

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

Course of Study & Scheme of Examination							B. Tech. VI 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-611	Structural Engineering Design - II	3	1	-	20	15	15	50	70	120	4
2	Civil	CE-612	Environmental Engineering-II	3	1	-	20	15	15	50	70	120	4
3	Civil	CE-613	Quantity Surveying and Cost Evaluation	4	2	-	20	15	15	50	70	120	5
4	Civil	CE-614	Geotech Engineering -II	3	1	-	20	15	15	50	70	120	4
5	Civil	CE-615	Construction Planning and Management	3	1	-	20	15	15	50	70	120	4
6	Refer Table -I		Professional Elective-I	3	1	-	20	15	15	50	70	120	4
7	Civil	CE-621	Structural Engineering Lab	-	-	3	30	-	-	30	20	50	2
8	Civil	CE-622	Environmental Engineering - II Lab	-	-	3	30	-	-	30	20	50	2
9	Civil	CE-624	Geotech Engineering-II Lab	-	-	3	30	-	-	30	20	50	2
10	Humanities	CE-627	I & E Skill	-	-	2	25	-	-	25	0	25	1
11	Civil	CE-628	Discipline	-	-	-	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"

<b>Table - 1</b>			
<b>Professional Elective I (CE614)</b>			
<b>Material Group</b>			
<b>S.No.</b>	<b>Board of Study</b>	<b>Subject Code</b>	<b>Subject</b>
1	Civil Engg.	CE-6161	Modern Construction Materials
2	Civil Engg.	CE-6161	Composite Materials
3	Civil Engg.	CE-6161	Advanced Concrete Technology
4	Civil Engg.	CE-6161	Advanced Strength of Materials
<b>Surveying Group</b>			
5	Civil Engg.	CE-6162	Modern Surveying Techniques
6	Civil Engg.	CE-6162	Remote Sensing and its Applications
7	Civil Engg.	CE-6162	GIS and its Applications
<b>Hydraulics Group</b>			
8	Civil Engg.	CE-6163	Computational Hydraulics
9	Civil Engg.	CE-6163	Instrumentation in Fluid Mechanics
10	Civil Engg.	CE-6163	Water Power Engineering
<b>Geotechnical Engineering Group</b>			
11	Civil Engg.	CE-6164	Expansive Soil
12	Civil Engg.	CE-6164	Geosynthetics and Reinforced Soil

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

Structural Engineering Design – II

Code: CE- 611

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 Materials and Methods of Analysis**

Properties of Structural Steel, I. S. Rolled Sections, I. S. Specifications, Elastic Analysis, Plastic Analysis for steel beams and frames - plastic hinges, Collapse mechanism, plastic modulus, shape factor.

Introduction to working stress method and Limit state method of design of steel structures, types of loads and load combinations.

**Unit 2 Fasteners and Tension Members**

Riveted, Bolted and Welded Connections, Strength, Efficiency and Design of Joints, Advantages and Disadvantages of Welded Joints, Design of Fillet and Butt Welds, Design of Eccentric connections, Introduction to high strength friction grip bolts.

Net Sectional Area, Design of Axially Loaded Tension Member, Steel Angles under tension

**Unit 3 Compression Members and Column Bases**

Modes of Failure of a Column, Buckling Failure: Euler's Theory, Effective Length, Slenderness Ratio, Design Formula: I.S. Code Formula, Design of Compression Members, Design of Built-Up Compression Members: Laced and Battened Columns, