

## National Institute of Technology, Raipur (C.G.)

Course of Study & Scheme of Examination							B. Tech. V Semester					Branch :	Civil Engineering
S.No.	Board of Studies	Sub.Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	Civil	CE-511	Structural Analysis -II	4	1	-	20	15	15	50	70	120	5
2	Civil	CE-512	Structural Engineering Design-I	4	1	-	20	15	15	50	70	120	5
3	Civil	CE-513	Geotech Engineering -I	3	1	-	20	15	15	50	70	120	4
4	Civil	CE-514	Transportation Engineering - II	3	1	-	20	15	15	50	70	120	4
5	Civil	CE-515	Environmental Engineering - I	3	1	-	20	15	15	50	70	120	4
6	Civil	CE-516	Engineering Hydrology	2	2	-	20	15	15	50	70	120	3
7	Civil	CE-523	Advanced Concrete Lab	-	-	3	30	-	-	30	20	50	2
8	Civil	CE-524	Geotech Engineering -I lab	-	-	3	30	-	-	30	20	50	2
9	Civil	CE-525	Environmental Engineering- I lab	-	-	3	30	-	-	30	20	50	2
10	Humanities	CE-527	Managerial Skill	-	-	2	25	-	-	25	0	25	1
11	Civil	CE-529	Technical Visit/ Practical Training	-	-	-	25	-	-	25	0	25	1
			Total	19	7	11	260	90	90	440	480	920	33

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ultimately in the following format which will be included in the semester mark-sheets.

**T.C.A. = Total of Continuous Assessment.**

Format for attendance					
Attendance					Category
> 85			----- >		High "H"
> 70 & < 85			----- >		Medium "M"
> 60 & < 70			----- >		Low "L"
< 60			----- >		Poor "P"

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Structural Analysis - II

Code: CE- 511

Total Theory Periods per Week: 4      Total Tutorial Periods per Weeks: 1      Total Marks: 120

Teacher's Assessment: 20    First Examination: 15    Second Examination: 15      End Semester Examination: 70

**Unit 1:- Concept of Structural Analysis:**

Concept of displacement methods of analysis, (comparison with Force Method of analysis) Degree of Kinematic Indeterminacy, Computation of Degree of Kinematic Indeterminacy. Analysis of Indeterminate beams (propped cantilever & fixed), Principle of superposition., Analysis by consistent deformation method, Theorem of three moments, Analysis of continuous beam using three moment theorem, shear force and bending moment diagrams, Effect of Sinking of support & rotation of support.

**Unit 2:- Force Method of Analysis using Strain Energy Concept :**

Strain Energy theorems of analysis of statically indeterminate structures-beams, frames and trusses, Lack of fit.

**Unit 3:- Displacement Method of structural analysis**

Slope deflection method, Application to indeterminate beams and rigid frames without sway & with sway problem. Basics of Column analogy method.

**Unit 4:- Iterative methods of analysis:**

Moment Distribution Method, Application to indeterminate beams and rigid frames without sway & with sway problem. Introduction to Kani's Method of Analysis.

**Unit 5**

Qualitative and Quantitative Influence lines of indeterminate beams by Muller Breslau Principle and its use. Introduction of multistoried frame analysis suitable for manual computation- substitute frame method for analysis for gravity load and portal and cantilever method of analysis for lateral loads.

**Name of Text Books:**

Structural Analysis – Punmia B.C. (Laxmi Publications)

Structural Analysis (Vol. – II) – Bhabhi Katti S. (Vikas Publishers)

**Name of Reference Books:**

Intermediate Structural Analysis – Wang. C.K. (McGraw Hill Book Company, 1983)

Matrix analysis of Framed Structures – Weaver, W. & Gere J.M. (CBS Publishers and Distribution, Delhi 1990)

Fundamentals of Structural Analysis – Lect & Vari (Tata McGraw Hill)

Structural Analysis – Pandit & Gupta (Tata McGraw Hill)

Theory of Structure – Ramamurtham S. (Dhanpat Rai Publication)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Structural Engineering Design - I

Code: CE- 512

Total Theory Periods per Week: 4      Total Tutorial Periods per Weeks: 1      Total Marks: 120

Teacher's Assessment: 20    First Examination: 15    Second Examination: 15    End Semester Examination: 70

**Unit 1 General Design Considerations**

Properties of Concrete and reinforcing steel, characteristic strengths, stress-strain curves, workmanship, I.S. specifications, Basis for design, loads and forces, requirements governing reinforcement and detailing.

Working stress, ultimate strength and limit states of design. Serviceability Conditions- Limit states of deflection and cracking, calculation of deflections.

**Unit 2 Working Stress Method – Introductory lessons**

Analysis and design by working Stress method - Singly and doubly reinforced sections, rectangular and T-sections. Short and long columns, eccentrically loaded columns.

**Unit 3 LIMIT STATE METHOD - BEAMS AND SLABS.**

Analysis and design by Limit State method - Singly and doubly reinforce sections, rectangular and Tsections. One way and two way slabs, staircases.

**Unit 4 Limit State Method – Columns and Column Footings**

Analysis and design by Limit State method - Short and long columns, eccentrically loaded columns. Uniaxial and Biaxial bending, Isolated Column Footings.

**Name of Text Books:**

Reinforced Concrete Design – Sinha N.C. & Roy S.K. (S. Chand & Co.)

RCC Design – Punmia, Jain & Jain (Laxmi Publications)

**Name of Reference Books:**

Relevant IS codes IS: 456:2000, IS 875, Part 1, 2

Reinforced Concrete Structures – Dayaratam P. (Oxford and IBH Publishing Co. 1986)

Reinforced Concrete Limit State Design – Jain, A.K. (Nem Chand & Bros. Roorkee, 1993)

Design Aids for Reinforced Concrete to I.S.-456-1978 – SP-16, 1980 (Bureau of Indian Standards, New Delhi)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Transportation Engineering - II

Code: CE- 514

Total Theory Periods per Week: 3      Total Tutorial Periods per Weeks: 1      Total Marks: 120

Teacher's Assessment: 20    First Examination: 15    Second Examination: 15    End Semester Examination: 70

**Unit 1**

Historical development of railway in India. Merits of rail transportation, gauges and gauge problems, railway, track cross sections, coning of wheels, rail cross sections, weight of rail, length of rail, wear of rails, Creep of rails, rail joints and welding of rails, advantages of welding.

**Unit 2**

Sleepers : Requirements, various types, spacing and density, rail fixtures, fastenings.

Ballast : Requirements, various types.

Geometrics : Grading, cant and cant deficiency, transition curves, widening of gauges on curves.

**Unit 3**

Points and Crossings, design of turnouts, various types of track junctions, signaling and interlocking, classification of signals, control of movements of trains, interlocking of signal and points, tractive power and track modernisation; Maintenance; Appurtenant works; Containerisation.

**Unit 4**

**Tunnel Engineering**

Consideration in tunneling shape and size, methods of tunnel, constructions, tunneling in soft soil and rocks, disposal of muck, lining of tunnels, lighting and ventilations, drainage of tunnels, traffic control, emergency management.

**Unit 5**

**Harbour Engineering**

Harbour layout, harbour works, break water, jetties, wharves, piers and berthing facilities, navigational aids, port facilities, docks; Dry and Wet docks, transit sheds and ware houses, general layout of a port, Littoral transport with erosion and deposition; sounding methods; components and operational Tidal data and analyses.

Name of Text Books:

Railway Engineering – S.C. Saxena & Arora (Dhanpat Rai Publications)

Tunneling Engineering – S.C. Saxena (Dhanpat Rai Publications)

Railway Engineering – Rangawala (Charotar Publications)

Name of Reference Books:

Harbour Engineering – Srinivas

Tunnel and Harbour – Seetharaman S. (Umesh Publications)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Geotech Engineering - I

Code: CE- 513

Total Theory Periods per Week: 3      Total Tutorial Periods per Weeks: 1      Total Marks: 120

Teacher's Assessment: 20    First Examination: 15    Second Examination: 15    End Semester Examination: 70

Unit 1 INTRODUCTION : Introduction to Soil Mechanics and Geotechnical Engineering; Unique nature of soil; Soil formation and soil types, interrelationship of soil, aim and scope of soil mechanics.

Index Properties of Soil : Basic definitions; phase relations; physical and engineering properties of soil, soil grain and properties coarse and fine grained soils, Stoke's law, method of fine grained analysis.

