Review of New Scheme & Syllabus

of

Third and Fourth Year (Semester-V, VI, VII and VIII)

courses

in

B. Tech. (Civil Engineering) Program

2020-21

CIVIL ENGINEERING DEPARTMENT

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

RAIPUR – 492010, CHHATTISGARH

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Semester-V

Scheme & Syllabus

National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 5th Semester					Branch: Civil
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Practical	Theory	Practical		
1	CV105101CV	Structural Analysis II	3	1	0	20	30		50		100	4
2	CV105102CV	Highway and Railway Engineering	3	1	0	20	30		50		100	4
3	CV105103CV	Design of Reinforced Concrete Structures	3	1	0	20	30		50		100	4
4		Program Elective-I	3	0	0	20	30		50		100	3
5		Open Elective-I	3	0	0	20	30		50		100	3
6	CV105401CV	Transportation Engineering Lab	0	0	2	40		20		40	100	1
7	CV105402CV	Structural Analysis Lab	0	0	2	40		20		40	100	1
8	CV105701CV	Summer Internship-I	0	0	2	-					-	1
												21

List of Courses offered as Program electives and Open electives

S.No.4: Program Elective-I			S.No.5: Open Elective-I	
Subject Code	List of Courses		Subject Code	List of Courses
CV105201CV	Geotechnical Engineering-II		CV105301CV	Project Planning and Management
CV105202CV	Modern Surveying Techniques		CV105302CV	Mechanics of composite materials

Structural Analysis II

[Vth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV105101CV

[Pre-requisites: Mechanics of Solids, Structural Analysis-I]

Course Objectives

1. To understand the concept of analysis of beams and frames by various methods
2. To understand fundamental principles of Influence line diagrams for indeterminate beams.
3. To understand and apply the concepts of plastic analysis

Course Content

Unit-1 : Concepts of Structural Analysis

Concepts of indeterminacies: Static and kinematic Indeterminacies, Degree of static and Kinematic indeterminacy and their significance in the structural Analysis. Computation of Indeterminacies of two dimensional and three dimensional skeletal structural systems, Concepts of Force Methods and Displacement methods of structural analysis.

Unit 2: Force methods of Structural Analysis

Use of Mohr's Area - moment theorems for structural analysis of propped cantilever and fixed beams. Method of Consistent deformation, Clapeyron's theorem of three moments for analysis of Continuous beams, Strain Energy method.

Unit 3 : Displacement Methods of Structural Analysis

Slope deflection methods for analysis of beams and frames, Displacement based iterative methods (Moment Distribution Methods and Kani's Method) for analysis of beams and frames.

Unit 4: Influence Line of Indeterminate beams

Concepts and use of Influence line diagrams, Qualitative and Quantitative Influence line diagrams of indeterminate beams by Muller-Breslau Principle. Use of Muller-Breslau Principle for qualitative analysis of multistoried building frames under various loadings.

Unit 5: Plastic Analysis of Structure

Introduction, Maximum strength of tensile structural system, Assumptions in bending beyond yield point, plastic moment of a section, moment curvature relationship, shape factor, plastic hinge, collapse load, basic theorems for determination of collapse loads under bending, Static and Kinematic methods. Collapse mechanisms for beams and frames.

Course Materials

Required Text: Text books

1. Intermediate of Structural analysis – Wang. C.K. (McGraw Hill Book Company, 1983)
2. Structural Analysis – Punmia B.C. (Laxmi Publications)
3. Structural Analysis (Vol.-II) – S.S. BhaviKatti S. (Vikas Publishers)

Optional Materials: Reference Books

1. Structural Analysis : A unified Approach-D S Prakash Rao, Sangam Books Limited, London E1 6EP
2. Fundamentals of Structural Analysis – Lect and Vari (Tata McGraw Hill)
3. Structural Analysis – Pandit and Gupta (Tata McGraw Hill)

Highway and Railway Engineering

[Vth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV105102CV

[Pre-requisites: None]

Course Objectives

1. To create ability in understanding the significance of development and various characteristics of road and rail transport infrastructure for the benefit of society.
2. To understand the fundamental concepts related to the planning, design, analysis, and maintenance of road and rail Transport infrastructure.
3. To create ability in implementing the scientific, technical and analytical knowledge for developing sustainable road and rail transportation system

Course Content

Unit 1: Highway Planning Principles, Alignment and Geometric Design

Highway Planning Principles: Introduction to transportation, different modes of transportation, classification of roads, network patterns, planning surveys.
Highway Alignment: Requirements and factors controlling and Engineering surveys
Geometric Design: Cross section Elements, Sight distances, Horizontal alignment and Vertical alignment.
Concepts of Highway project preparation

Unit 2: Traffic Engineering Principles and Traffic Operations

Traffic studies on flow, Speed and travel time, Highway capacity and level of service of rural highways and urban roads. Types of intersections, and channelization;
Traffic operations: traffic signs, road markings, signals and warrants.

Unit 3: Pavement Materials, Design & Construction

Experimental characterization of pavement materials; Types of pavement structures, Concepts on Analysis and Design of pavement systems; functions of pavement components, design factors.. Design of flexible and rigid pavement as per IRC methods.
Highway Construction: Types of Pavement layers, Construction of Granular, Bituminous and Cement Concrete layers.

Unit 4: Introduction, Permanent Way, Geometric Design

Role of Indian Railways in National Development – Railways for Urban Transportation –LRT & MRTS.
Permanent Way: Components and their Functions; Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks; Sleepers & Ballast – Functions, Materials, Density;
Geometric Design of Railway Tracks: Gradients and Grade Compensation, Speed types, Cant, Negative superelevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

Unit 5: Points & Crossings, Signalling & Interlocking, Stations & Yards

Design of turnouts, Classification of signals, Control systems of train movements, Points and signals interlocking, Types of Stations and Yards, Rolling Stock, Tractive Power, Track Maintenance.

Course Materials

Required Text: Text books

1. Highway Engineering - S.K Khanna, C.E.G. Justo and Veeraragavan, (Nem Chand and Bros, Roorkee, India, Tenth edition 2017).
2. Principles and Practices of Highway Engineering - L. R. Kadiyali & N. B Lal, (Khanna Publishers) New Delhi, Ninth Edition, 2017.
3. Railway Engineering - Chandra S. and M.M. Agarwal Oxford University Press, New Delhi, India, Second edition, 2013

Optional Materials: Reference Books

1. Principles of Pavement Design - Yoder, E.J. and M.W. Witczak, (John Wiley and Sons), Second Edition 2012
2. Relevant MORTH, and IRC codes and guidelines
3. Pavement Analysis and Design - Y.H. Huang, (Pearson Prentice Hall), New Jersey, USA, 2008
4. Railway Engineering- Saxena, S.C. and S.P. Arora, Dhanpat Rai and Sons, New Delhi, India, 1997.
5. Railway Track Engineering - J.S. Mundrey, Tata McGraw-Hill Education Private Limites, New Delhi, Fourth Edition, 2010.

Design of Reinforced Concrete Structures

[Vth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV105103CV

[Pre-requisites: Mechanics of Solids, Structural Analysis-I]

Course Objectives

1. To understand the material properties and philosophy of analysis and design as per codal practices
2. To understand and carryout analysis and design of structural elements such as Beams, Slabs, Columns and column footings by Limit state method as per codal practices.
3. To understand and carryout analysis and design of structural Columns and column footings by working stress method.

Course Content

Unit-1 : General Design Considerations

Properties of concrete and reinforcing steel, characteristic strengths, stress-strain curves. Study of IS 456:2000,IS 875 Part I to III & V. Basis for design, loads and forces (Dead load, live load, and wind loads).

Unit 2: Working Stress Method

Working stress, Analysis, Design & detailing by working stress method- singly and doubly reinforce sections, rectangular and T-sections. Short and long columns, eccentrically loaded columns, and footings.

Unit 3: Introduction to Design Philosophy

Limit states of design. Limit states of Collapse: flexure, shear, compression, and Torsion. Serviceability conditions- limit states of deflection and cracking, calculation of deflections. Governing reinforcement as per IS 456:2000.

Unit 4 : Design by Limit State Method- Beams and Slabs

Analysis, Design & detailing by Limit state method: singly and doubly reinforced sections, rectangular and T-sections. One way and two-way slabs and staircases. Reinforcement detailing as per SP 34 of BIS.

Unit 5: Design by Limit State Method- Columns and Columns Footings

Analysis, Design & detailing by Limit state method-pedestal short and long columns, eccentrically loaded columns. Uniaxial and Biaxial bending, Isolated Column Footings for axial and bending cases. Reinforcement detailing as per SP 34 of BIS.

Course Materials

Required Text: Text books

1. Reinforced Concrete Structures: Robert L. Park and Thomas Paulay, · 1975 (ISBN:9780471659174, 0471659177) Publisher:Wiley
2. Reinforced Concrete Limit State Design of - Jain A.K. (Nerm Chand& Bros. Roorkee,1993)
3. Relevant IS codes IS456:2000, IS 875 part1,2,3 and 5, SP-34.
4. Design Aids for Reinforced Concrete to I.S.-456-1978- SP16: 1980 (Bureau of Indian Standards, New Delhi)

Optional Materials: Reference Books

1. Reinforced Concrete Design, Second Revised Edition: S N Sinha (McGraw-Hill Education)
2. Advanced Reinforced Concrete Design: P. C. Varghese, (Prentice-Hall of India)
3. Fundamentals of Reinforced Concrete- Sinha N.C. & Roy S.K. (S. Chand & Co.)
4. Limit State Design of Reinforced Concrete –Punmia B C, Jain A K& Jain A K(Laxmi Publications)
5. Reinforced Concrete Structures- Dayaratam P. (Oxford and IBH Publishing Co. 1986)
6. Schaum's Outline of Reinforced Concrete Design- Noel J. Everard, McGraw Hill Professional.

Geotechnical Engineering - II

[Vth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV105201CV

[Pre-requisites: Geotechnical Engineering - I]

Course Objectives

1. To be able to understand and analyze the concept of stability of slopes and earth pressure for the field application related to Geotechnical Engineering.
2. To involve the application of scientific and technical principles of planning, analysis, design of foundation
3. To give an experience in the implementation of Engineering concepts which are applied in field of Geotechnical Engineering

Course Content

Unit 1 : Stability of Slopes
Embankment slopes, examples of embankment, road and earth dams, stability analysis for finite and infinite slopes, Concept of factor of safety, friction circle method, method of slices, Bishop's simplified method, limiting values of factor of safety; critical conditions for the stability of earth dams.

Unit 2: Earth Pressure
Earth Pressure at rest, active and passive earth pressure, computations using Rankine's and Coulomb's earth pressure theories, Culmann's graphical method, and additional earth pressure due to surcharge.

Unit 3: Shallow Foundations and Settlements
Common types of foundations with examples, brief illustration of situations where each one of them is adopted, basis for design, review of major soil parameters used in proportioning of shallow foundations, types and their selection, Bearing Capacity, various method of determination of bearing capacity, computation of bearing capacity in cohesion less and cohesive soils, effect of various factors on bearing capacity, use of field test data, limits of settlement, differential and permissible settlement of footing.

Unit 4: Well and Pile Foundations
Various types of caissons situations where adopted, elements of wells, types, method of construction.
Pile Foundation, their types, criteria of selection of piles, outline of steps involved in proportioning, bearing capacity and settlement of single and group of piles, design of pile groups and settlement of pile group in clay, negative skin friction.

Unit 5: Machine Foundation, Contaminated, Expansive Soil, Ground Improvement Techniques and Introduction of Rock Mechanics:
Introduction of machine foundation, types of machines and their foundations, Design criteria, Field methods of determining design Parameters, block vibration test.
I.S. code recommendations and foundation on expansive soil, identification of expansive soil, contaminated soil, problems associated with contaminated and expansive soil, design consideration of foundation on expansive soil, CNS soils. Various ground improvement techniques- grouting, stone piling, reinforced earth, Rock tests and RQD.

Course Materials

Required Text: Text books

Basic and applied Soil Mechanics (Revised Edition) – Gopal Rajan and Rao A.S.R. (New Age, New Delhi. 1998)

Optional Materials: Reference Books

1. Geotechnical Engineering: Gulhati S.K., Datta, M. (Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005).
2. Soil Engineering in Theory and Practice (Vol-II) – Alam Singh (Asia Publishing House, New Delhi)
3. Foundation Engineering (2nd Edition) – Peck, R.B., Hanson (W.E. and Thornburn. W.H. Johan Wiley, New York 1976)
4. Foundation design and Construction (5th Edition) – Tomlinson, M.J. (ELBS, Singpore. 1988)
5. Foundation Analysis and Designing – J.E. Bowles (McGraw Hill, New Delhi)
6. Soil Engineering in Theory and Practice (Vol. - II) – Alam Singh (Asia Publishing House, New Delhi, 1981)

Modern Surveying Techniques

[Vth Semester, Third Year]

Course Description			
Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV105202CV

[Pre-requisites: Surveying]

Course Objectives

1. Understanding modern surveying equipment and surveys
2. Using various modern equipment/technology related to EDM, Total Station, GPS, Photogrammetry, Laser Scanners etc.
3. Application of the modern surveying techniques in solving engineering problems.

Course Content

Unit 1: Modern Surveying Equipment and Surveys

Electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, Total Station and GPS: Basic principles, classifications, applications, comparison with conventional surveying.

Unit 2: Global Positioning System

Global Positioning System – working principle and methods, reference systems, satellite orbits, GPS observations, Different Approaches to use GPS and their accuracies, Advantages of GPS in Navigation, Survey, Planning and Mapping. Overview of GNSS.

Unit 3: Photogrammetry

Aerial and terrestrial, applications of photogrammetry, types and geometry of aerial photograph, flying height and scale, relief(elevation) displacement.

Unit 4: Applications of Lasers

Point cloud, Lasers in distance, angular and volumetric measurements, Laser Scanning for mapping, Multi-sensor surveying.

Unit 5: Case Studies

Structural/3D modelling, Topographic mapping and Road profiling using modern techniques, methods, and software.

Course Materials

Required Text: Text books

1. Punmia B. C, Ashok K. Jain, Arun K. Jain, Higher Surveying, Laxmi Publications, 2005.
2. Lilles and, T.L., and Kiefer, R.W., “Remote Sensing and Image Interpretation, 4th Edition, John Wiley & Sons, 2005

Optional Materials: Reference Books

1. Agarwal, C.S. and Garg, P.K., “Remote Sensing in Natural Resources Monitoring and Management”, Wheeler Publishing House.2000
2. Bossler, J.D., “Manual of Geospatial Science and Technology”, Taylor and Francis.2002
3. Burrough, P.A. and McDonnell, R.A., “Principles of Geographic Information System”, Oxford University Press.2000
4. Borden D. Dent, Jeffrey Troguson, Thomas W. Hodler, Cartography: Thematic Map Design, McGraw-Hill Higher Education, 2008.
5. Hoffman.B, H.Lichtenegga and J.Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001

Project Planning and Management

[Vth Semester, Third Year]

Course Description			
Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV105301CV

Course Objectives

1. To understand project management fundamentals for managing small and large scale projects.
2. To understand and apply planning, scheduling and controlling of various activities in a project.
3. To learn and apply various project management tools and techniques in various projects.

Course Content

Unit 1: Introduction

Concept of project, planning and management and its features, Types & characteristics of construction projects, organization of construction project, project categories, project planning & organization systems, Stakeholders in a Project, heavy construction projects, construction industry in India

Unit 2: Project Planning and Scheduling

Work scope planning, project work breakdown structures, bar charts, network analysis fundamentals, network elements, network development, CPM network development and analysis, PERT, CPM vs. pert, precedence network analysis fundamentals, line of balance, network updating, resource allocation and scheduling fundamentals, leveling & smoothing, time–cost analysis

Unit 3: Project Contracts and Safety

Project contracts and its types, tendering procedure; Construction hazards & safety measures, Safety management systems, Safety training, Safety audit, project management techniques for safety management.

Unit 4: Construction Equipments and Plants

Classification of construction equipment, types & characteristics of construction equipment, equipment capacities & costs, machine power, dozers, scrapers, excavators, trucks & hauling equipment, draglines & clamshells, pile driving equipment, selection of equipment, acquisition of equipment, time value of money for heavy construction equipment. Batching Plants: Cement Concrete, Bituminous Concrete and Aggregate mixes.

Unit 5: Construction Economics

Need & types of project appraisals, concepts of financial appraisal, finance source for heavy construction projects, methods of financing the heavy construction projects, major financing bodies, economic evaluation of project, Indian practice of investment appraisal, time value of money, analysis of risk, discounted and non-discounted cash flow methods.

Course Materials

Required Text: Text books

1. Construction Project Management Planning, Scheduling and Control – Chitkara, K.K. (Tata McGraw Hill Publishing Co., New Delhi,)
2. R E Levitt and N M Samelson, Construction Safety Management, John Wiley and Sons, New York, 1993
3. R L Peurifoy, Construction Planning, Equipment, and Methods, Tata McGraw-Hill, New Delhi, 2002

Optional Materials: Reference Books

1. F Harris and R McCaffer, Modern Construction Management, Seventh Edition, Blackwell Publishers, Oxford, 2013.
2. K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015.
3. P Chandra, Projects: Planning, Analysis, Selection, Financing, Implementation, and Review, Tata McGraw-Hill, New Delhi, 2009

Mechanics of composite materials

[Vth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV105302CV

Course Objectives

1. To understand the mechanical behavior of anisotropic materials and how they differ from isotropic materials.
2. Familiarization with the basic expressions and methods used in the mechanics of composite structures.
3. To use failure theories to determine the composite lamina failure.

Course Content

Unit 1: Introduction to Composite Materials

Composites Definition, Fibers and Matrix materials, Types of composites, Classification: Metal matrix, Ceramic matrix and Carbon-Carbon composites; Polymer matrix composites, Advantages, Applications and Fabrication Methods of Composites.

Unit 2: Macromechanical Behavior of a Lamina

Generalized Hooke's law, Material symmetry: Anisotropic, Monoclinic, Orthotropic and transversely isotropic and isotropic materials, Plane stress constitutive equations, Transformation of stress and strain, Stiffness and Compliances Matrices of a Lamina. Hygro-thermal effects in Lamina.

Unit 3: Micromechanical Behavior of a Lamina

Develop concepts of volume and mass fractions of fiber and matrix, density and void fraction in composites.

Determine the effective mechanical and hygrothermal properties of composite using strength of material approach: Axial Modulus, Transverse Modulus, Poison's Ratio, Shear Modulus, Coefficients of Thermal Expansion, and Coefficients of Thermal Expansion.

Unit 4: Macromechanical Analysis of a Laminate

Introduction to Classical Plate Theory, Laminate stacking sequence, Laminate Constitutive relationship, Types of Laminates, Special cases of laminates, Hygro-thermal effects in Laminate.

Unit 5: Failure, Analysis and Design of Laminates

Damage Mechanisms in Unidirectional Composites: micro-level, matrix-level, coupled mechanisms.

Fundamental Failure Theories, Lamina Failure Theories: Maximum Stress Theory, Maximum Strain Theory, Tsai-Hill Theory, Hoffman Theory, Tensor Polynomial Failure Criterion (Tsai-Wu) .

Course Materials

Required Text: Text books

1. Autar K. Kaw, Mechanics of Composite Materials , CRC-LLC Press
2. R. M. Jones, Mechanics of Composite Materials, CRC Press
3. CT Herakovich, Mechanics of Fibrous Composites, John Wiley & Sons, Inc. New York

Optional Materials: Reference Books

1. M. Mukhopadhyay, Mechanics of Composite Materials, University Press
2. S. Daniel and Ori Ishai, Engineering Mechanics of Composite Material, Oxford University Press
3. B.D. Agarwal and L.J. Broutman, Analysis and Performance of Fiber Composites, John Wiley & Sons.

Transportation Engineering Lab

[Vth Semester, Third Year]

Course Description			
Offered by Department	Credits	Status	Code
Civil Engineering	0-0-2, (1)	Laboratory	CV105401CV

Course Objectives

1. To develop an ability in understanding the behavior of aggregates and Bitumen under different types of loading.
2. To understand the procedure for testing of various physical and mechanical properties of aggregate and Bitumen and its mixtures.
3. To interpret the test results of aggregates, Bitumen and its mixtures by comparing with standard specifications.

Course Content

A. Aggregate Tests

1. To determine the Abrasion value of aggregates
2. To determine the Impact value of aggregates
3. To determine the Crushing value of aggregates
4. To determine the Specific Gravity and Water Absorption of aggregates
5. To determine the combined Flakiness & Elongation index value of aggregates

B. Bitumen Tests

1. To determine the Penetration value of Bitumen sample
2. To determine the Specific Gravity value of Bitumen sample
3. To determine the Softening point value of Bitumen sample
4. To determine the Absolute and Kinematic Viscosity value of Bitumen sample
5. To determine the Flash and Fire point value of Bitumen sample
6. To determine the Ductility value of Bitumen sample
7. To determine the Binder Content of Bitumen mixtures
8. To determine the Marshall Stability value of Bitumen mixtures

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Course Materials

Required Text: Text books

1. Indian Standards IS 2386 (Part-1 to Part-8), “Methods of Test for Aggregates”
2. Indian Standards IS 1201 to 1220, “Methods for testing Tar and Bituminous Materials”.

Optional Materials: Reference Books

1. MoRTH (Fifth Revision) 2013, Specifications for Roads and Bridges
2. MoRD (First revision), 2014, “Specifications for Rural roads”.
3. Relevant ASTM standards for testing of Aggregates and Bituminous materials

Structural Analysis Lab

[Vth Semester, Third Year]

Course Description			
Offered by Department	Credits	Status	Code
Civil Engineering	0-0-2, (1)	Laboratory	CV105402CV

Course Objectives

1. To develop an understanding of the effects of different types of forces and support conditions in structural members.
2. To introduce the students to the available software for the analysis of structural members.
3. To impart the importance of analysis methods in the field of civil engineering.

Course Content

1. To study the behavior of beams with respect to the support conditions and loadings.
2. To study the effects of change in material properties and cross-section areas in a beam.
3. To study the behavior of 2-dimensional trusses.
4. To study the influence line diagram for beams and trusses.
5. To study the behavior of two hinged and three hinged arches.
6. To study the portal frames under different loading and support conditions.
7. To study slabs under different loading and support conditions.
8. To study the effects of lateral loading in the structures.
9. To study unsymmetrical bending and torsion in the beams.
10. To study the behavior of 3-dimensional trusses.

Course Materials

Required Text: Text books

1. Reddy, Basic Structural Analysis, Tata McGraw Hill, Third Edition
2. Wang, Intermediate Structural Analysis, Tata McGraw Hill, Second Edition
3. Prakash Rao, Graphical Method of structural Analysis, Universities Press, First Edition

Optional Materials: Reference Books

1. Kassimali, Structural Analysis, Cengage, Fifth Edition
2. Hibbler, Structural Analysis, Pearson Publication, Ninth Edition
3. Willbur and Norris, Elementary Structural Analysis, Literary Licensing, First Edition
4. Menon, Structural Analysis, Narosa Publication, Third Edition
5. Negi, Structural Analysis, Tata McGraw Hill, Second Edition

Semester-VI

Scheme & Syllabus

National Institute of Technology Raipur													
Course of Study and Scheme of Examination							B. Tech. 6th Semester				Branch: Civil	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	CV106101CV	Design of Steel Structures	3	1	0	20	30		50		100	4
2	CV106102CV	Environmental Engineering-I	3	1	0	20	30		50		100	4
3	CV106103CV	Quantity Surveying, Cost Estimation & Valuation	3	1	0	20	30		50		100	4
4		Program Elective-I	3	0	0	20	30		50		100	3
5		Open Elective-I	3	0	0	20	30		50		100	3
6	CV106401CV	Environmental Engineering Lab	0	0	2	40		20		40	100	1
7	CV106402CV	Computer applications in Civil Engineering Lab	0	0	2	40		20		40	100	1
												20

List of Courses offered as Program electives and Open electives

S.No.4: Program Elective-I	
Subject Code	List of Courses
CV106201CV	Advanced Structural Analysis
CV106202CV	Advanced hydrology
CV106203CV	Geo-synthetics and Reinforced soil
CV106204CV	Advanced Pavement Engineering

S.No.5: Open Elective-I	
Subject Code	List of Courses
CV106301CV	Air & Noise Pollution and Control
CV106302CV	Construction Management

Design of Steel Structures

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV106101CV

[Pre-requisites: Mechanics of Solids, Structural Analysis-I]

Course Objectives

1. To familiarize the students with available national codes for steel design.
2. To understand the basis of design of steel structures.
3. To understand the design process of structural members, their connections, and application of built-up sections.

Course Content

Unit 1: Materials and Methods of Analysis

Properties of structural steel, methods of design of steel structures, types of loads and load combinations, plastic analysis of beams and frames.

Unit 2: Connections and Tension Members

Riveted, bolted and welded connections, design of joints, design of eccentric connections, and design of axially loaded tension members.

Unit 3: Compression Members

Design of columns, design of built-up compression members: laced and battened columns, design of slab and gusseted bases.

Unit 4: Beams

Design of laterally supported and laterally unsupported beams, built-up sections, web crippling, web buckling, and curtailment of flange plates.

Unit 5: Member Subjected to Combined Forces

Design of members subjected to combined forces, eccentricity of load, interaction formulae, eccentrically loaded base plates.

Course Materials

Required Text: Text books

1. Design of Steel Structures– Subramanian, N. (Oxford University Press)
2. Limit State Design of Steel Structures – Duggal, S. K. (McGraw Hill)

Optional Materials: Reference Books

1. Design of Steel Structures –Gaylord, E. H. and Gaylord, C. N. (McGraw Hill)
2. Steel Structures: Design and Behavior–Salmon, C. G. and Johnson, J. E. (Pearson)
3. Design and Drawing of Steel Structures– Bhavikatti, S. S. (I. K. International)

Codes:

1. IS 800: 2007- General Construction in Steel-Code of Practice
2. SP 6-1 (1964)- ISI Handbook for Structural Engineers - Part 1: Structural Steel Sections
3. IS 808: 1989- Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections
4. IS 816: 1969 – Code of Practice for use of Metal Arc Welding for General Construction in Mild Steel
5. IS 3757: 1985 High Strength Friction Grip Structural Bolts

Environmental Engineering -I

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV106102CV

[Pre-requisites: Engineering Chemistry]

Course Objectives

1. To plan and design various components of water supply scheme.
2. To carry out the analysis of various water quality parameters and to design various units of water treatment plant.
3. To identify the sources, appreciate the effects, and methods of control of air and noise pollution.

Course Content

Unit 1: Water supply schemes

Necessity and importance of water supply schemes.

Classification of water demands, Estimation of quantity of water required by a town, per capita demand, factors affecting per capita demand, design period and population forecasting, variations in water demand.

Surface sources and underground sources, Intake works, site selection, type of intake works.

Unit 2: Water characteristics and treatment

Common impurities, physical, chemical, and biological characteristics of water, water quality standards for municipal and domestic supplies.

Water Treatment: Necessity and objects of water treatment, flow diagrams of treatment schemes for ground water and surface water systems.

Water treatment unit operations and processes: Aeration, Sedimentation - Theory of sedimentation, sedimentation with coagulation, coagulation-flocculation theory, coagulants and coagulant aids, optimum coagulant dose, sedimentation tanks, design parameters.

Unit 3: Water treatment

Filtration: Theory of filtration, slow sand and rapid sand filters, construction and operation.

Disinfection: Methods of disinfection, Chlorination, Types of chlorination.

Softening and other treatments: Methods of Softening, Iron and Manganese Removal, De-fluoridation. Removal of taste, odour, and colour. Advanced water treatment systems.

Unit 4: Water distribution system

Water distribution, distribution reservoir, hydraulic analysis and design of water distribution system. Building water supply.
Pipe appurtenances. types of pipe joints and fittings.

Planning of water supply projects and implementation.

Unit 5: Air and noise pollution

Air Pollution: Introduction, sources, various air pollutants, characteristics, effects of air pollution; dispersion and control.

Noise Pollution: Definition, sources, effects of noise pollution, methods of noise measurement and control.

Course Materials

Required Text: Text books

1. Peavy, H. S., Rowe D.R., and Tchobanoglous G., Environmental Engineering, McGraw Hill, New York (1985)

2. Sawyer C. N., McCarty, P. L. and Parkins, G. F., Chemistry for Environmental Engineering and Sciences, McGraw Hill New York (2003)

Optional Materials: Reference Books

1. CPHEEO manual on Water Supply and Treatment, Ministry of Urban Development (1999).
2. Qasim S R., Motley E. M. and Zhu G., Water Works Engineering- Planning, Design and Operation, Prentice Hall (2000).
3. Water Treatment: Principles and Design, 3rd Edition. John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous. Wiley.
4. Mackenzie L. Davis, Water & Wastewater Engineering: Design Principles and Practice, McGraw Hill (2020).

Quantity Surveying, Cost Estimation & Valuation

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV106103CV

[Pre-requisites: Civil Engineering Drawing, Building Construction]

Course Objectives

1. To understand the basic concepts of quantity surveying, Methods and rules of measurement and estimates for various types of construction activities
2. To understand and carryout quantity estimation and rate analysis for various construction activities.
3. To understand concepts on types of contracts and valuation of property.

Course Content

Unit 1: Introduction

Quantity surveying, Estimate, Purpose of Estimating, Units of Measurements, Rules and Methods of measurement of works, Different types of Estimates, Approximate Estimate.

General Terms

Contingencies, Work-charged Establishment, Tools and Plants, Lump-sum, Departmental Charges, External Services, Administrative Approval, Expenditure Sanction, Technical Sanction, Measurement Book, Muster Roll, Imprest account, Indent of stores, Material at site account, Stock account.

Unit 2: Quantity Estimate

Data required, detailed estimate of Civil Engineering works; Buildings, Roads, Canals, R.C.C. works, Bar bending schedule, Water supply and Sanitary works.

Unit 3: Analysis of Rates

Purpose, Factors effecting the Rate Analysis, Analysis of Rates of different items such as; Brick work, Cement Concrete work, Plastering, Flooring (Cement Concrete, Tiles, Mosaic), Use of Schedule of Rates.

Specifications

Necessity, Basic Principles, Types: General and Detailed specifications for various items of works.

Unit 4: Contracts

Essentials of Contracts, Types of Engineering Contract, Conditions, Termination of Contract, Earnest Money, Security Deposit, Liquidated damage, Arbitration, Escalation.

Tender

Brief idea, Tender from, Tender documents, Tender Notice, Global Tender, Informal Tender, Unbalanced Tender, Acceptance of Tender.

Unit 5: Valuation of Property

Purpose, Definitions of Terms related to Valuation, Factors affecting the valuation of a property, Different Methods of Valuation, Concept of Capitalized value and Year's Purchase, Depreciation, Obsolescence, Lease, Mortgage, Easement.

Course Materials

Required Text: Text Books

1. Estimating and Costing in Civil Engineering- B.N. Dutta (UBS Publishers, New Delhi)
2. Estimating, Costing, Specification & Valuation in Civil Engineering- M. Chakraborti (M. Chakraborti, Calcutta)

Optional Materials: Reference Books

1. Textbook of Estimating and Costing -G.S. Birdi (Dhanpat Rai Publication)
2. Valuation of Real Properties- S.C. Rangwala (Charotar Publication)
3. A Textbook of Estimating and Costing- Kohli & Kohli (S. Chand & Co.)
4. SP 27: Handbook of Method of Measurement of Buildings Works. (BIS)
5. IS 1200: Methods of Measurement of Building and Civil Engineering Works. (BIS)

Advanced Structures Analysis

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV106201CV

[Pre-requisites: Structural Analysis-I & II]

Course Objectives

1. To equip students with different methods of analysis using matrix approach.
2. To analyze static and kinematic indeterminate structural systems using matrix flexibility and stiffness methods.
3. To impart students, the concepts of making of structural analysis software.

Course Content

Unit 1

Introduction to matrix algebra, matrix operations and Gauss-Jordan elimination method. Basic concept of analysis, static and kinematic indeterminacy, formulation of stiffness and flexibility matrices, application to simple problems, comparison between stiffness and flexibility methods.

Unit 2

Stiffness matrix methods of analysis for bars, springs, beams and inextensible plane frames.

Unit 3

Concepts of local and global axis system, co-ordinate transformation matrix, Stiffness matrix method of analysis for plane trusses. Introduction of analysis of space trusses.

Unit 4

Stiffness matrix method of analysis for plane frames. Introduction of analysis of space frames.

Unit 5

Computer applications in structural analysis: Development of algorithm for analysis of different types of structures by matrix stiffness method.

Course Materials

Required Text: Text Books

1. Kassimali, A. - Matrix Analysis of Structures, (Cengage Learning).
2. Pandit and Gupta - Structural Analysis: A Matrix Approach, (McGraw Hill).

Optional Materials: Reference Books

1. Singh, P. K. - Matrix Analysis of Structures, (Cengage Learning).
2. Maity, D. - Computer Analysis of Framed Structures, (I.K.International).
3. Weaver, W., Gere, J. M. -Matrix Analysis of Framed Structures, (CBS Publishers).

Advanced Hydrology

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV106202CV

[Pre-requisites: Engineering Hydrology]

Course Objectives

1. To understand the types of models used in hydrology.
2. Applying the basic knowledge of engineering hydrology, probability and statistics in formulation of hydrologic models.
3. To simulate models for various scenarios.

Course Content

Unit 1

Hydrologic Principles- hydrologic cycles and weather, hydrologic losses; Mathematical Models of Watershed Hydrology.

Unit 2

Hydrologic Analysis - watershed concepts, rainfall-runoff, hydrograph analysis, unit hydrograph theory, linear and kinematic wave model, overland flow models.

Unit 3

Routing - lumped flow, distributed flow, dynamic wave routing, Muskingum method. Saint-Venant Equations - Reynold's transport theorem, continuity equation, momentum equation, energy equation.

Unit 4

Hydrologic Statistics - statistical parameter estimation, probability distribution, goodness of fit, concepts of probability weighted moments & L –moments, frequency analysis, Markov process, Markov chain, reliability analysis.

Unit 5

Hydrologic Simulation Models - steps in watershed modeling, major hydrologic models.

