

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

Course of Study & Scheme of Examination				B. Tech. VIII 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-811	Structural Engineering Design - IV	4	1	-	20	15	15	50	70	120	5
2	Civil	CE-812	Water Resources Engineering - II	3	1	-	20	15	15	50	70	120	4
3	Civil	CE-813	Numerical Methods in Civil Engg. (Finite Element Analysis)	3	1	-	20	15	15	50	70	120	4
4	Refer Table -3		Professional Elective - III	3	1	-	20	15	15	50	70	120	4
5	Civil	CE-821	Structural Engineering Drawing - II Lab	-	-	3	30	-	-	30	20	50	2
6	Civil	CE-822	Water Resources Engineering Drawing Lab	-	-	3	30	-	-	30	20	50	2
7	Civil	CE-825	Major Project	-	-	16	100	-	-	100	100	200	8
8	Civil	CE-828	Discipline	-	-	-	50	-	-	50	-	50	1
			<b>Total</b>	<b>13</b>	<b>4</b>	<b>22</b>	<b>290</b>	<b>60</b>	<b>60</b>	<b>410</b>	<b>420</b>	<b>830</b>	<b>30</b>

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"

**Table - 3**  
**Professional Elective III (CE814)**  
**Environmental Engineering Group**

<b>S.No.</b>	<b>Board of Study</b>	<b>Subject Code</b>	<b>Subject</b>
1	Civil Engg.	CE-8141	Industrial Waste Treatment
2	Civil Engg.	CE-8141	Advanced Environmental Engineering
3	Civil Engg.	CE-8141	Environmental Pollution and Management
4	Civil Engg.	CE-8141	Air Pollution and Control Measures
<b>Structural Engineering Group</b>			
5	Civil Engg.	CE-8142	Prestressed Concrete Structures
6	Civil Engg.	CE-8142	Analysis of Framed Structures
7	Civil Engg.	CE-8142	Seismic Design of Structures
<b>Water Resources Engineering Group</b>			
8	Civil Engg.	CE-8143	Open Channel Flow
9	Civil Engg.	CE-8143	Water Resources Planning and Management
10	Civil Engg.	CE-8143	Water Shed Management
<b>Geotechnical Group</b>			
11	Civil Engg.	CE-8144	Soil Dynamics and Earthquake Geotechnical Engineering
12	Civil Engg.	CE-8144	Rock Mechanics and Underground Structures
13	Civil Engg.	CE-8144	Geotechnical Process

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

Structural Engineering Design – IV

Code: CE- 811

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

Design of Combined Footings, Rectangular, Trapezoidal and Strap beam type & raff foundation.

Unit 2

Design of Retaining Walls, Cantilever and Counterfort

Unit 3

Design of Tanks, Rectangular and Circular, resting on ground and overhead type with flexible and fixed base, Intze Type

Unit 4

Bridges, Design of super structure for slab bridge and T-Beam bridge for Highways

Unit 5

Prestressed Concrete, Introduction to Prestressed Concrete, Pre-tensioning and Post-tensioning, Different Systems, Losses in Prestress, Permissible stress in Concrete and Steel, Design of Simply supported beam with symmetrical sections, use of IS code

Name of Text Books:

RCC Structures – B.C. Punmia (Laxmi Publications)

Prestressed Concrete – N. Krishna Raju (New Age Publications)

RCC Design – Sinha & Roy (S. Chand & Co.)

Name of Reference Books:

RCC Structures – N. Krishna Raju (New Age Publications)

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

Bridge Engineering – R.K. Raina

IS code

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

Water Resources Engineering - II

Code: CE- 812

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

DURATION OF END SEMESTER EXAM: 4 HOURS

**Unit 1**

Types of Dams, Suitability of a type of dam, Gravity dams - Forces acting on dams, failure of dams and criteria for structural stability, Overturning, Compression or crushing, tension, sliding, principal and shear stress, stability analysis, Elementary profile of a gravity dam, High and low gravity dams, Profile from practical considerations, Design considerations, Openings in dams, Functions and Effects of opening, Joints, Keys and Water stops in gravity dams, Foundation treatment.

