visualization and communication.
CO5	Ability to create, manage, and analyze geographic data effectively.
CO6	Knowledge of spatial analysis methods for decision-making in various fields.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	**BL**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3- High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Geographic Information Systems and Science" by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind
2. "Geographic Information Systems: Principles, Techniques, Management, and Applications" by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind
3. "Introduction to Geographic Information Systems" by Kang-tsung Chang
4. "GIS Fundamentals: A First Text on Geographic Information Systems" by Paul Bolstad
5. "Geographic Information Systems: Applications in Natural Resource Management" by Michael G. Wing and Pete Bettinger

Quality control and management

Course code: CEO714

COURSE OBJECTIVES:

- Understand the principles and importance of quality control in manufacturing and service industries.
- Learn techniques for process improvement and defect prevention.
- Explore statistical tools for quality monitoring and analysis, such as control charts and Pareto analysis.
- Acquire skills in implementing quality management systems like Six Sigma and Total Quality Management (TQM).
- Understand the role of quality audits and inspections in ensuring compliance with standards andregulations.
- Develop strategies for continuous improvement and customer satisfaction through effective quality control and management practices.

DETAILED SYLLABUS:

MODULE-I

Construction projects, Agencies involved in construction projects, mutual relationship, quality controlat site, why and whose job site. **(12Hrs)**

MODULE-II

ISO/IS Requirements: IS9000 (Parts1to 4), (Pt1:1994, Pt2:1993 Pt 3:1994 Pt 4:1993 for total quality management. ISO] 4000– 988 for environment – impact of large construction projects **(12Hrs)**

MODULE-III

Quality control on construction projects, Inspection of reinforced concrete, masonry and steel works. Testing techniques & quality audit reports **(8Hrs)**

MODULE-IV

Statistical Analysis, Sampling frequencies, statistical & reliability analysis, optimum sample size. **(8Hrs)**

CO	COURSE OUTCOMES
CO1	Explain the different meanings of the quality concept and its influence.
CO2	Describe distinguish hand use the several techniques and quality management tools.
CO3	Explain and distinguish the Normalization, homologation and certification activities.
CO4	Predict the errors in the measuring process, distinguishing its nature and the root causes.
CO5	Development of problem-solving skills through case studies and quality improvement projects.
CO6	Knowledge of quality standards and regulatory requirements across industries.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Quality Management for Organizational Excellence: Introduction to Total Quality" by David L.Goetsch and Stanley Davis
2. "Quality Control and Industrial Statistics" by Acheson J. Duncan and Richard A. Dean
3. "Quality Management: A Comprehensive Guide to Total Quality Management" by Dale H.Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, and Mary Besterfield-Sacre
4. "The Quality Toolbox" by Nancy R. Tague
5. "Statistical Quality Control" by Eugene L. Grant and Richard S. Leavenworth

Repairs & Rehabilitation of Structures

Course code: CEO715

COURSE OBJECTIVES:

- Understand the causes and types of structural damage.
- Learn methods for assessing the condition and stability of damaged structures.
- Explore techniques for repairing and strengthening structural elements.
- Acquire skills in selecting appropriate materials and methods for rehabilitation projects.
- Understand the importance of structural retrofitting and seismic strengthening.
- Develop strategies for sustainable and cost-effective repairs to ensure the longevity and safety of structures.

DETAILED SYLLABUS:

MODULE-I
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. **(6Hrs)**

MODULE-II
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. **(6Hrs)**

MODULE-III
Special Concretes- Polymer concrete, Sulphur in filtrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geo polymerconcrete, Reactive powder concrete, Concrete made with industrial wastes. **(8Hrs)**

MODULE-IV
Corrosion – Effects of cover thickness; Corrosion monitoring, Corrosion protection techniques, – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathode Protection; Repair, Rehabilitation and Retro fitting of Structures. **(8Hrs)**

MODULE-V
Evaluation of root causes; Underpinning & shoring; some simple systems of rehabilitation of structures; Grunting, concreting; and Techniques for Repair and Protection Methods- Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning.
Non-Destructive testing systems; Use of external **(6Hrs)**

MODULE-VI
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– Engineer demolition methods–Case studies**(6Hrs)**

CO	COURSE OUTCOME
CO1	Perform structural health monitoring and Perform notable applications of structural health monitoring in civil applications
CO2	Diagnosis the damage of distress structures and Investigate the condition assessment Of structures
CO3	Select the proper repair materials and its application
CO4	Select the method to Strengthen the distressed structures
CO5	Understanding of structural deterioration mechanisms and failure modes.
CO6	Knowledge of materials and techniques used in structural rehabilitation.