Course Materials

Required Text: Text Books

1. Chow, V. T., D. R. Maidment, and L. W. Mays; "Applied Hydrology", McGraw Hill International Editions.
2. Reddy, P. J, “Stochastic Hydrology”, Laxmi Publication

Optional Materials: Reference Books

1. Bras, R. L., and Rodriguez-Iturbe, 1994, "Random Functions and Hydrology", Dover Publications, New York.
2. Haan, C. T., 2002, "Statistical Methods in Hydrology", 2nd ed., Blackwell Publishing, Ames, IA.
3. Hoskings, J. R. M. and J. R. Wallis, 1997, "Regional Frequency Analysis, An Approach Based on L-Moments", Cambridge University Press, New York.
4. Viessman Jr., W., and G. L. Lewis, "Introduction to Hydrology", 4th ed., Harper-Collins, New York, 1996.

Geosynthetics and Reinforced Soil

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective -I	CV106203CV

[Pre-requisites: Geotechnical Engineering - I]

Course Objectives

1. To understand of the behavior of geosynthetics for engineering application.
2. To be able to analyze and use of geosynthetics in various field applications.
3. To be able to determine the design data for the design of various structure by the use of geosynthetics materials.

Course Content

Unit 1: Types and functions
Introduction, Materials and manufacturing processes, Testing and evaluations, Principles of soil reinforcement.

Unit 2: Design of geosynthetics
Design and construction of geosynthetic reinforced soil retaining structures- walls and slopes.

Unit 3: Improvement of soils
Codal Provisions, Bearing Capacity improvement, embankments on soft soils, Indian experiences

Unit 4: Geosynthetics in pavements
Geosynthetics in roads and railways, Reinforced Earth walls separations, drainage and filtering in road pavements and railway tracks, overlay design and construction, AASTHO and other relevant guidelines, trench drains.

Unit 5: Geosynthetics in Environmental control

Liners for ponds and canals, covers and liners for landfills-material aspects and stability considerations, Landslides-occurrences and methods of mitigation, Erosion- causes and techniques for control.

Course Materials

Required Text: Text Books

Gulhati S.K., Datta, M.: Geotechnical Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi

Optional Materials: Reference Books

1. Terzaghi, K. and Peck B., “Soil Mechanics in Engineering Practice”, John Wiley & Sons, New York, 2nd Edition, 1967.
2. Das B. M., “Advanced Soil Mechanics”, Taylor & Francis Publishers, 2nd Edition, 1997.
3. Gopal, Ranjan and A.S.R. Rao, “Basic and Applied Soil Mechanics”, New Age International Publishers, 2nd Edition, 2000.
4. Lambe and Whitman, “Soil Mechanics”, John Wiley & Sons Inc., 1969.
5. Arora, K.R., “Soil Mechanics and Foundation Engineering” Standard Publishers Distributors, 5th ed., 2005..

Advanced Pavement Engineering

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV106204CV

[Pre-requisites: Highway and Railway Engineering]

Course Objectives

1. To understand of the behavior of pavement Materials and modeling under various traffic and environmental conditions.
2. To analyze and design of pavement systems for Road, Rail and Air transport.
3. To understand the importance and techniques for preservation of pavement infrastructure.

Course Content

Unit 1: Introduction

Types of pavements: Conventional and Non-conventional. Components of pavement structure, function and its requirements

Unit 2: Pavement materials: Design and Modeling

Materials used in pavement construction: aggregate, Portland cement, asphalt, Portland cement concrete, asphalt concrete; Aggregates: production, properties, testing procedures, gradation and blending; Portland cement based materials: mixture design, production, properties, testing, construction; Asphalt binder: refining process, properties, testing procedures, grading systems; Asphalt concrete mixture design: fundamentals of mix design procedure, mixture volumetric, current mix design procedures; Factors affecting material behavior: temperature, rate, time, confining pressure; Unbound materials: soil, aggregate; Bound materials: binding using asphalt, water, lime, polymer, fly ash, cement; Constitutive models: unbound materials, bound materials; Field performance of pavement materials: fatigue, rutting, temperature issues, moisture damage, permeability; Utilization of Industrial by products and locally available materials

Unit 3: Analysis and Design of Pavement systems

Stresses and strains in pavement system: traffic, environment considerations; Factors for Design of pavements: Drainage consideration, Analysis & Design of Flexible and Rigid pavements: Urban and rural roads, Design of Permanent way, Airfield Pavement, Helipads, Pavement Classification Number.

Unit 4: Pavement Construction and Quality Control

Construction of subgrade, Embankments, Unbound and Bound Granular layers, Bituminous layers, Dry lean Concrete layers, Cement Concrete layers, Quality control of Pavement layers: Testing and practices.

Unit 5: Pavement Maintenance

Pavement Failures, Performance evaluation of pavement systems using NDT techniques, Introduction to overlay design, strengthening of flexible pavement by overlay -Flexible overlay, Rigid overlay. Strengthening of rigid pavement by overlay –Flexible overlay over rigid pavement, Rigid overlay over rigid pavement, Unbounded rigid overlay, Partially bonded rigid overlay.

Course Materials

Required Text: Text Books

1. L R Kadiyali and NB Lal, Principles and Practices in Highway Engineering (including Expressway and Airport Engineering), Khanna Publishers, New Delhi, 2017
2. Y H Huang, Pavement Analysis and Design, Pearson Prentice Hall, New Delhi, 2013.

Optional Materials: Reference Books

1. E J Yoder and M W Witczak, Principles of Pavement Design, Wiley India Pvt. Ltd., New Delhi, 2012.4.
2. R B Mallick and T El-Korchi, Pavement Engineering –Principles and Practice, CRC Press, Taylor and Francis Group, Boca Raton, Florida, 2013.5.
3. Relevant IRC, FAA and AASHTO Codes of Practices

Air & Noise Pollution and Control

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV106301CV

[Pre-requisites: None]

Course Objectives

1. To identify various air pollutants, their sources, their measurement, transport mechanism and dispersion, and their control.
2. To evaluate and develop the emission factors and source apportionment.
3. To identify the sources, appreciate the effects, and carry out the monitoring and control of noise pollution.

Course Content

Unit 1: Air Pollution: Introduction, Sources and Measurement

Introduction, classification, sources, effect of air pollutants on regional and global climate, air quality standards, measurement / monitoring techniques and guidelines for gaseous and particulate air pollutants, stack monitoring.

Unit 2: Air Pollution Meteorology and Dispersion Modeling

Meteorological parameters influencing the air pollutants, lapse rate, atmospheric stability conditions, mixing height, plume behavior and air quality modeling; types and classification of models, factors to be considered, dispersion model (Gaussian).

Unit 3: Emission Inventories and Source Apportionment

Emission inventories techniques, evaluation of emission factors, source apportionment techniques (Positive Matrix Factorization (PMF), Chemical Mass Balance (CMB) model).

Unit 4: Air Pollution Control at Source

Air pollutants control and removal of gaseous and particulate pollutants; engineering control concepts, process change, alternative fuel, control devices and systems.

Unit 5: Noise Pollution and Its Control

Introduction, basics of noise pollution; sound power, sound intensity and sound pressure level. Sources and effects of noise pollution on human health. Noise standard and limit values, noise pollution measurement/ monitoring techniques, noise mapping.

Course Materials

Required Text: Text Books

1. Wark K., Warner C. F. and Davis W., Air Pollution, its Origin and Control, Pearson (1998).
2. De NeversN., Air Pollution Control Engineering, Mc Graw Hill (2000)
3. Environmental Noise Pollution- P E Cunniff, Mc Graw Hill New York, 1987.i

Optional Materials: Reference Books

1. Seinfeld, J. H. and Pandis, S. N., Atmospheric Chemistry and Physics: from Air Pollution to Climate Change, John Wiley, New York, 1998
2. Mycock, J. C., McKenna, J. D. and Theodore, L., Handbook of Air Pollution Control Engineering and Technology, CRC, Lewis Publishers, Boca Raton, Florida ,1998
3. Hinds, W. C., Aerosol Technology: Principles, Behavior and Measurement of Airborne Particles, Wiley: NY, 1982
4. Turner, D. B., Workbook of Atmospheric Dispersion Estimate, CRC Press (1998)
5. Rao, C. S., Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996

Construction Management

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV106302CV

[Pre-requisites: None]

Course Objectives

1. Latest management tools for effectively managing construction sites.
2. An ability to optimise the resources at site
3. An ability to complete project successfully.

Course Content

Unit 1: Introduction

Introduction of Construction Management, The project life cycle, Construction economics, Legal and regulatory requirements, Role of project manager, factors behind the success of a construction organization, Ethical conducts for engineers

Unit 2: Organizing for Project Management

Trends in Modern Management-Strategic planning and project programming- Effects of project risks on organization- Traditional designer-Constructor sequence-Professional construction management-Owner-Builder-Operation-Turnkey operation-Leadership and Motivation for the Project team-Interpersonal behaviour in project organization-perceptions of Owners and Contractors

Unit 3: Design and Construction Process

Design and construction as an integrated system-Innovation and technological Feasibility-Innovation and technological feasibility-Design Methodology-Functional Design-Physical Structures-Geo- Technical Engineering Investigation-Construction Site Environment-Value engineering-Construction Planning-Industrialized Construction and Prefabrication-Computer -Aided Engineering, Total quality management,

Unit 4: Labour, Material and Equipment Utilization

Labour Productivity-Factors Affecting Job-Site Productivity-Labour Relations in construction-Problems in collective bargaining-Materials Management-Materials Procurement and Delivery- Inventory control-Tradeoffs of cost in Material Management-Construction Equipment- Choice of Equipment and Standard production Rates-Construction Processes Queues and Resource Bottlenecks, Construction safety management

Unit 5: Cost Estimation

Project cost and value management, Costs Associated with Construction Facilities-Approaches to cost estimation-Type of construction cost estimates- Effects of scale on construction cost-Unit cost-Method of estimation-Methods for allocation of joint costs- Historical cost data-Cost indices-Applications of cost Indices to Estimating-Estimate based on Engineers List of Quantities-Allocation of Construction costs over time.

Course Materials

Required Text: Text Books

1. Construction Project Management Planning, Scheduling and Control – Chitkara, K.K. (Tata McGraw Hill Publishing Co., New Delhi,)
2. Construction Project Management, theory and practice by Kumar Neeraj Jha

Optional Materials: Reference Books

1. Project Mangement: A systems Approach to Planning, Scheduling and Controlling – Harold Kerzner (CBS Publishers & Distributors, Delhi)

Environmental Engineering Lab

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	0-0-2, (1)	Laboratory	CV106401CV

[Pre-requisites: None]

Course Objectives

1. To carry out the sampling and preservation techniques involved during the collection, transportation, storage and analysis of water and wastewater samples.
2. To understand the role of the various factors governing the performance of water/sewage treatment plant and their interpretation.
3. To carry out air and noise pollution measurements.

Course Content

Analysis of Water Quality: Determination of pH, turbidity, conductivity, hardness, alkalinity, chlorides, sulphates, fluorides, phosphate, optimum coagulant dose, heavy metals, residual chlorine, available chlorine in bleaching powder.

Analysis of Wastewater Characteristics: Solids analysis, dissolved oxygen, BOD, COD, determination of most probable number.

Monitoring of Air pollutants: Determination of PM_{10}, $PM_{2.5}$ and gaseous pollutants in ambient air.

Noise Monitoring: Ambient Noise Monitoring by sound level meter.

List of Experiments: Analysis of water and wastewater samples

1. To determine pH, acidity, alkalinity and hardness.
2. Determination of Turbidity.
4. To determine chloride content.
5. To determine D.O., BOD and COD content.
6. Determination of quantity of Optimum Coagulant Dose.
7. Determination of solids- suspended, dissolved, total, settleable, organic and inorganic.
8. Determination of TKN.
9. Determination of Phosphates.
10. Determination of Most Probable Number.
1. 10.Microbiological Examination.
11. Determination of particulates (PM_{10} and $PM_{2.5}$) in ambient air by gravimetric method.
12. Determination of ambient noise level by sound level meter

Course Materials

Required Text: Text Books

Sawyer C. N., McCarty, P. L. and Parkins, G. F., Chemistry for Environmental Engineering and Sciences, Mc Graw Hill New York (2003)

Optional Materials: Reference Books

1. Standard methods, Standard method for the examination of water and wastewater, American Public Health Association, Washington, D.C (1998).
2. Ramp, H.H. and Krist, H., Laboratory Manual for the Examination of Water, Wastewater, and soil, VCH publishers, Weinheim, 1998.
3. Indian standard, IS 3025-39 (1991),; Methods of sampling and test (physical and chemical). Indian standard codes, IS 3025 IS 5182, IS 11255, IS 8829, IS 3028, IS 10500

Computer applications in Civil Engineering Lab

[VIth Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	0-0-2, (1)	Laboratory	CV106401CV

[Pre-requisites: None]

Course Objectives

To be able to develop computer programs on civil engineering problems.

Course Content

List of Experiments:

1. Software Basics : General commands and features
2. Computer program on simple Civil Engineering examples.
3. Computer program on Cost Estimation.
4. Computer program on applications in Surveying.
5. Computer program on applications in Geotechnical Engineering.
6. Computer program on applications in Water resources engineering.
7. Computer program on applications in Structural Engineering.

Course Materials

Required Text: Text Books

1. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers- Rudra Pratap (Oxford University Press)
2. MATLAB Programming for Engineers - Stephen J. Chapman (Cengage Publication)
3. Excel VBA Programming For Dummies- by Michael Alexander, John Walkenbach

Optional Materials: Reference Books

Civil Engineering Books related to the Topics Covered.

Semester-VII

Scheme & Syllabus

National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 7th Semester				Branch: Civil	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	CV107101CV	Environmental Engineering II	3	1	0	20	30		50		100	4
2		Program Elective-I	3	0	0	20	30		50		100	3
3		Program Elective-II	3	0	0	20	30		50		100	3
4		Open Elective-I	3	0	0	20	30		50		100	3
5	CV107401CV	Structural Engineering Drawing Lab	0	0	2	40		20		40	100	1
6	CV107501CV	Project Work	0	0	8	40		20		40	100	4
7	CV107701CV	Summer Internship-II				-					-	2
												20

List of Courses offered as Program electives and Open electives

S.No.2: Program Elective-I	
Subject Code	List of Courses
CV107201CV	Irrigation & Hydraulic Structures
CV107202CV	Seismic Design of Buildings
CV107203CV	Probabilistic approaches in Civil engineering

S.No.3: Program Elective-II	
Subject Code	List of Courses
CV107251CV	Advanced Design of Reinforced Concrete Structures
CV107252CV	Intelligent Transportation Systems
CV107253CV	Rock Engineering

S.No.4: Open Elective-I	
Subject Code	List of Courses
CV107301CV	Environmental Impact Assessment & Environmental Management
CV107302CV	Finite Element Methods
CV107303CV	Urban Hydrology

Environmental Engineering II

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV107101CV

[Pre-requisites: Environmental Engineering-I]

Course Objectives

1. To estimate the quantity of wastewater and design collection system, transport system, and various units of the wastewater treatment plant.
2. To identify the suitable methods for recycle, reuse, and disposal of treated wastewater and sludge.
3. To learn the various techniques for treating industrial wastewater and solid waste management.

Course Content

Unit 1: Sanitation and Wasterwater

Sanitation: Need, types of sanitation systems.

Wastewater: Estimation of quantity and collection system. Sources, estimation of wastewater flow and its variations, estimation of storm water run-off, Wastewater collection systems, patterns of collection system.

Design of sewers. Sewer appurtenances.

Unit 2: Wastewater characteristics and treatment

Characteristics of wastewater-physical, chemical, and biological characteristics, Sustainable management of wastewater – Centralized and decentralized/onsite management, Fundamentals of unit operations & processes in wastewater treatment. Types of reactors, Sewage treatment-preliminary treatment systems - racks and screens, comminutors, grit chambers, Primary treatment systems- Plain sedimentation. Primary settling tank, clariflocculators.

Unit 3: Biological treatment of wastewater

Aerobic treatment processes: Suspended growth processes, activated sludge process and its variations. Attached growth processes: trickling filter, MBBR technique.

Unit 4: Anaerobic treatment process, sludge management, and disposal

Anaerobic treatment process: anaerobic reactors, Sludge: Collection, management, treatment and disposal, Onsite waste water treatment- septic tank, Imhoff tank, oxidation pond.

Stabilization Ponds / Lagoons: aerobic, anaerobic and facultative lagoon, Sewage disposal: disposal by dilution, self-purification of polluted streams, factors affecting self-purification, Sag curve, disposal on land surfaces.

Reuse, recycling of treated wastewater.

Unit 5: Industrial waste treatment and solid waste management

Industrial Waste Management- Principles of waste management. Industrial wastes, origin, character, and management.

Sustainable solid waste management: sources and characteristics, collection, transportation, processing, and disposal of solid waste.

Course Materials

Required Text: Text books

1. Peavy, H. S., Rowe D.R., and Tchobanoglous G., Environmental Engineering, McGraw Hill, New York (1985).
2. Metcalf and Eddy Inc, Wastewater Engineering- Treatment and Reuse, Tata McGraw Hill (1995)

Optional Materials: Reference Books

1. CPHEEO Manual on Sewerage and Sewage Treatment Systems, Ministry of Urban Development (2013). http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php
2. CPHEEO Manual on Solid Waste Management (2016). http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php
3. Mackenzie L. Davis, Water and Wastewater Engineering. McGrawHill)

Irrigation & Hydraulic Structures

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107201CV

[Pre-requisites: None]

Course Objectives

1. To understand various types of irrigation and hydraulic structures.
2. Applying the basic knowledge of hydrology, open channel flow and soil mechanics.
3. To design structures using relevant standards codes

Course Content

Unit 1 : Canal Irrigation

Classification of canal, parts of canal irrigation system, canal alignment, lay-out of canal system, typical canal cross section, command areas, losses in irrigation systems; Water logging and its control.

Unit 2: Canal Design & Regulations works

Design an unlined canal and lined canal; Canal Regulation works: Canal drops and falls, cross regulators, distributaries head regulators, canal escapes.

Unit 3: Reservoir Planning and Dams

Reservoir Planning

Type of reservoirs, storage zones of a reservoir, mass curve and demand curve, determination of reservoir capacity, safe yield.

Dams:

Types of Dam; Suitability of Dams; Gravity Dam: Elementary profile of a gravity dam, High and low gravity dams; Earth Dam: Types of Earth fill dams, Causes of failures, Control of Seepage, Stability of slopes.

Unit 4: Spillway and Energy Dissipaters and Diversion Headworks

Spillway and Energy Dissipaters:

Types of spillway; essential requirements of spillway; Design of Ogee Spillway; Energy Dissipation below spillways; Types of Energy dissipater; Hydraulic jump; stilling basins.

Diversion Headworks:

Types of diversion works; location and components; Weir and Barrage; Causes of failures of Weirs; Design of Weirs on permeable foundations.

Unit 5: Cross Drainage Works

Cross Drainage Works:

Types of cross drainage works: Aqueduct, Syphon Aqueduct, Super Passage, Syphon, level crossing, inlets and outlets; Channel Transition; Design of Cross Drainage works.

Course Materials

Required Text: Text books

1. Theory and Design of Irrigation Structures (Volume - I & II) - Varshney (Nem Chand Bros.)
2. Irrigation Engineering - B.C. Punmia (Laxmi Publications)

Optional Materials: Reference Books

1. Irrigation, Water Resources and Water Power Engineering - Dr. P.N. Modi (Standard Book House)
2. Irrigation Engineering - Asawa G.L. (New Age International Publications)
3. Fundamentals of Irrigation Engineering - Bharat Singh (Nem Chand & Bros.)
4. Irrigation Engineering and Hydraulic Structures - S.K. Garg (Khanna Publications)

Seismic Design of Buildings

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107202CV

[Pre-requisites: Structural Analysis-I]

Course Objectives

1. To cultivate the basic knowledge related to the seismic analysis and design of structures and various fundamental aspects of Earthquake Engineering.
2. To provide the basic concepts of ductile detailing and seismic control of structures.
3. To develop the skills of students for becoming a design professional in seismic designing concepts of structures and serve the society of seismic region

Course Content

Unit 1: Engineering seismology and Theory of Vibrations

Causes of earthquakes; seismic waves; magnitude, intensity and energy release, characteristics of strong earthquake ground motions, Introduction to theory of vibrations - Flexibility of long and short period structures, concept of response spectrum, Seismic zones.

Unit 2: Seismic design concepts

Desirable features of earthquake resistant buildings, Building forms for earthquake resistance, Seismic design philosophy, Performance of buildings in past earthquakes, Lessons from structural damage during past earthquakes, Equivalent static lateral earthquake force, Study of codal provisions IS 1893: (Part 2).

Unit 3: Masonry buildings

Basic terminologies in structural masonry, Basics of design of load bearing masonry, Failures of masonry structures, Lessons from structural damage during past earthquakes, Concepts for reinforced masonry and earthquake resistant masonry, Study of Codal provisions IS 4326: 2014, IS 1905:2002, Concepts of Seismic design of masonry buildings, Box action of masonry buildings, Seismic Bands in masonry buildings, and detailing of masonry buildings.

Unit 4: RCC buildings

Introduction –Behavior of RCC Buildings, Lessons from structural damage during past earthquakes, Methods of analysis, Equivalent Static Method of Analysis , Static and Dynamic methods of analysis , Concept of modal analysis, Seismic Design of RCC Buildings, Ductile detailing of RCC buildings and IS13920codal provisions, Introduction to seismic control of structures.

Unit 5: Steel Buildings

Introduction, Behavior of steel buildings, Design philosophy of steel buildings, Lessons from structural damage during past earthquakes, Types of failures in steel buildings, Concept of seismic design of steel buildings, Bracing systems.

Course Materials

Required Text: Text books

1. Murty C. V. R., (2005), Earthquake Tips, Learning Earthquake Design and Construction, IIT Kanpur.
2. Pankaj Agarwal and Manish Shrikhande, (2006), Earthquake Resistant Design of Structures, Prentice-Hall of India Pvt. Limited, New Delhi

Optional Materials: Reference Books

1. Design of Earthquake Resistant Buildings – Minoru Wakabayashi (McGraw Hill Publication)
2. Dynamics of Structures: Theory and Application to Earthquake Engineering (2nd edition) – Anil K Chopra (Pearson Education Publication).
3. Seismic Analysis of Structures – T. K. Datta (Wiley Publication)

Probablistic Approaches in Civil Engineering

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107203CV

Course Objectives

1. To identify topics where probability and statistics have been or should be applied in Civil engineering.
2. To Choose appropriate probabilistic models for a given problem, using information from observed data and knowledge of the physical system being studied.
3. To use probability tools to perform Civil engineering calculations.

Course Content

Unit 1: Introduction to Statistics

Role of statistics in engineering, Mean, Mode and Median, Standard Deviation and Skewness Coefficient.