**Earth Dams**

Types of Earth fill dams, design criteria, Causes of failures, Control of Seepage, Stability of slopes.

**Unit 2**

**Spillways and Energy Dissipaters**

Introduction, essential requirements of a spillway, spillway capacity, components, Types of spillways, Design of Ogee Spillway, Energy Dissipation below spillways, Types of Energy dissipater, Hydraulic jump as energy dissipater, Stilling basins, design of stilling basin, USBR stilling basins, standard basins.

**Unit 3**

**Diversion Headworks**

Introduction, Types of diversion works, location and components, Weir and Barrage, Effect of construction of weir on the river regime, Causes of failures of Weirs on permeable foundations, their remedies, Bligh's creep theory, Lane's Theory, Theory of seepage flow, Khosla's theory, Design of Vertical drop Weir, Design of Glacis Weir, Canal head regulator.

**Unit 4**

**Regulation Works**

Introduction, Definition of falls, necessity and location of falls, Design and comparative study of the main types of falls, Cross regulator and distributary regulators, their designs.

**Hydraulic Gates**

Control equipments for out-lets, spillway gates, types, design criteria for radial gates, air vents.

## Unit 5

### Cross Drainage Works

Introduction, types, suitability, design of various types of C-D Works, Aqueduct, Syphon Aqueduct, Super Passage, Syphon, level crossing, inlets and outlets.

### Channel Transition

Design of channel transition-expansions and contractions, curves for sub-critical and super critical flows.

### Name of Text Books:

Irrigation Engineering and Hydraulic Structures - S.K. Garg (Khanna Publications)

Irrigation Engineering - B.C. Punmia (Laxmi Publications)

### Name of Reference Books:

Irrigation, Water Resources and Water Power Engineering - Dr. P.N. Modi (Standard Book House)

Theory and Design of Irrigation Structures (Volume - I & II) - Varshney (Nem Chand Bros.)

Irrigation Engineering - Asawa G.L. (New Age International Publications)

Fundamentals of Irrigation Engineering - Bharat Singh (Nem Chand & Bros.)

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

Numerical Methods in Civil Engineering (FEM)

Code: CE- 813

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 to calculus of variation body strain displacement relation for 3D body, plain stress, plain strain cases, potential energy & equilibrium, Degree of freedom, discretization, Convergence requirement, patch test, Hermitian polynomial, stiffness matrix through energy method, lumped & work equivalent load.

**UNIT 2:**

Theory of Linear elasticity: Potential energy principle, Galerkin's method, principle of virtual work. Euler Lagrange equation, Ryleigfh-Ritz method, method of weighted residuals, boundary conditions, Isoperimetric problem.

**UNIT 3:**

Finite element method for one dimensional problem, element and node numbering, shape function, local & Global coordinate system, potential energy approach, quadratic, temp effect, assembly of FE matrix for simple truss and its solution.

Two dimensional problem using constant strain triangle (CST), Isoperimetric element, four noded quadrilateral element , eight noded quadrilateral element

**UNIT 4:**

Beams & Frames: Structural mechanics, finite element formulation, load vector, load, reaction calculation, SF & BM, beam on elastic support, plane frame, 3D frames assembly, Introduction to theory of thin plates, Ressoners Mindlin theory for plate elements.

**UNIT 5:**

Assembly of structure using finite element method using C++/Matlab language. FEM Software & applications.

**Reference Books:**

- 1      Energy & Finite Elements Method in Structural Mechanics- Irving H Shames & Clove L- New Age International Publication.
- 2      Finite Element Primwer- V K Manicka Selvam- Dhanpat Rai & Sons.
- 3      Introduction to Finite Element in Engineering- Tirupathi R. Chandrupatla & A D Belegundu
- 4      FEM Procedure- K J Bathe- Prantice Hall of India, New Delhi
- 5      Finite Element Concepts – Cook
- 6      FEM- Bhavikatti

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

**Industrial Waste Treatment**

Code: CE- 8141

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

General

Effect of discharge of industrial wastewaters on streams, land and environment, Importance and scope, Problems involved in treatment, Variation in quality and quantity of industrial wastewaters.