*****Soft Skills and Interpersonal Communication (syllabus prepared and taught by Humanities Department)

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Repair and Rehabilitation of Concrete Structures" by H. Al-Khaiat and M. I. Tadros
2. "Rehabilitation of Metallic Civil Infrastructure Using Fiber Reinforced Polymer (FRP) Composites" by Vistasp M. Karbhari
3. "Rehabilitation of Pipelines Using Fiber-reinforced Polymer (FRP) Composites" by Vistasp M. Karbhari and Leonard J. Bond
4. "Rehabilitation of Water Pipelines Using Fiber-reinforced Polymer (FRP) Composites" by Vistasp M. Karbhari and Leonard J. Bond
5. "Repair, Protection, and Waterproofing of Concrete Structures" by H. Al-Khaiat and M. I.Tadros

Engineering Economics and Accountancy

Course code: CEO716

COURSE OBJECTIVES:

- Grasp fundamental economic principles and concepts relevant to engineering decision-making.
- Learn methods for evaluating project feasibility and conducting cost-benefit analysis.
- Explore techniques for estimating project costs, including direct and indirect expenses.
- Acquire skills in financial accounting and budgeting for engineering projects.
- Understand the principles of depreciation, taxation, and financial risk assessment.
- Apply economic and accounting principles to optimize resource allocation and maximize project profitability.

DETAILEDSYLLABUS

MODULE-I

Engineering Economics:- Introduction to Engineering Economics– Fundamental concepts– Time value of money – Cash flow and Time Diagrams – Choosing between alternative investment proposals. **(9Hrs)**

MODULE-II

Methods of Economic analysis, The effect of borrowing on investment- Various concepts of National Income– Significance of National Income estimation and its limitations. **(9Hrs)**

MODULE-III

Inflation:–Definition Process and Theories of Inflation and measures to control, New Economic Policy1991–Impact on industry. **(9Hrs)**

MODULE-IV

Accountancy: Accounting Principles, Procedure– Double entry system–Journal–Ledger, Trail Balance– Cash Book–Preparation of Trading, Profit and Loss Account–Balance sheet. **(9Hrs)**

MODULE-V

Cost Accounting–Introduction–Classification of costs–Methods of costing – Techniques of costing – Cost sheet and preparation of cost sheet-Break even Analysis–Meaning and its application, Limitations. **(9Hrs)**

CO	COURSE OUTCOME
CO1	Understanding of economic principles and their application to engineering decision-making.
CO2	Proficiency in financial analysis techniques for evaluating engineering projects.
CO3	Ability to perform cost-benefit analysis and assess project feasibility.
CO4	Knowledge of accounting principles and financial reporting relevant to engineering firms.
CO5	Application of financial management strategies to optimize project budgets and resources.
CO6	Development of problem-solving skills through case studies and financial modeling exercises.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1."Engineering Economy" by Leland Blank and Anthony Tarquin
2."Engineering Economic Analysis" by Donald G. Newnan, Jerome P. Lavelle, and Ted G. Eschenbach
3."Engineering Economics and Financial Accounting" by A. Ramachandra Aryasri
4."Engineering Economics" by R. Panneerselvam
5."Engineering Economics" by Ronald A. Chisman

Basics of Computational Hydraulics
Course code: CEO717

COURSE OBJECTIVES:

- Learn numerical methods for solving hydraulic equations and simulating flow phenomena.
- Explore the application of computational techniques in hydraulic engineering.
- Acquire skills in using computational software for modeling and analyzing hydraulic systems.
- Understand the limitations and assumptions associated with computational hydraulics.
- Apply computational methods to solve practical engineering problems in water resources management.

DETAILED SYLLABUS

MODULE-I

Introduction: Basic equations of fluid motion, heat and mass transfer, need for their numerical solution. **(12Hrs)**

MODULE-II

Solution Techniques: Classification of governing equations-parabolic, elliptic and hyperbolic type, method of characteristics, explicit and implicit finite difference schemes–Crank Nicholson, Penceman - Rachford ADI, Leaf from, Lax- Wendroff, Successive over-relaxation methods. **(12Hrs)**

MODULE-III

Types of Problems: Analysis of water distribution networks, hydraulic transients in closed conducts, flood routing in stream using Saint-Venant equations, numerical solutions for one–dimensional convection and diffusion equation. Analysis of dam break problems. Positive and negative surge analysis, design and analysis of surges hocks. **(16Hrs)**

CO	COURSE OUTCOME
CO1	Understanding of fundamental principles of fluid dynamics and computational methods.
CO2	Proficiency in numerical techniques used to solve hydraulic problems.
CO3	Ability to model and simulate fluid flow phenomena in hydraulic systems.
CO4	Knowledge of computational tools and software commonly employed in hydraulic engineering.
CO5	Application of computational approaches to analyze and design hydraulic structures and systems.
CO6	Development of problem-solving skills through practical applications and simulation exercises.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	3	3	1	1	2	3	2	1	1	2	1	-	1	-	-
CO2	L5	3	2	2	2	3	1	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L2	3	2	1	3	3	3	1	3	2	2	2	2	-	2	2
CO5	L5	3	2	2	2	2	3	3	2	2	2	2	-	3	-	-
CO6	L1	3	2	3	3	3	2	3	3	2	3	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Computational Methods in Hydraulic Engineering" by P. R. N. Childs
2. "Computational Fluid Dynamics in Hydraulic Engineering: An Introduction" by Roger G. Blake
3. "Numerical Methods in Hydraulic Engineering" by J. Nalluri and R. Narayanan
4. "Computational Hydraulics and Hydrology: An Illustrated Dictionary" by P.R. Samuels
5. "Computational River Dynamics" by Chih Ted Yang

Urban Hydrology and Hydraulics

Course code: CEO718

COURSE OBJECTIVES:

- Understand the hydrological processes in urban areas, including rainfall-runoff relationships.
- Learn methods for quantifying stormwater runoff and peak flows in urban catchments.
- Explore hydraulic principles relevant to urban drainage systems, including pipe flow and open channel hydraulics.
- Acquire skills in designing stormwater management infrastructure, such as detention basins and green infrastructure.
- Understand the importance of flood risk assessment and mitigation in urban areas.
- Apply hydrological and hydraulic principles to solve practical challenges in urban water management and infrastructure design.

DETAILEDSYLLABUS

MODULE-I

Review of basic hydrology; Strom water runoff, generation; Return period; Hydrologic risk; Frequencyanalysis. **(10Hrs)**

MODULE-II

IDF relationships; Design storm; Open channel flow in urban watersheds; Interception storage, Infiltration, Depression storage **(10Hrs)**

MODULE-III

Combined loss models; Estimation of runoff rates from urban watersheds; Flow routing; Storm water drainage structures Storm water detention; structural and non-**(10Hrs)**

MODULE-IV

Structural control measures; Source control techniques; urban storm water models; introduction to urbanground water systems. **(10Hrs)**

CO	COURSE OUTCOME
CO1	Analyze urban storm water systems, urban precipitation and storm water runoff
CO2	Learn quantification of impacts of climate change on short duration high intensity Rainfall in urban areas
CO3	Case studies of several cities in India are dealt with, in these minars presented by the Students
CO4	They get an exposure to a variety of urban flooding problems
CO5	Development of problem-solving skills through case studies and real-world urban water management projects.
CO6	Understanding of urban water cycle dynamics and its interaction with built environments.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Urban Hydrology, Hydraulics, and Stormwater Quality: Engineering Applications and Computer Modeling" by A. Osman Akan
2. "Urban Stormwater Hydrology: A Guide to Engineering Calculations" by G. Thomas Dalrymple
3. "Urban Hydrology: A Multidisciplinary Perspective" by Ben Urbonas, Joe Jacangelo, and Neil Weinstein
4. "Urban Hydrology, Watershed Management and Socio-Economic Aspects" by B. V. Mudgal and O. P. Singh
5. "Urban Drainage, Third Edition" by David Butler and John W. Davies

Intelligent Transportation Systems

Course code: CEO719

COURSE OBJECTIVES:

- Understand the fundamentals of Intelligent Transportation Systems (ITS) and their role in modern transportation.
- Learn about the various components of ITS, including traffic management, traveler information, and vehicle technologies.
- Explore techniques for data collection, analysis, and modeling in ITS applications.
- Acquire skills in designing and implementing ITS solutions to improve traffic flow, safety, and efficiency.
- Understand the integration of ITS with emerging technologies such as connected and autonomous vehicles.
- Apply ITS principles to address real-world transportation challenges and enhance urban mobility.

DETAILED SYLLABUS:

MODULE-I

Fundamentals of ITS: Definition of ITS, the historical context of ITS from both public policy and marketeconomic perspectives, Types of ITS; Historical Background, Benefits of ITS. **(6Hrs)**

MODULE-II

Sensor technologies and Data requirements of ITS: Importance of telecommunications in the ITS. Information Management, Traffic Management Centers (TMC).Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centers; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection. **(8Hrs)**

MODULE-III

ITS User Needs and Services and Functional areas–Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS),Advanced Rural Transportation systems (ARTS). **(8Hrs)**

MODULE-IV

ITS Architecture–Regional and Project ITS architecture;

Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and safety, ITS and security,ITS as a technology deployment program, research, development and business models, ITS planning **(10Hrs)**

MODULE-IV

ITS applications: Traffic and incident management systems; ITS and sustainable mobility, travel demandmanagement, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems-Vehicles in Platoons–Integration of Automated Highway Systems. ITS Programs in the World–Overview of IT Simple mutations in developed countries,ITS in developing countries. **(10Hrs)**

CO	COURSE OUTCOMES
CO1	Differentiate different ITS user services
CO2	Select appropriate ITS Technology depending upon site specific conditions
CO3	Design and implement ITS components
CO4	Development of problem-solving skills through ITS case studies and projects.
CO5	Knowledge of emerging technologies such as connected vehicles and smartinfrastructure.
CO6	Proficiency in analyzing transportation data and applying ITS technologies fortraffic management.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	3	3	3	1	2	3	2	1	1	3	1	-	1	-	-
CO2	L6	3	2	2	2	3	3	3	2	1	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	1	3	1	2	2	2	2	2	-	2	3
CO5	L5	3	2	2	3	2	3	3	2	3	2	2	-	2	-	-
CO6	L2	3	1	3	3	3	2	3	3	2	2	3	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Intelligent Transportation Systems: Smart and Green Infrastructure Design" by Sumit Ghosh and Tonya L. Nilsson
2. "Intelligent Transportation Systems: New Principles and Architectures" by Sumit Ghosh and Tonya L. Nilsson
3. "Principles of Intelligent Transportation Systems Planning" by Ennio Cascetta
4. "Intelligent Transportation Systems: From Good Practices to Standards" by Konstadinos G. Goulias
5. "Intelligent Transportation Systems Deployment: Concepts and Practices" by U.S. Department of Transportation

Structural geology
Course code: CEO720

COURSE OBJECTIVES:

- Understand the principles of rock deformation and tectonic processes.
- Learn methods for analyzing geological structures, including folds, faults, and foliations.
- Explore the interpretation of geological maps and cross-sections.
- Acquire skills in field techniques for structural geology mapping and data collection.
- Understand the relationship between geological structures and mineral deposits.
- Apply structural geology principles to interpret the tectonic history and deformational events in geological formations.

DETAILEDSYLLABUS

MODULE-I
Description, classification, and origin of earth structures. Ways in which the continental crust can deform; link scales of Structure from the field, out crops, hand specimen, thin section by integrating analytical techniques with practical examples. **(10Hrs)**

MODULE-II
Theoretical and macro to micro-scale analysis, of structures developed through a linked series of lectures and practical; practical 2D strain analysis; 3D strain concepts. **(10Hrs)**

MODULE-III
Incremental strain, kinematics and poly phase deformations; fold construction and classes; fault evolution and section balancing; Fault rock micro structures; **(10Hrs)**

MODULE-IV
Fault and fold mechanics, current concepts in plate tectonics, cross-section construction techniques, structural interpretation of seismic data, structural styles in different tectonic settings (thrust and fold belts, rifts, strike and slip, gravity tectonics, inversion), structural geology of reservoir units. **(10Hrs)**