Unit 2: Introduction to Probability

Probability, Sample Space, Events, Venn diagram, Combinations of Events, Operational Rules, De Morgan's Rule, Probabilities Multiplication Rule, Theorem of Total Probability, Conditional Probabilities, Marginal Probability Independent Event, Bayes' Theorem

Unit 3: Random Variables

Random Variables, types of random variables, Multiple Random Variables, Joint Distributions, Conditional PDF and PMF, Marginal PDF and PMF, Covariance and Correlation, Multivariate Distributions

Unit 4: Probability Distribution Function

Both discrete (binomial distribution, poisson's distribution) and continuous distribution functions (normal, lognormal, exponential distribution, gamma distribution).

Unit 5: Testing of Hypotheses:

Null and alternative hypotheses, the critical and 8 acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.

Course Materials

Required Text: Text books

1. Probability, Reliability and Statistical Methods in Engineering Design. Achintya Haldar Sankaran Mahadevan
2. Structural Reliability Analysis and Optimization: Use of Approximations. Ramana V. Grandhi and Liping Wang.

Optional Materials: Reference Books

1. Probabilistic Methods in Geotechnical Engineering. Gordon A. Fenton
2. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross

Advanced Design of Reinforced Concrete Structures

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-II	CV107251CV

[Pre-requisites: Design of Reinforced Concrete Structures]

Course Objectives

1. Able to do the design and detailing of different types of footing.
2. Able to do the design and detailing of different types of retaining walls.
3. Able to do the design and detailing of different types of water tank and bridges.

Course Content

Unit 1: Combined Footing

Concepts of Combined Footings, Design of rectangular, trapezoidal, and strap beam combined footings

Unit 2: Retaining walls

Design of Cantilever and Counter fort retaining walls

Unit 3: RCC Water Tanks

Concepts of water tank design, IS Code provisions, Design of underground circular water tank, Design of overhead rectangular water tank.

Unit 4: Over head water tank

Design of RCC circular double dome tank and Intze tank.

Unit 5: RCC Bridges

Introduction to Relevant IRC codes for bridge design, Design of solid slab & T-beam bridge deck.

Course Materials

Required Text: Text books

1. RCC Structures – B.C. Punmia (Laxmi Publications)
2. Design of RCC Structures -Subramainin
3. RCC Design – Sinha & Roy (S. Chand & Co.)
4. Design of RCC Structures- M.L Gambir
5. Bridge Superstructure N. Rajagopalan (Narosa Publishing House)
6. Relevant Bureau of Indian Standard Codes and Indian Road Congress codes

Optional Materials: Reference Books

1. RCC Structures (Vol. – I & II) – O.P. Jain and Jaikrishna (Nem Chand Publications)

2. Bridge Engineering – R.K. Raina

Intelligent Transportation Systems

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective -II	CV107252CV

[Pre-requisites: Highway and Railway Engineering]

Course Objectives

1. To understand various components of Intelligent Transportation Systems (ITS) and supporting technologies.
2. To understand significance of ITS and its applications for improving the performance of the transportation system
3. To learn and Construct ITS related strategies for varying roadway and traffic conditions using design and control parameters

Course Content

Unit 1: Introduction to ITS

Definition Objectives, Historical Background, Benefits of ITS –Introduction to Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Traffic control and monitoring aspects, components of ITS**.**

Unit 2: Advanced Traveler Information Systems (ATIS)

Trip Planner and its impact, Traffic density measurement, Variable message signs, Parking guidance, Weather information and variable speed limits, Impacts of ATIS.

Unit 3: Advance vehicle monitoring systems & commercial vehicle operations (CVO)

Security CCTV systems, Wireless Sensor Network and RFID, Blue-tooth and Wi-Fi sensors, inductive loop detectors and image processing techniques, Impacts of AVMS. Emergency vehicle notification systems, Automatic road enforcement, Variable speed limits, Collision avoidance systems, Dynamic Traffic Light Sequence, Cooperative systems on the road, Automatic number plate recognition by Image processing, Impacts of CVO

Unit 4: ITS applications & ITS programs in the world

Advanced Traffic Management Systems (ATMS) Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS), Automated Highway Systems, and Framework for evaluating ITS related strategies.

Overview of ITS implementations in developed countries, ITS in developing countries, Potential applications of offline and online real time measurement of traffic flow characteristics.

Unit 5: Intelligent Supporting Technologies

Wireless communications, Standards and Cellular Technology, ITS Data acquisition and processing, Hardware and Software--Micro-Controllers, PLC, Embedded systems, Ubiquitous Computing, Sensing Technologies, Detectors/Detection Techniques—Triangulation Technique, Inductive loop detection, Video vehicle detection, Microwave detection, etc. Global Positioning System (GPS). Case studies.

Course Materials

Required Text: Text books

1. S Ghosh and T Lee, Intelligent Transportation Systems, CRC Press, Boca Raton, 2010.
2. C Drane and C R Drane, Positioning Systems in Intelligent Transportation Systems, Artech House Publishers, London, 1997

Optional Materials: Reference Books

1. JMC Queen and B McQueen, Intelligent Transportation System and Architecture, Artech House Publishers, Artech House, London, 1999.
2. A J Khattak, Intelligent Transportation Systems: Planning, Operations, and Evaluation, CRC Press, United Sates, 2014.
3. M A Chowdhury and A Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, London, 2010.

Rock Engineering

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107253CV

[Pre-requisites: None]

Course Objectives

1. To understand of the mechanical behavior of rock materials, rock discontinuities and rock masses.
2. To be able to analyze and to determine mechanical and engineering properties of rocks for engineering applications.
3. To be able to determine the design data for the design of various structure in rock and rock masses

Course Content

Unit 1: Introduction

Definition, Importance, History of Rock Mechanics, Types of Rocks, Drilling, Blasting and underground open excavation, Mining and other Engineering applications, Modes of failure – Rotational, Plane and wedge failures.

Unit 2: Laboratory testing on rocks

Tests for Physical Properties, Compressive strength, Tensile strength, Direct shear, Triaxial Shear, Slake Durability, Schmidt Rebound Hardness.

Unit 3: Strength, Modulus and stress strain behavior of rocks

Factors influencing rock behavior, Strength criteria for Isotropic Intact Rocks, Modulus of Isotropic Intact Rocks, Compressive strength and modulus from SPT, Stress Strain models – Elastic model, Elasto plastic model, Visco-elastic model.

Unit 4: Engineering classification of rocks and rock masses

RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMRS and RSR System. Classification based on strength and modulus, Classification based on strength and failure strain, rock discontinuity qualitative description.

Unit-5: Rock foundation and field-test on rocks

Estimation of Bearing Capacity – Intact, Fractured rocks, Stress distribution in rocks, Settlement in rocks, Bearing capacity of piles in rock. Geophysical methods, Seismc Refraction method, Deformability tests– Plate Jack Test, Goodman Jack Test, Field Permeability Test –Packers Test.

Course Materials

Required Text: Text books

Engineering in Rocks by Rammaruthum, Prantice Hall of India Private Limited, New Delhi

Optional Materials: Reference Books

1. Introduction to Rock Mechanics by R.E.Goodman, John Wiley & Sons
2. Fundamentals of Rock Mechanics, Fourth Edition, by Jaeger, Cook and Zimmerman, Blackwell Publishing.

Environmental Impact Assessment & Environmental Management

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective -I	CV107301CV

[Pre-requisites: Environmental Engineering-I]

Course Objectives

1. Appreciation of the need to assess and evaluate the impact on environment. Understanding of major principles of environmental impact assessment and various environmental attributes to be considered for the EIA study.
2. Understand the different steps within environmental impact assessment, identify the suitable methodology and prepare EIA.
3. Indentify and incorporate mitigation measures

Course Content

Unit 1: Introduction

Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA. EIA process – screening– scoping - setting – analysis – mitigation

Unit 2: Components and Methods for EIA

Matrices – Networks – Checklists – Connections and combinations of processes – Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction Assessment of impacts – air – water – soil – noise – biological –– Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation. EIA methods in other countries.

Unit 3: Socio-Economic Impact Assessment

Definition of social impact assessment. Social impact assessment model and the planning process. Rationale and measurement for SIA variables. Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition - neighborhood and community impacts. Selecting, testing and understanding significant social impacts. Mitigation and enhancement in social assessment. Environmental costing of projects.

Unit 4: Environmental Management Plan

Environmental Management Plan - preparation, implementation and review Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

Unit 5: Life Cycle Assessment

Life cycle assessment and its purpose. Evolution of Life Cycle Assessment. Stages in LCA of a Product. Code of Good Conduct for LCA. Procedures for LCA. Defining the goal and scope. Analyzing the inventory. Assessing environmental impact. Evaluating environmental profiles. Different Applications of LCA. Private sector applications. Governmental applications

Course Materials

Required Text: Text books

1. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science London. 1999
2. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996
3. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey. 2003

Optional Materials: Reference Books

1. World Bank –Source book on EIA
2. Glynn, J. and Gary, W. H. K. -Environmental Science and Engineering, Prentice Hall Publishers.
3. Wathern, P. –Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.
4. A Chadwick, Introduction to Environmental Impact Assessment, Taylor & Francis , 2007
5. R.Therirvel, E. Wilson, S. Hompson, D. Heaney, D.Pritchard, Strategic Environmental Assessment, Earthscan, London , 1992
6. Paul, A Erickson, A Practical Guide to Environmental Impact Assessment, Academic Press , 1994

Finite Element Methods

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV107302CV

[Pre-requisites: None]

Course Objectives

1. The students should understand the mathematical and physical principles underlying the FEA.
2. Be able to identify and solve relatively complex engineering problems using FEA.
3. To provide students with basic skills of FEA programming using Matlab.

Course Content

Unit 1: Introduction to Finite Element Analysis

Overview of Engineering systems: Continuous and discrete systems (discussion on differential equations, matrix algebra), Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Plane Stress, Plane Strain.

Unit 2: Finite Element Formulation Techniques

Weighted residual techniques (least square method, collocation, sub-domain collocation, Galerkin method), Rayleigh-Ritz Formulation, Energy methods and Variational principles.

Unit 3: FEM for One Dimensional Analysis

Development of bar and beam element, Derivation of element shape functions (Lagrangian and Hermite) in physical coordinates, Derive bar and beam element equations using energy approach and Galerkin Method. Application to truss and frames.

Unit 4: FEM for Two Dimensional Analysis

Discretization concepts, choice of elements: Triangular elements (CST and LST), Rectangular elements, Lagrange and Serendipity elements, Analyze plane stress problems using energy approach, Higher order elements.

Unit 5: FEM for Three Dimensional Analysis and Isoparametric Elements

Axisymmetric elements, Solid elements, Iso-parameteric eormulation, Numerical integration, Practical considerations in FE modeling and Interpreting results, Computer implementation.

Course Materials

Required Text: Text books

Daryl Logan, A First Course in the Finite Element Method, Cengage Learning

Optional Materials: Reference Books

1. C.S.Krishnamoorty, Finite Element Analysis, Tata McGraw-Hill
2. J. Fish and T. Belytschko, A First Course in Finite Elements, Wiley, USA
3. K. J.Bathe, Finite Element Procedures, Prentice-Hall of India, New Delhi, India
4. R D Cook, D A Malkus, M E Plesha, RJ Witt, Concepts and Applications of Finite Element Analysis, John Wiley & Sons
5. O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, Butterworth-Heinemann

Urban Hydrology

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV107303CV

[Pre-requisites: None]

Course Objectives

1. Compare and contrast natural versus urban water cycle.
2. Understand the natural and human factors that regulate hydrologic processes in urban areas.
3. Explain the spatial and temporal variability of the water cycle.