Standards & Criteria

Indian standards for discharge of treated wastewaters onland, into municipal sewer and natural water courses.

Sampling of Wastewaters

Representative sample, Grab and composite samples.

Unit 2

Effluent Quality and Quantity

Approaches to minimization – good house keeping, equalization and neutralization by mixing of different effluent streams; recycling of wastewater streams. Process modifications in terms of raw materials and chemicals used, Treatment of industrial wastes, Removal of dissolved and suspended solids, Organic waste treatment processes, Sludge treatment and handling.

Unit 3

General Approaches to Planning of Industrial Wastewater Treatment and Disposal

Equalization and proportioning, Neutralization

Treating different effluent streams separately

Treating different streams jointly after mixing them partly or fully

Including / excluding domestic wastewater along with the industrial waste

Treating industrial wastewaters along with town waste.

Unit 4

General Approaches for Handling and Treatment of Specific Characteristics of Industrial Wastewaters

Stream Water Quality, DO Sag Curve, etc. Approaches for treating wastes having shock loads, colours, toxic metal-ions, refractory substances, e.g., ABS and other detergents, growth inhibiting substances such as insecticides, high concentration of nutrients (N.P.K., etc.), oil and grease, suspended solids, BOD., hot wastes, wastes with acidity, alkalinity, etc.

Unit 5

Process Flow Diagrams, Characteristics and Treatment of Various Industrial Wastes

Industrial wastes of pulp and paper, textile, tannery, food, canning, sugar mill, distillery, dairy, pharmaceutical, electroplating, etc.

Industrial pollution abatement measures, referring to case studies in fertilizer industries, textile, petroleum refineries and distilleries.

Name of Text Books:

Introduction to Environmental Science – Y. Anjaneyulu (B.S. Publications)

Elements of Environmental Engineering – K.N. Duggal (S. Chand & Co., New Delhi)

Name of Reference Books:

The Treatment of Industrial Wastes – Besseliere, E.B. and Schwartz, M. (McGraw Hill Kogakusha Ltd., New Delhi, 1969)

Industrial Water Pollution – Nemerow, N.L. (Ann Arbour, New York, 1978)

Waste Water Engineering – MetCalaff Eddy (Tata McGraw Hill, New Delhi)

Environmental Engineering – G.N. Pandey & G.C. Karney (Tata McGraw Hill, New Delhi)



**Civil Engineering Department**  
**Eighth Semester**

**Advanced Environmental Engineering**

Code: CE- 8141

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

Concept of ecological principles, fundamental constituents of environment, Concept of productivity, Pollution and environmental health, pollution cost, Monitoring of pollution, environmental pollution, strategy for a livable environment, international institutions for environmental management.

Unit 2

Air Pollution, introduction, effect of air pollution on the environment, sources of air pollution and control, biomedical aspects of air pollution, Meteorological aspects of air pollution, lapse rate, temperature inversion, adverse effects of air pollution.

Sources and effects of air pollutants like CO, nitrogen oxides, sulphur oxides, hydrocarbons, particulate matters.

Unit 3

Water Pollution, What is water pollution, drinking water standards, quality of water for other uses, stream pollution and self purification natural streams, Streeter-Phelps Water Quality Model.

Biological treatment, design of A.S.P., trickling filter, oxidation pond, sludge treatment and disposal, disposal system and effluent discharge standards.

Unit 4

Air pollution monitoring, stack monitoring system, high volume sampler, air quality standards for ambient air, mathematical modeling in air of pollution control, Box model, Gaussian Plume Model, air pollution from mobile sources and their control.