CO	COURSE OUTCOME
CO1	Acquire knowledge on the geometry and type of structures present in earth
CO2	Understand and describe the features for med in rocks when subjected to stress and impact of structural geology to active tectonic settings
CO3	Interpret graphs and mode lsused demonstrate poly-phase deformations.
CO4	Structural geology to understand
CO5	Understanding of geological structures and their formation processes.
CO6	Proficiency in interpreting and analyzing geological maps, cross-sections, and field data.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	3	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	2	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	1	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. Structural Geology" by Haakon Fossen
2. "Structural Geology" by Robert J. Twiss and Eldridge M. Moores
3. "Structural Geology of Rocks and Regions" by George H. Davis, Stephen J. Reynolds, and Chuck Kluth
4. "Introduction to Structural Geology" by Richard H. Groshong
5. "Structural Geology: Fundamentals and Modern Developments" by S.K. Ghosh

Environmental, Health and Safety Management

Course code: CEO721

COURSE OBJECTIVES:

- Understand the importance of environmental, health, and safety (EHS) management in industrial settings.
- Learn regulatory requirements and standards governing EHS practices.
- Explore techniques for identifying and assessing environmental risks and hazards.
- Acquire skills in developing and implementing EHS policies, procedures, and programs.
- Understand the principles of occupational health and safety, including hazard communication and emergency response.
- Apply EHS management strategies to promote a safe and sustainable work environment while complying with legal and ethical obligations.

DETAILED SYLLABUS

MODULE-I

Occupation, Safety And Management; Occupational Safety**,** Health and Environmental Safety, Management–Principles & practices, Role of Management in Industrial Safety Organization Behaviarai on Human factors contributing to accident. Planning for Safety: Planning: Definition, purpose nature, scope and procedure. Management by objectives and its role in Safety, Health and Management (SHE)

MODULE-II

Monitoring for Safety, Health & Environment: Occupational Safety, Health and Environment Management System, Bureau of Indian Standards on Safety and Health: 14489–1998and15001–2000, ILO and EPA Standards. Principles of Accident Prevention: Definition: Incident, accident, injury, dangerous, occurrences, unsafe acts, unsafe conditions, hazards, error, oversight, mistakes etc.

MODULE-III

Education, Training and Employee Participation in Safety: Element of training cycle, Assessment of needs. Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs.

MODULE-IV

Competence Building Techniques (CBT), Concept for training safety as a non-line function. Employee Participation: Purpose, areas of participation, methods, Role of trade union in Safety, Health and Environment Protection.

MODULE-V

Management Information System: Sources of information on Safety, Health and Environment Protection. Compilation and collation of information, Analysis &use of modern methods of programming, storing and retrieval, of MIS for Safety, Health and Environment. QCCHS Computer Software Application and Limitations

CO	COURSE OUTCOME
C**O1**	Understanding of environmental regulations and standards pertaining to industry.
C**O2**	Proficiency in conducting risk assessments and implementing safety protocols.
C**O3**	Ability to develop and implement environmental management systems (EMS).
C**O4**	Knowledge of occupational health and safety practices and regulations.
C**O5**	Application of principles of pollution prevention and waste management.
C**O6**	Development of problem-solving skills through case studies and practical applications in EHS management.

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

CO	BL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	3	3	3	1	2	3	2	1	1	1	1	-	3	-	-
CO2	L6	3	2	2	2	3	3	3	2	2	2	1	-	3	-	-
CO3	L2	3	1	3	1	2	2	2	3	2	2	1	-	1	1	-
CO4	L4	3	2	1	3	3	3	1	2	2	2	2	2	-	2	2
CO5	L5	3	2	2	3	2	3	3	2	2	2	2	-	2	-	-
CO6	L1	3	3	3	3	3	2	3	3	2	2	2	-	2	-	1

3-High, 2- Moderate, 1- Low, '-' for No correlation

Reference Books

1. "Environmental, Health, and Safety Management: A Practical Guide" by Thomas D. Schneid and Alaric N. Haag
2. "Environmental Health and Safety Audits" by Lawrence B. Cahill
3. "Principles of Environmental Management" by Balwant Singh and L.C. Sharma
4. "Environmental Health and Safety Management: A Guide to Compliance" by Nicholas P. Cheremisinoff

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF CIVIL ENGINEERING

B. TECH (8th) SEMESTER SYLLABUS

Semester -VIII

Branch: Civil Engineering

Semester -VIII
CIVIL ENGINEERING

S.N.	Code	Course Title	L	T	P	Credits
1.	CE801D	Project-II			16	08
					Total Credit	08

NOTE- A Student can be allowed to do project outside after the permission of departmental Academic Committee. Those students doing project outside has present their project progress every month. Those students doing project outside can be permitted to present progress every fortnight though video conferencing. Students doing project in house has present their project progress every week.