Course Content

Unit-1

Review of basic hydrology, hydrometeorology, infiltration, evapotranspiration, runoff and hydrograph analysis.

Unit-2

Strom water runoff generation; Return period; Hydrologic risk, commonly used probability distributions in hydrology.

Unit-3

Fitting probability distributions to hydrologic data. Probability plotting and frequency analysis, IDF relationships; Design storm

Unit-4

Open channel flow in urban watersheds; Interception storage, Infiltration, Depression storage; Combined loss models; Estimation of runoff rates from urban watersheds.

Unit-5

Flow routing; Storm water drainage structures; storm water detention; structural and non-structural control measures, Source control techniques; urban storm water models; introduction to urban groundwater systems.

Course Materials

Required Text: Text books

Hall, M.J. Urban Hydrology. Elsevier, 1984

Optional Materials: Reference Books

1. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 2004.
2. Akan A.O and Hioughtalen R.J. Urban Hydrology, Hydraulics and Storm water Quality " Engineering Applications and Computer Modeling, John Wiley & Sons 2003.
3. Hall, M.J. Urban Hydrology. Elsevier, 1984.
4. Shaw, E.M. Hydrology in Practice. 3rd Edn., Chapman & Hall, 1994

Structural Engineering Drawing Lab

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	0-0-2, (1)	Lab	CV107401CV

Course Objectives

To learn the detail drawing of different elements of RCC Structures and Steel Structures

Course Content

List of Experiments

1. RCC detailing of variation structural elements such as Footing(Isolated & combined), columns, beams and slabs
2. RCC detailing of Water Tank (tank Resting on ground & overhead water tank)
3. RCC detailing of Retaining Walls (cantilever & counter fort)
4. Detailing of Steel Connections
5. Detailing of Built up sections(Beams & connections)
6. Detailing of Steel Truss.

Course Materials

Required Text: Text books

Relevant Bureau of Indian Standard (BIS) codes and guidelines

Optional Materials: Reference Books

Structural Design And Drawing - Dr. D Krishnamurthy (CBS Publisher)

Semester-VIII

Scheme & Syllabus

National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 8A Semester				Branch: Civil	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1		Program Elective-I	3	0	0	20	30		50		100	3
2		Program Elective-II	3	0	0	20	30		50		100	3
3		Open Elective-I	3	0	0	20	30		50		100	3
4		Open Elective-II	3	0	0	20	30		50		100	3
												12

List of Courses offered as Program electives and Open electives

S.No.1: Program Elective-I		S.No.2: Program Elective-II		S.No.3: Open Elective-I		S.No.4: Open Elective-II	
Subject Code	List of Courses	Subject Code	List of Courses	Subject Code	List of Courses	Subject Code	List of Courses
CV108201CV	Advanced Design of steel structures	CV108251CV	Prestressed Concrete	CV108301CV	Remote Sensing, GIS & its applications	CV108351CV	Stability of slopes & Ground improvement Techniques
CV108202CV	Airport, Tunnel & Harbour Engineering	CV108252CV	Expansive soils	CV108302CV	Hazardous Wastes Management		
CV108203CV	Geo-Environmental Engineering	CV108253CV	Transportation Planning & Management				

National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 8B Semester				Branch: Civil	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	CV108301CV	#Open Elective-I	3	0	0	20	30		50		100	3
2	CV108302CV	#Open Elective-II	3	0	0	20	30		50		100	3
3	CV108701CV	Major Internship										6 (4^+2^^)
												12

Courses for Open Elective-I and II to be opted from Online

^ Mid-Semester evaluation report and field evaluation report to be submitted by industry

^^ Report Submission and Presentation in the department

Advanced Design of Steel Structures

[VIIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective	CV108201CV

[Pre-requisites: Design of Steel Structures]

Course Objectives

1. Able to design steel structures connections.
2. Able to analyze and design advance level steel structures.
3. Familiar with the relevant BIS codes to be used in steel design.

Course Content

Unit 1
Connections: Connection Classifications, Semi-rigid and Rigid Connections, Framed and seated connections, Moment resistant connections.

Unit 2
Industrial Buildings: Various components of an industrial building, Loads and load combinations, Roof systems, Design of purlins, Roof trusses, Industrial building frames.

Unit 3
Plate Girders: Riveted and Welded Plate Girders - Design of cross-section, curtailment of flange plates, stiffeners, splices.
Gantry Girder.

Unit 4
Cold Formed Steel: Introduction, application, Advantages of cold formed sections, Local buckling, Beam, Column, Combined bending & compression, Tension members, Empirical method.

Unit 5
Towers: Introduction, Types of Towers, Tower Configurations, Loads, Codal Provisions, Analysis and Design, Foundations of Towers.

Course Materials

Required Text: Text books

1. N. Subrhamanyan, “Design of Steel Structures”, Oxford Publication.
2. M. L. Gambhir, "Fundamentals of structural steel design", Mc Graw Hill.
3. Ram Chandra, “Design of Steel Structures (Vol. - I & II)” , Standard Book House, New Delhi

Optional Materials: Reference Books

1. S.K. Duggal, “Design of Steel Structure”, Tata Mc Graw Hill.
2. P. Dayarathnam , “Design of Steel Structures”, Wheeler.
3. C.G. Salmon and J.E. Johnson, “Steel Structures: Design and Behaviour”, Harper and Row, New York

Airport, Tunnel & Harbour Engineering

[VIIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV108202CV

[Pre-requisites: None]

Course objectives

1. To understand the fundamental principles and methods of transport planning
2. To understand the basic infrastructure elements of Airports and design the geometrics of runways and taxiways
3. To understand basic infrastructure elements of tunnels and learn construction practices of tunnels
4. To understand the basic infrastructure elements of Harbours and study shore and shore line process

Course Content

Unit 1 Introduction to Transportation Planning

Fundamental Concepts of Transport Planning, Introduction to Transport infrastructure Planning methods, Urban and Regional Planning.

Unit 2 Airport Planning Principles, Alignment and Geometric Design

Definition of terms related to airport engineering, factors affecting site selection, obstructions, surveys for site selection, zoning laws, Classification of obstructions, Helipads, Hangers.

Runways: Orientation, Basic Runway length and its corrections, Geometric design, Runway configuration, Taxiways layout standards, exit taxiways fillets separation.

Unit 3: Tunnel Engineering

Classification of tunnels, Tunnel shapes and sizes- Criteria and selection, Tunnel surveying, Tunnel Construction methods- Soft and Hard strata, Muck disposal methods, Tunnel lining, Ventilation and Lighting, Drainage in Tunnels.

Unit 4: Harbours and Ports: Introduction

Harbors and Ports: Classification of ports, requirements of a good port, classification of harbour, harbour planning, requirements of harbor, Docks and Spillways -Introduction, advantages of docks, moles, shape of docks and basins, dock entrance, entrance docks, quays, jetties and wharves, tide, wind and wave, dry dock, types of breakwaters.

Unit 5: Harbors and Ports: Navigational aids, shores and shore processes

Navigational Aids, Long term and short term changes of shores, factors influencing beach characteristics, beach wave interaction, beach profile modification, littoral drift, stability of shores, shore erosion due to sea level, on shore and off shore transport, long shore transport, interaction of shore structures,, mud banks.

Course Materials

Required Text: Text books

1. Prabir Kumar, “Transportation Planning: Principles, Practices and Policies”, Prentice Hall India Learning, New Delhi.
2. Khanna and Arora, “Airport Planning And Design”, Khanna Publishers, New Delhi
1. S.C. Saxena, “Tunnel Engineering”, Dhanpat Rai Publications
2. R. Srininvasan, “Harbour, Dock and Tunnel Engineering”, Charotar Publishers, New Delhi

Optional Materials: Reference Books

1. Horenjeff Robert, ”Planning & Design of Airports”, McGraw Hill Book Co., New Delhi,1985
2. Henry F. Cornik, “Dock and Harbour Engineering Vol.–I to IV”, Charles Griffin & Company Ltd., London.(1988)
3. Robert M.Sorensen, “Basic Coastal Engineering” , Springer, (2006)

Geo-Environmental Engineering

[VIIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV108203CV

[Pre-requisites: None]

Course Objectives

1. To create a awareness in the field of Geo-Environmental Engineering.
2. To impart the knowledge on Geotechnical aspects in the disposal of waste materials and the remediation of contaminated sites.
3. To familiarize design of landfill and know the effect of change in environment on soil properties.

Course Content

Unit 1
Introduction and Soil-water-environment interaction, Geotechnical applications of waste materials.

Unit 2

Geotechnical characterization of waste and disposal and Site characterization.

Unit 3
Landfill Components its functions and design, Compacted clay liner, selection of soil, methodology of construction, Geosynthetics in landfill- types and functions, geosynthetic clay liners .

Unit 4
Leachate and Gas Management, Soil remediation, Investigation of contaminated soil, insitu/exiture mediations, bio remediation, thermal remediation, pump and treat method, phyto remediation and electro kinetic remediation.

Unit 5
Leachate disposal and Post closure of landfill, Variation in properties of soil due to change in environment.

Course Materials

Required Text: Text books

Dr. G V Rao and Dr. R S Sasidhar (2009) Solid waste Management and Engineered Landfills, Saimaster Geoenvironmental Services Pvt. Ltd. Publication

Optional Materials: Reference Books

1. Reddi L.N and Inyang HI (2000) Geoenvironmental Engineering: Principles and Applications, Marcel Dekker Inc Publication
2. R. N. Yong (2000) Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate, Mitigation Lewis Publication.

Prestressed Concrete

[VIIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-II	CV108251CV

[Pre-requisites: Mechanics of Solids, Design of Reinforced Concrete Structures]

Course Objectives

1. To provide the basic concepts of prestressing.
2. To analyze and design the prestressed structure.
3. To become familiar with professional and contemporary issues in the design and fabrication of prestressed concrete members.

Course Content

Unit 1

Introduction, Basic concepts, Need for High strength steel and concrete, Terminology, Advantages and Applications of prestressed concrete, Materials for prestressed concrete, Prestressing systems and Devices.

Analysis of Members: Resultant stresses at a section, Pressure line or thrust line and internal resisting couple, Concept of load balancing, Stresses in Tendons
Flexure Strength: Types of Failure, Simplifies Code Procedures; Shear Strength

Unit 2

Losses of prestress: Total Losses in Pretensioned Members, Total Losses in Post-Tensioned Members, Methods for Estimating Prestress Losses, Elastic Shortening, Relaxation, Shrinkage, Creep, Friction, Anchorage Slip

Unit 3

Calculation of Deflections and Crack widths, Transfer of prestresses: Transmission Length, Bond Stresses, End-zone reinforcement; Anchorage Zone Stresses: Stresses distribution in end block, Anchorage zone reinforcement.

Unit 4

Limit state design: Philosophy, Criteria for Limit States, Design Loads and Strengths, Strength and Serviceability Limit States, Crack Widths in prestress Members, Dimensioning of prestressed Members.

Unit 5

Design of sections for Axial Tension, Design of sections for Flexure.

Course Materials

Required Text: Text books

1. N. Krishna Raju, Prestressed concrete, Tata McGraw Hill
2. IS:1343 (2012) - Code for Practice for Prestressed Concrete

Optional Materials: Reference Books

1. T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons.
2. P. Dayaratnam, P. Sarah, Prestressed Concrete Structurse, Medtech
3. R. Rajagopalan, Prestressed Concrete, Narosa
4. J.P. Annie & P. Easwary Dr. Y.R.M. Rao, Prestressed Concrete Analysis and Design, S.K Kataria.
5. Y. Guyon. Translated by P. Chambon and F.H. Turner, Limit-state Design of Prestressed Concrete ..