Unit 5

Reclamation of waste water, radio active waste management, eutrophication of lakes, measurement and detection of eutrophication, acid rain, global warning and green house effect, ozone depletion.

Indoor air pollution control measures, Occupational diseases and their impact on environment.

Name of Text Books:

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

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

Name of Reference Books:

- (1) Environmental Engineering – Peavy & Rowe (Tata McGraw Hill, New Delhi).
- (2) Water Supply and Sanitary Engineering – G.S. Birdi (Dhanpat Rai Publications).
- (3) Introduction to Environmental Science – Y. Anjaneyulu (B.S. Publications).
- (4) Environmental Science and Engineering – Henry and Heinke (Pearson Education).
- (5) Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).

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

**Environmental Pollution and Management**

Code: CE- 8141

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**

Basic principles of environmental management, its Pollution and control, Environmental Policies and Legislation, Rules, acts, standards, criteria, specification, nature and scope of environmental problems.

**Unit 2**

Ecology of population, population attributes, world population growth and the effect of over crowding on ecology, economy and the future of man.

**Unit 3**

Environmental Research Methodology, approaches, method of Data collection, sampling systems, approach to environmental problems, health and environmental implications of solid waste management, Fate of pollutants in air, water, soil and ground water.

**Unit 4**

Management and handling of hazardous substances, Sanitary land fills, incineration, composting, hydropulping, pyrolysis.

Environmental Audit, The Indian Scenario, definition of audit, procedure of auditing.

**Unit 5**

Introduction to sustainable development, Definitions, strategies for sustainable development, environmental debts, appropriate technologies, related case studies.

Environmental inventory, Environmental Impact Assessment methods, Basic steps for prediction and assessment, water environment, air environment, noise environment.

**Name of Text Books:**

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

Introduction to Environmental Science – Y. Anjaneyulu (B.S. Publications)

**Name of Reference Books:**

Introduction to Environmental Engineering and Science – Masters, G.M. (Prentice Hall of India Pvt. Ltd., 1991)

Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).

Introduction to Environmental Science – Y. Anjaneyulu (B.S. Publications).

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

Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).

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

**Air Pollution and Control Measures**

Code: CE- 8141

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

Air Pollution

Problem, Definitions, Classification of pollutants, characteristics and sources.

A.P. Monitoring

Measurement of stack gases, Sampling methods, Difficulties in sampling, sampling of SPM, stack sampling techniques.

Unit 2

Air pollution meteorology, stability class condition, plume behaviour, topographical effects on air pollution, wind profiles, wind roses.

Gaussian plume models, assumptions and limitations of GPM, problem on modelling.

Unit 3

SO<sub>x</sub> sources, ambient concentrations, test methods, SO<sub>x</sub> control techniques, effects of SO<sub>x</sub> on human, animal health, plants and on materials.

NO<sub>x</sub> sources, ambient concentrations, test method control techniques, effects of NO<sub>x</sub> on human health, animal health, plants and on materials.

Particulate size distribution, collection and removal mechanics.

Unit 4

Major air pollution disaster episodes, special diseases caused by air pollution, symptoms of chronic air pollution.

Mechanisms of deterioration in polluted atmospheres, effect of air pollution on art treasures in India.

Unit 5

Air quality criteria and emission standards, US and Indian standards, air pollution act, constitution, power and functions of the boards.

Global effects of air pollution – Green house effect, acid rains, ozone layer depletion, etc.

Name of Text Books:

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

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

Name of Reference Books:

Air Pollution – Henry C. Perkins, (McGraw Hill Kogakusha Ltd., Tokyo, Japan, 1974)

Air Pollution – Stern, Arthur C. (Academic Press, New York, USA, 1977)

Introduction to Environmental Science – Y. Anjaneyulu (B.S. Publications).

Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).

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

**Prestressed Concrete Structures**

Code: CE- 8142

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

Methods, Systems and Materials

Basic principles, methods and systems of prestressing, external, internal, full, partial, pre-tensioning and post-tensioning, quality of concrete and steel, I.S. Code provisions for allowable stresses, Advantages of prestressing and importance of high strength materials.