Unit 2 SOIL CLASSIFICATION AND EFFECTIVE STRESS : Clay mineralogy, soil structure, Indian standard soil classification system, Purpose of soil Classification, Different System of soil Classification, Field Identification, Principal of Effective Stress and Related Phenomena, Types of soil moisture; capillarity; seepage force and quicksand condition;

Unit 3 COMPACTION, PERMEABILITY AND SEEPAGE ANALYSIS OF SOIL : Compaction theory, laboratory compaction tests, method of compaction control, permeability, one dimensional flow, permeability of soil, Darcy's law, laboratory methods of determination, pumping out tests for field determination of permeability, seepage through soils, two-dimension flow problems, confined flow and unconfined flow, flow nets and their characteristics, exit gradient and failure due to piping, criteria for design of filters.

Unit 4 STRESSES DUE TO APPLIED LOADS AND CONSOLIDATION : Stresses due to applied Loads, Boussinesq equation of vertical pressure under concentrated loads, rectangularly loaded area, circular Loaded Area Newmart's Chart, Westergoard's equation, compressibility, effects of soil type, stress history and effective stress on compressibility, consolidation, factors affecting consolidation and compressibility parameters. normally consolidated and over consolidated soils, different forms of primary consolidation equation – transient flow condition, Terzaghi theory of one-dimensional consolidation and time rate of consolidation.

Unit 5 Shear Strength and Soil Exploration : Introduction, stress at a point and Mohr's stress circle; Mohr-Columb Failure criterion: Laboratory tests for shear strength determination; shear strength parameters; UU, CU and CD tests and their relevance to field problems; Shear strength characteristics of normally consolidated and reconsolidated clays; Shear strength Characteristics of sands, Soil Exploration, Various Method of field Exploration, Undisturbed Soil Sampling equipments and Field test (Static & Dynamic Penetration Test, Field Vane Shear Test), modern electronic test of site characterisation.

Name of Text Books:

Basic and Applied Soil Mechanics – Gopal Ranjan & Rao A.S.R. (New Age International, New Delhi, 1998)

Soil Mechanics and Foundation Engineering – B.C. Punmia (Laxmi Publication)

Name of Reference Books:

Geotechnical Engineering : Gulhati S.K., Datta, M. (Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005).

Soil Mechanics and Foundation Engineering – S.N. Murthy (Dhanpat Rai Publications)

Soil Engineering in Theory and Practice (Vol-II) – Alam Singh (Asia Publishing House, New Delhi)

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

Geotechnical Engineering Principles and Practice – Donald P. Coduto (Prentice Hall of India, New Delhi)

Soil Mechanics and Foundation Engineering – Garg S.K. (Khanna Publishers)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Environmental Engineering -I

Code: CE- 515

Total Theory Periods per Week: 3      Total Tutorial Periods per Weeks: 1      Total Marks: 120

Teacher's Assessment: 20    First Examination: 15    Second Examination: 15    End Semester Examination: 70

Unit 1 INTRODUCTION : Necessity and importance of water supply schemes.

Water demand : 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, variation in water demand.

Sources of water supply : Surface sources and underground sources, Intake works, site selection, type of intake works.

Unit 2 QUALITY OF WATER : Common impurities, physical, chemical and biological characteristics of water, water quality standards for municipal and domestic supplies.

Water Processing : Object of water processing, flow diagrams of typical ground water system and surface water systems.

Sedimentation : Theory of sedimentation, sedimentation tanks and its types, design parameters related with sedimentation tanks, sedimentation with coagulations, coagulants and coagulant aids, Jar test for determining coagulant dosage.

Unit 3 Filtration : Theory of filtration, slow sand and rapid sand filters, Construction and operation.

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

Unit 4 Softening : Methods of Softening, Iron Removal, Fluoridisation.

Distribution System : Methods of distribution, layout of distribution system, methods of analysis, pressure in the distribution system, distribution reservoirs, functions and its types, storage capacity of distribution reservoir.

Unit 5 Air Pollution : Introduction, causes, sources, characteristics, effects of air pollution on plants, humans, animals and materials and atmosphere, air pollution control methods and equipment.

Noise Pollution : Definition, sources, effects of noise pollution on humans, animals and non-living things, methods of noise control.

Name of Text Books:

Water Supply Engineering – S.K. Garg (Khanna Publication).

Water Supply Engineering – B.C. Punmia (Laxmi Publication, New Delhi)

Name of Reference Books:

Environmental Engineering – Peavy & Rowe (Tata McGraw Hill, New Delhi).