Expansive soils

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-II	CV108252CV

[Pre-requisites: Geotechnical Engineering - I]

Course Objectives

1. To understand of the behavior of expansive soils and problem related to it.
2. To be able to analyze and to determine behaviour of expansive soil for engineering applications.
3. To be able to determine the design data for the design of various structure on problematic ground condition.

Course Content

Unit 1: Introduction and Identification

Expansive Soils of India, related civil engineering problems, formation of expansive soils in field, identification of expansive solids in laboratory by X-ray diffraction method and differential thermal analysis.

Unit 2: Physical and Chemical Properties

Soil structure and clay minerology of expansive soil, atomic bond and molecular bonds, honey comb structure, base exchanges capacity, clay water relation, electrolysis processes.

Unit 3: Foundation on Black Cotton Soil

Foundations on swelling soils, swelling potential and mechanism of volume change, chemical composition of black cotton soil, construction techniques in black cotton soil, modern method of construction in under reamed coil.

Unit 4: Ground Improvement Techniques

Stabilization of expansive soils with lime, slag (silica fume and aluminium sludge), cement, fly ash, chemicals, reinforced earth technique, micro reinforced vegetation, vibro floatation, grouting and soil nailing.

Unit 5: Liquifaction Hazard Mitigation

Factors affecting the expansive soil, method of assessment for liquifaction, effect instrumentation for monitoring, consolidation of marine clay deposits, expansive soil model of Bingham fluid bounded by porous beds.

Course Materials

Required Text: Text Books

Design Aids in Soil Mechanics and Foundation Engineering – S.R. Kaniraj (Tata McGraw Hill, New Delhi)

Optional Materials: Reference Books

1. Basic and applied Soil Mechanics (Revised Edition) – Gopal Rajan and Rao A.S.R. (New Age, New Delhi.1998)
2. Gulhati S.K., Datta, M.: Getotechnical Engineering, Tata McGraw-Hill Publshing Company Limited, New Delhi.
3. Foundation Engineering (2nd Edition) – Peck,R.B., Hanson (W.E. and Thornburn. W.H. Johan Wiley, New York 1976)
4. Foundation Analysis and Designing – J.E. Bowles (McGraw Hill)
5. Soil Engineering in Theory and Practice (Vol. - II) – Alam Singh (Asia Publishing House, New Delhi, 1981).

Transportation Planning and Management

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-II	CV108253CV

[Pre-requisites: Highway and Railway Engineering]

Course Objectives

1. To understand of the basic concepts of transport planning, surveying and sampling methods.
2. To learn and apply the transportation planning methods for planning of road, rail and air transport network
3. To understand basic concepts of public transportation planning in urban and regional level
4. To understand and apply economic evaluation of various transportation projects

Course Content

Unit 1: Introduction

Urban transportation in India, need for planning, principles of transportation Planning, land use and traffic & their interrelation, transportation planning process, systems approach.

Unit 2: Transportation Surveys

Study area, zoning, inventory, classification studies, cordon surveys, screen line survey, O –D surveys, traffic impact studies, survey methods, sampling.

Unit 3 : Traffic demand forecasting

Trip generation factors, trip generation models, rates, trip distribution and models, Assignment techniques, modal split, mode choice modeling, land use transport interaction models.

Unit 4 : Public Transportation Planning

Classification of public transportation system, Rapid transit, Para-transit, City bus services, transport demand, planning & scheduling bus route network, public transportation in India issues.

Unit 5: Economic Evaluation of Transport Plans

Concepts of Economic evaluation, Need and benefits of Transport projects, Methods of economic evaluation.

Course Materials

Required Text: Text Books

1. Kadiyali L. R., “Traffic Engineering and Transportation Planning”, Khanna Publishers, Delhi. 2002.
2. Das Animesh, Chakraborty Parth, “Introduction to Transportation Engineering”, Prentice Hall Of India Pvt. Ltd., New Delhi, 2003

Optional Materials: Reference Books

1. Papacostas C. S. , “ Fundamentals of transportation engineering ”, Prentice Hall Of India Pvt. Ltd., New Delhi, 2002
2. Hutchinson B.G., “Principles of Urban Transportation Systems Planning”, Mc Graw Hill Publishers, 19745.
3. Khisty C.J., Lall B.K., “Transportation Engineering –An Introduction”, Prentice Hall, NJ, 2005

Remote Sensing, GIS, and its Applications

Course Description Offered by Department	Credits	Status	Code
Civil Engineering [Pre-requisites: None]	3-0-0, (3)	Open Elective-I	CV108301CV

Course Objectives

1. Understanding RS & GIS concepts
2. Using various data model.
3. Application of the technology in solving engineering problems.

Course Content

Unit 1: Remote Sensing

Introduction and definition of Remote Sensing terminology, Physics of remote sensing, electromagnetic radiation (EMR), LANDSAT, SPOT, ERS, IKONOS and others, Indian Space Programme.

Unit 2: Maps

Introduction and types of Maps, Ellipsoid and Datum, Projection, Coordinate system, UTM, Thematic Maps.

Unit 3: GIS Data Models

Input data, Field data, Statistical data, Maps, Aerial photographs, Satellite data, Points, lines and areas features, Vector and Raster data, Advantages and Disadvantages, Digitizers and scanners, Digital data, GIS data formats and standards.

Unit 4: GIS Data Processing and Analysis

Satellite Data analysis, Visual interpretation, Digital image processing, Data Management, Data Analysis – Data layers, analysis of spatial and non-spatial data, Data overlay and modeling.

Unit 5: Applications of RS and GIS

Applications of GIS in Map Revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, Water Resources, Soil Erosion, Land suitability analysis, Change detection.

Course Materials

Required Text: Text Books

1. Introduction to Remote Sensing – Campbell, J.B. (The Guilford Press, London, 1986)
2. Remote Sensing and Geographic Information Systems – Legg, C.A. (Ellis Horwood, London, 1992)

Optional Materials: Reference Books

1. Curran, P.J., “Principles of Remote Sensing”, Longman, London, 1985.
2. Engman, E.T. an Gurney, R.J., “Remote Sensing in Hydrology”, (Chapman and Hall, London, 1991.
3. Principles of Geographic Information System for Land Resources Assessment – Burrough, P.A. (Monograph on Soil Resources Survey No. 12, Claredon, Press, Oxford, 1988)
4. Remote Sensing in Hydrology – Engaman, E.T. and Gurney, R.J. (Chapman and Hall, London, 1991)
5. Campbell, J.B., “Introduction to Remote Sensing”, The Guilford Press, Lond, 1986.

Hazardous Wastes Management

Course Description			
Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV108302CV

[Pre-requisites: None]

Course Objectives

1. To introduce students to various rules and regulations regarding planning and management of hazardous waste management.
2. To appreciate the necessity of hazardous waste management.
3. To understand the science and technology involved in hazardous waste management

Course Content

Unit 1

Relevant Regulations – Municipal solid waste (management and handling) rules; hazardous waste(management and handling) rules; biomedical waste handling rules; flyash rules; recycled plastics usage rules; batteries (management and handling) rules.

Unit 2

Hazardous Waste Management –Fundamentals

Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects

Unit 3

Radioactive Waste Management –Fundamentals

Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options

Environmental Risk Assessment, Defining risk and environmental risk; methods of risk assessment; case studies

Unit 4

Physicochemical Treatment Hazardous Waste –Chemical treatment processes

(combustion, stabilization and solidification of hazardous wastes); physico-chemical processes for hazardous wastes (soil vapour extraction, air stripping, chemical oxidation); ground water contamination and remediation

Biological Treatment of Hazardous Waste – Composting; bioreactors; anaerobic decomposition; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation

Unit 5

Landfill design – Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; Incineration

Biomedical Waste Management: Sources; Generation; Classification; Storage; Transportation; Disposal; Waste Treatment: Disinfection, Irradiation, and Incineration

Course Materials

Required Text: Text Books

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D. Buckingham, P.L. and Evans, J.C.Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous Wastes - Sources,Pathways, Receptors John Wiley and Sons, New York,1997

Optional Materials: Reference Books

1. Basics of Solid andHazardous Waste Mgmt.Tech. by Kanti L. Shah1999, Prentice Hall.
2. Solid AndHazardousWaste Management2007 by S.C. BhatiaAtlantic Publishers &Dist.

Important Online Material:

1. http://www.iswa.org.
2. http://enfor.nic.in
3. http://nptel.iitm.ac.in
4. http://www.britannica.com/EBchecked/topic/257926/hazardous-waste
1. 5.www.epa.gov/solidwaste/hazard/tsd/index.htm
5. www.envfor.nic.in/legis/hsm.htm
6. www.cpcb.nic.in/upload/NewItems/NewItem_149_Protocol.pdf

Slope Stability and Ground Improvement Techniques

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-II	CV108351CV

[Pre-requisites: None]

Course Objectives

1. To understand need for ground improvement and different mechanical, chemical, static and dynamic techniques of ground improvement.
2. To learn various stabilization techniques for cohesionless and cohesive soils.
3. To study and understand miscellaneous techniques of ground improvement including geotextiles and reinforced earth.

Course Content

Unit 1: Slope Stability

Slope stability analysis, deterministic and probabilistic approaches, method of slope stability analysis, factor of safety, stability charts and its applications, physical, analytical and mechanical methods in slope analysis. Landslides – causes, prediction, prevention and monitoring for stability.

Field instrumentation, monitoring and design of stable slopes, stabilization and strengthening of slope, design of waste and tailing dams, case study, histories of slope failures.

Unit 2: Ground Improvement Techniques

Need for ground improvement, different types of problematic soils, emerging, trends in ground Improvement, shallow and deep compaction requirements, Principles and methods of soil compaction.

Unit 3: Drainage and Dewatering system

Ground Improvement by drainage, dewatering methods, design of dewatering, systems, preloading, vertical drains, vacuum consolidation, dewatering, design and construction methods.

Unit 4: Soil Stabilization

Cement stabilization and cement columns, lime stabilization, stabilization using bitumen and emulsions, stabilization using industrial wastes

Unit 5: Geosynthetics and its Application

Introduction & need for geosynthetics types and functions of geosynthetics, testing of geosynthetics, different types of soil retaining structures, construction aspects of geosynthetic reinforced soil retaining walls

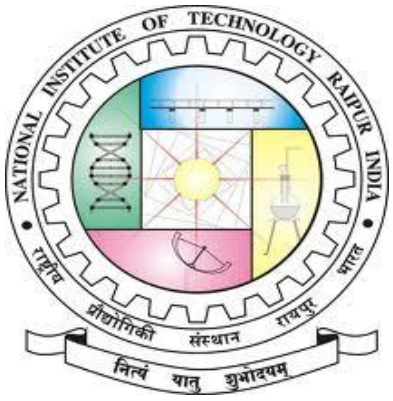
Course Materials

Required Text: Text Books

1. Purushothama Raj P. , Ground Improvement Techniques, Laxmi Publications, 2016.
2. Hausmann R., “Engineering principles of Ground Modification”, McGraw Hill Publishing Co, 1990.

Optional Materials: Reference Books

1. Hoek, E. and Bray, J.W. Rock Slope Engineering, Institute of Mines and Metallurgy, London, 1977.
2. 2. Abranison, W L, Lee, T. and Sarma, S. Slope Stability and Stabilization Method, John Wiley & Sons, New York, 2001.011.



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