Unit 2

Analysis of Structures for Flexure

Cases of axial and eccentric prestressing allowing suitable percentage loss of prestress. Stresses in concrete at various stages, lever arm concept and center of pressure, pressure line, kern distances, load balancing cable profiles, critical span (for solid slabs only), Efficiency of a section.

Unit 3

Losses of Prestressing

Various types of losses of prestress and their calculation, loss due to friction, I.S. Code provisions, Elastic shortening due to successive tensioning of cables.

Design of section for flexure

I.S. Code provisions for cover and spacing, standard Fressinet and Gifford Udall cables, Design of beams and slabs, cable zones and profiles.

Unit 4

Composite Beams

Different types, Loading conditions, analysis for stresses, differential shrinkage.

Bond and Anchorage

Bond stress and its significance in pre-tensioned beams, transmission length, determination of bursting force due to anchor zone stresses and provision of steel according to I.S. Code for prestressed concrete.

Shear

Calculation of diagonal tension and its inclination (including vertical prestressing also) provision of steel according to elastic method and I.S. Code method, advantages of prestressing.

Unit 5

Limit State Design

Limit state of serviceability and strength, calculation of ultimate bending moment for given sections, advantages of limit state method over working stress method.

Miscellaneous uses

Analysis and design of poles and circularly prestressed pipes and tanks.

Name of Text Books:

Prestressed Concrete – Krishna Raju N. (New Age International)

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

**Analysis of Framed Structures**

Code: CE- 8142

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

Kani Method

Analysis of Indeterminate beams and frames by Kani's Method.

UNIT 2

Approximate Methods

Analysis of multistoreyed frames for horizontal loads by Cantilever and Portal Methods.

Dead and Live Load (Substitute Frame) Analysis for multistoreyed buildings.

UNIT 3

Flexibility Method

Introduction to Matrix method of analysis, formulation of flexibility matrices, application to simple problems involving not more than three unknowns.

UNIT 4

Stiffness Method

Formulation of stiffness matrices, application to simple problems involving not more than three unknowns.

UNIT 5

Finite Element Method

Fundamentals, Element DOF's, Variational functions. Application of Rayleigh Ritz method and Galerkin method to FEM – Solution methodology, spring and beam Elements. Cartesian and natural co-ordinates, Assembly and solution techniques for Matrix and FEM problems

Name of Text Books:

Basic Structural Analysis – C.S. Reddy (Tata McGraw Hill)

Structural Analysis (Vol. – II) – Gupta, Pandit G.S. and Gupta S.P. (Tata McGraw Hill, New Delhi, 1999)

Name of Reference Books:

Matrix Finite Element Computer and Structural Analysis – Mukhopadhyaya (Oxford and IBH Publishing Co.)

Computational Structural Mechanics – S. Rajashekar and G. Sankarasubramaniam (Prentice Hall of India, 3E Edition, 2001)

Structural Analysis (2<sup>nd</sup> Edition) – Alexander Chajas (Prentice Hall, Engineering and Engineering Mechanics Series – 1990)

Introduction to Finite Elements in Engineering – Chandrupatla T.R. & Belegundu A.D. (Prentice Hall of India, 1996)

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

**Seismic Design of Structures**

Code: CE- 8142

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**

Engineering seismology

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, codal provisions

**Unit 3**

Masonry buildings

Seismic design and detailing of masonry buildings.

**Unit 4**

RCC buildings

Seismic design and detailing of RCC buildings.

**Unit 5**

Steel Buildings

Seismic design and detailing of Steel buildings.

**Name of Text Books:**

Dynamics of Structures: Theory and Application to Earthquake Engineering (2<sup>nd</sup> edition) – Anil K Chopra (Pearson Education Publication)

IS 1893, IS 13920, IS 4326, IS 13828, Bureau of Indian Standards, New Delhi

**Name of Reference Books:**

Design of Earthquake Resistant Buildings – Minoru Wakabayashi (McGraw Hill Publication)

Fundamentals of Vibrations – Anderson, R.A. (Mc Millan)

Vibration and Structural Dynamics – Timoshenko, S. (VanNostrand Co.)