C P H E E O Manual on Water Supply and Treatment

Environmental Science and Engineering – Henry and Heinke (Pearson Education)



**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Engineering Hydrology

Code: CE- 516

Total Theory Periods per Week: 2      Total Tutorial Periods per Weeks: 2      Total Marks: 120

Teacher's Assessment: 20    First Examination: 15    Second Examination: 15    End Semester Examination: 70

Unit 1 Introduction : Definition and scope, Hydrology in relation to water resources development, Hydrologic Cycle, The necessity for hydrologic data, the global water budget, Practical applications.  
Hydrometeorology : Introduction, constituents of atmosphere, the weather and the atmosphere, the general circulation, air masses and fronts, climate and weather seasons in India.

Unit 2 A. Probability and Statistics : Introduction, probability and random variable, Distribution Functions, Selection of Distribution Function and Estimation of Parameters, Frequency analysis, correlation and Regression analysis.  
B. Precipitation : Forms of precipitation, measurement of precipitation, Recording and Non-recording type of rain gauges, Typical and record rainfall data, errors in measurement of rainfall. Location of rain gauge stations, analysis and interpretation of rainfall data, Average depth of rainfall over area, Probable maximum precipitation (PMP).

Unit 3 A. Infiltration and Run off : Introduction, factors affecting in filtration, measurement of infiltration, infiltrometers, infiltration equations, infiltration indices, effect of infiltration on runoff and recharge of ground water, Runoff, components of runoff, estimation of runoff, calculations by infiltration method, rainfall-runoff relationship, rational method of estimating runoff, Basin yield.  
B. Stream-Flow Measurement : Introduction, Measurement of stage, discharge measurement by various methods, stage-discharge relationships, rating curve, stream gauging network, units of stream flow.

Unit 4 Hydrograph Analysis : Introduction, characteristics of the hydrograph, Effect of rainfall distribution on the shape of hydrograph, hydrograph separation, Unit hydrograph, Derivation of the unit hydrograph, Unit hydrograph from the complex storms-hydrograph, applications of Unit hydrograph.

Unit 5 A. Evaporation and Evapotranspiration : Introduction, evaporation process, Factors affecting evaporation, estimation of evaporation, measurement of evaporation, reducing evaporation from water surfaces, transpiration, Evapotranspiration  
B. Ground Water : Introduction, occurrence of ground water, aquifer parameters, ground water movement, Darcy's Law, permeability, steady and unsteady flow to wells in Confined and Unconfined aquifers, ground water exploration, Safe yield.

Name of Text Books:

Engineering Hydrology- K. Subramanya (Tata McGraw Hill)

A Text Book of Hydrology- Dr. P. Jaya Rami Reddy (Laxmi Publications)

Name of Reference Books:

Hydrology Principles and Analysis - H.M. Raghunath (New Age International Publication)

Applied Hydrology - Ven Te Chow, David R. Maidment, Larry W. Mays (McGraw Hill)

Applied Hydrology- Linsely R.K. Kohler, M.A. and J.L.H. Paulhus (McGraw Hill)

Hydrology for Engineers and Planners- Cassidy W.C. (Iowa State University Press)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Advanced Concrete Lab

Code: CE- 523

Total Periods per Week: 3

Total Marks: 50

Teacher's Assessment: 30

End Semester Examination: 20

Experiments to be performed (Min 10 experiments)

1. Determination of Strength of concrete
2. Determination of Workability by compaction factor
3. Determination of Slump test for a concrete mix
4. Determination of workability by Veebee test
5. Determination of workability by Flow table test
6. Determination of Modulus of elasticity of concrete and strain measurement by longitudinal compressometer
7. Determination of Soundness test on aggregate
8. Determination of Deleterious materials in fine aggregate
9. Determination of flexural strength of concrete
10. Mix Design by I.S. Code method (with OPC Cement)
11. Mix Design by I.S. Code method (with Slag Cement)
12. Mix Design by I.S. Code method (with Admixtures Cement)
13. Determination of Grading curve of Mix aggregate & sieve analysis  
Determination of Compressive strength of concrete by non destructive test – Rebound Hammer

List of Equipments / Machine Required:

Slump Cone with Tamping Rod, Concrete Cubes (15 x 15 x 15) cm<sup>3</sup>, Tray (45 x 60) cm<sup>2</sup>, (60 x 60) cm<sup>2</sup>, (30 x 45) cm<sup>2</sup>, Trowel (6 Nos.), I.S. Sieves for Coarse and Fine Aggregate, Compression Testing Machine (200 T), Weighing Balance, Sieve Shaker, Compaction Factor Test Apparatus  
Vee-Bee Consistometer, Flow Table, Longitudinal Compressometer, Cylindrical Mould  
Graduated Glass Cylinder (500 ml, 1000 ml), Beaker (500 ml), Rebound Hammer

Recommended Books:

Lab Manual Concrete – M.L. Gambhir (Tata McGraw Hill)  
Concrete Technology – M.S. Shetty (S. Chand & Co.)  
Concrete Technology – M.L. Gambhir (Tata McGraw Hill)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Code: CE- 524

Geotech Engineering I Lab

Total Periods per Week: 3

Total Marks: 50

Teacher's Assessment: 30

End Semester Examination: 20

Experiments to be performed (Min 10 experiments)

1. To determine the water content of soil (%) by oven dry method and pycnometer bottle method.
2. To determine the specific gravity of soil sample by pycnometer bottle method.
3. To determine the specific gravity of soil sample by Specific gravity bottle method.
4. To determine the liquid limit and Plastic limit of a soil sample.
5. To determine the shrinkage limit of soil sample.
6. To determine the particle size distribution of a soil by dry mechanical analysis (sieve analysis).
7. To determine the grain size distribution by wet mechanical analysis (Hydrometer apparatus).
8. To determine in situ dry density of soil by sand replacement method.
9. To determine the mass density of soil by core cutter method.
10. To determine the permeability of soil by falling head methods.
11. To determine the permeability of soil by constant head methods.
12. To determine the liquid limit of soil sample by static cone penetrometer method.
13. Study of various field control test method.
14. Determination of density for contaminated soil.
15. Study of Skempton's pore pressure parameters.

List of Equipments / Machine Required:

Core Cutter Mould, Pycnometer of capacity 500 ml and 1000 ml, Small and Big Soil Container Hydrometer Apparatus, Oven, Liquid Limit Apparatus, Shrinkage Limit Apparatus Constant Head Permeability Test Apparatus, Falling Head Permeability Test Apparatus Mechanical Sieve Analysis (Complete Sets of Sieves), Static Cone Penetrometer Test Apparatus Skempton's Core Pressure Apparatus, Soil Sampling Tube, Piston Tube, Rammer for Compaction Soil Extractor, Measuring Jar Cylinder (1000 CC)

Name of Text Books:

Basic and Applied Soil Mechanics – Gopal Ranjan & Rao A.S.R. (New Age International, New Delhi, 1998)

Soil Mechanics and Foundation Engineering – B.C. Punmia (Laxmi Publication)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Fifth Semester**

Environmental Engineering – I Lab

Code: CE- 525

Total Periods per Week: 3

Total Marks: 50

Teacher's Assessment: 30

End Semester Examination: 20

Experiments to be performed (Min 10 experiments)

1. To determine acidity of water sample.
2. To determine alkalinity of water sample.
3. To determine hardness of water sample.
4. To determine chloride content of water sample.
5. To determine D.O. content of water sample.
6. To estimate the quantity of BOD from water sample.
7. To determine the availability of chlorine in bleaching powder.
8. To determine the residual quantity of Cl<sub>2</sub> Content.
9. Determination of quantity of Optimum Coagulant Dose.
10. Determination of Break Point Chlorination.
11. Determination of Total Solids.
12. Determination of Turbidity.
13. Determination of particulates in air.
14. Determination of MPN.
15. Determination of pH of water.

List of Equipments / Machine Required:

BOD Incubator  
Dust Sampler  
Turbidity meter  
Microscope  
pH meter  
Muffle Furnace  
Hot Air Oven  
Jar Test Apparatus

Name of Text Books:

Environmental Engineering Lab Manual – Dr. B. Kottaiah & N. Kumaraswamy (Charotar Publications)  
Water Supply Engineering – S.K. Garg (Khanna Publication).  
Water Supply Engineering – B.C. Punmia (Laxmi Publication, New Delhi)  
Environmental Science and Engineering – Henry and Heinke (Pearson Education).