Vibration and Structural Dynamics – Mukyopadhyaya (Oxford & IBH)

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

**Open Channel Flow**

Code: CE- 8143

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**

Difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation.

**Uniform flow**

Chezy's and Manning's equations for uniform flow in open channel, velocity distribution, most efficient channel section.

**Unit 2**

**Energy and Momentum Principles**

Critical depth, concepts of specific energy and specific force, application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions.

**Unit 3**

**Non-Uniform Flow in Open Channel**

Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods, flow in curved channels.

**Unit 4**

**Hydraulic Jump, Surges, Water Waves**

Classical hydraulic jump, evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, equation of motion for unsteady flow, open channel surge, celerity of the gravity wave, deep and shallow water waves.

**Unit 5**

**Spatially-varied flow**

Introduction, SVF with increasing discharge, differential equation of SVF with increasing discharges, control point, classification and solutions, profile computation, SVF with decreasing discharge, differential equation for SVF with decreasing discharge, computations.

**Name of Text Books:**

Fluid Mechanics – A.K. Jain (Khanna Publication)

Open Channel Flow – Subramanya (Tata McGraw Hill, New Delhi)

**Name of Reference Books:**

Engineering Fluid Mechanics (including Hydraulic Mechanics) (2<sup>nd</sup> Edition) – Garde, R.J., and A.G. Mirajgaoker (Nem Chand & Bros., Roorkee, 1983)

Flow Through Open Channels – Ranga Raju, K.G. (Tata McGraw Hill, New Delhi, 1993)

Experimental Fluid Mechanics (Vol. 2) – Asawa, G.L. (Nem Chand and Bros., 1992)

Open Channel Flow – Ven Te. Chow (McGraw Hill)



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

**Water Resources Planning and Management**

Code: CE- 8143

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

Role of water in national development, assessment of water resources of country, scope of water resources development vis-a-vis environment, Irrigation development in India, utilisation of Irrigation potential.

Unit 2

Planning

Water resources planning process; planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis.

Unit 3

Water Resources Systems

Definition, types of system, optimization techniques, system approach, system analysis, linear programming, formulation of a linear programming problem, formulation with different types of constraints, graphical analysis, graphical solution, simplex method, optimization techniques and systems approach.

Unit 4

Management

Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water, conjunctive use of surface and ground water.

Unit 5

Modelling

Water quantity and quality modelling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

Name of Text Books:

Principles of Water Resources Planning – Good Man, A.S., (Prentice Hall, Inc., Englewood Cliffs, N.J. 1984.)

Water Resources Engineering – Linsley, R.K. and Franzini, J.B., (3<sup>rd</sup> Edition) (McGraw Hill, New York, 1979)

Name of Reference Books:

Water Resources System, Planning and Management – M.C. Chaturvedy (Tata McGraw Hill)

System Approach to Water Management – Biswas A.K. (Tata McGraw Hill)

Water Resources System, Planning and Management – Helweg O.J. (John and Wiley & Sons)

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

**Water Shed Management**

Code: CE- 8143

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

Soil and Water, Issues related to plant life like composition of soil, water requirement of crops, necessary conditions for plant growth etc.  
Soils, their origin and classification.

Unit 2

Land classification for WM, Land capability rating, determination of land capability class, land capability and suitability surveys.

Unit 3

Soil erosion, problem, types, conservation, and control measures in agricultural and non-agricultural land. Water conservation and Harvesting, Agronomical measures in soil and water conservation. Examples and critical reviews.

Unit 4

Watershed Management, Approach in Govt. programmes, people's participation, conservation farming, watershed-management planning, identification of problems, objectives and priorities, socioeconomic survey, use of tools like GIS.

Unit 5

Hill slope processes, forest and land use, hill slope conservation. Bad lands, bad land development.

Name of Text Books:

Watershed Management – J.V.S. Murthy (New Age International Ltd.)

Name of Reference Books:

Watershed Management – B.M. Tideman

Modern physical geography – Strahler A.N. and Strahler A.H.

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

**Soil Dynamics and Earthquake Geotechnical Engineering** Code: CE- 8144

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

Engineering problems involving soil dynamics; Role of Inertia; Theory of Vibrations: Single and two-degree freedom systems, Vibration measuring instruments, Vibration isolation, Wave propagation in elastic media

Unit 2

General nature of soil behavior under cyclic/dynamic loading; Field and Laboratory tests for measurement of small strain and large strain dynamic properties of soils.

Unit 3

Design criteria for machine foundations, elastic homogeneous half space solutions, lumped parameter solutions. Codal provisions.

Unit 4

Strong ground motion: Measurement, characterization and estimation, Amplification theory and ground response analysis.

Unit 5

Densification and liquefaction of granular soils, Seismic slope stability analysis, Seismic bearing capacity and earth pressures. Codal Provisions.

Text Book:

1. Kramer, S. L.: Geotechnical Earthquake Engineering, Prentice-Hall International Series in Civil Engineering and Engineering Mechanics, Pearson Education.
2. Gulhati S.K., Datta, M.: Geotechnical Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books

1. Gulhati S.K., Datta, M.: Geotechnical Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Cording et. al. : the art and science of Geotechnical Engineering, Prentice-Hall International Series in Civil Engineering and Engineering Mechanics, Pearson Education
3. Wolf: Dynamics Soil-Structure Interaction, Prentice-Hall International Series in Civil Engineering and Engineering Mechanics, Pearson Education.
4. Wray: Measuring Engineering Properties of Soils, Prentice-Hall International Series in Civil Engineering and Engineering Mechanics, Pearson Education.

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

**Rock Mechanics and Underground Structures**

Code: CE- 8144

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 Structural Geology**

Origin, Interior and composition of the earth, Rock cycle, Igneous, Metamorphic and sedimentary rocks, Rock structures, Plate tectonics, Continental drift and sea floor spreading, Layered formations, attitude and true dips, topographic maps, Measurement of attitude of formations.

**Unit 2 Engineering Properties of Rock and Rock Masses**

Introduction, Rock materials, Physical properties, Strength behavior in uniaxial compression, tension and triaxial state, Laboratory testing methods, Stress-strain relationship, Factors influencing strength, Failure criteria, Post failure behavior.

Strength and deformation behavior of discontinuities, Rock mass behavior, Shear strength of jointed rocks, roughness, peak and residual strength. Strength criteria for rockmass.

**Unit 3 Geotechnical Process in Rock Engineering**

Ground improvement techniques, assessment, compaction of disintegrated and weathered rocks, Grouting and grouting techniques, Shotcrete, method and materials, factors, Fibre reinforced shotcrete, Ground anchors, principles of reinforcement, rock bolts, cable anchors, Dewatering techniques, codal provisions.

**Unit 4 Excavation Methods and Machinery**

Principles of rock breakage, Explosive energy, Energy balance, Blasting mechanism, Types of explosive, Initiators, Delay devices, Blast hole timing, Open pit and underground blasting.

**Unit 5 Design of underground structures**

Introduction, Types and classification of underground openings, Factors affecting design, Design methodology, Functional Aspects, Size and shapes, Support systems. Design based on analytical methods, Empirical methods based on RSR, RMR, Q system, Design based on Rock support interaction analysis, Observational method, NATM, Convergence and confinement method.

**Text Book:**

1. Goodman, R.E.,: Introduction to Rock Mechanics. John Wiley & Sons.
2. Ramamurthy, T.: Engineering Properties in Rocks For Slopes, Foundations and Tunnels. Prentice hall of India Private Limited.

**Reference Books:**

1. Vutukauri, Lama & Saluja: Handbook of Engineering Properties of Rock Vol-I.
2. Singh, B. & Goel, R.K.: Rock mass classification. A practical Approach in Civil Engineering.
3. Housmann,: Ground Modification
4. Shoeff: Ground Modification by Rock Bolts and Anchors.
5. Hoek, E. and Brown, E.T., : Underground Excavation in Rock. The institution of Mining and Metallurgy, London.

6. Hoek, E. and Brey, J. : Rock Slope Engineering. The institution of Mining and Metallurgy, London.
7. Obert, L. & Duvell, W. J.: Rock Mechanics & the Design of Structures in Rock. John Wiley & Sons.
8. Bieniawski, Z.K. : Rock Mechanics & the Design of Structures in Rock. John Wiley & Sons.

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

**Geotechnical Process**

Code: CE- 8144

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

Dewatering

Methods, selection, analysis and design of dewatering system.

Unit 2

Grouting

Types of grouts and their properties; Methods of grouting; Grout selection and control.

Unit 3

Compaction

Diffused double layer theory of compaction; Methods of compaction; Engineering properties of compacted soil; Field compaction and its control.

Unit 4

Soil Stabilisation

Stabilisation using chemical additives and other methods.

Unit 5

Reinforced Earth

Concept, materials, application and design of reinforced earth wall.

Name of Text Books:

1. Modern Geotechnical Engineering – Alam Singh (IBT Publishers, Delhi, 1987)
2. Gulhati S.K., Datta, M.: Geotechnical Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Name of Reference Books:

1. Foundation Design and Construction (5th Edition) – Tomlinson, M.J. (ELBS, Singapore, 1988)
2. Foundation Engineering (Ed.) – Leonards, G.A. (McGraw Hill, New York, 1962)
3. Geotechnical Engineering – Lee, I.K., White, W. and Ingles, O.G. (Pitman, Marshfield, Mass (U.S.A.), 1983)
4. Analysis and Design of Substructures – Swami Saran (Oxford and IBH, New Delhi, 1996)

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

Structural Engineering Drawing II Lab

Code: CE- 821

Total Theory Periods per Week: 3

Total Marks: 50

Teacher's Assessment: 30

End Semester Examination: 20

Experiments to be performed (Min 10 experiments)

RCC and steel structural drawings based on Structural Engineering Design III & Structural Engineering Design IV

Field Visit (Minimum 3 times)

List of Equipments / Machine Required:

List of Equipments – Not Required.

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

Water Resources Engineering Drawing Lab

Code: CE- 822

Total Theory Periods per Week: 3

Total Marks: 50

Teacher's Assessment: 30

End Semester Examination: 20

Experiments to be performed (Min 10 experiments)

1. Drawing of gravity dam section showing following details: openings in dams, joints, key and water stops.
2. Drawing of Earth dam section showing details of different types of earth dam.
3. Drawing of Ogee Spillway section.
4. Drawing of different types of energy dissipater and stilling basins.
5. Drawing of layout of diversion head works showing its different components.
6. Drawing of vertical drop weir.
7. Drawing of Glacis weir.
8. Drawing of canal head regulator.
9. Drawing of main types of canal fall.
10. Drawing of different types of hydraulic gates.
11. Drawing of aqueduct.
12. Drawing of Syphon Aqueduct.
13. Drawing of Super Passage.
14. Drawing of Canal Syphon.
15. Drawing of Level Crossing and inlets and outlets.

Name of Text Books:

Irrigation Engineering and Hydraulic Structures - S.K. Garg (Khanna Publications)

Irrigation Engineering - B.C. Punmia (Laxmi Publications)

Name of Reference Books:

Irrigation, Water Resources and Water Power Engineering - Dr. P.N. Modi (Standard Book House)

Theory and Design of Irrigation Structures (Volume - I & II) - Varshney (Nem Chand Bros.)

Irrigation Engineering - Asawa G.L. (New Age International Publications)

Fundamentals of Irrigation Engineering - Bharat Singh (Nem Chand & Bros.)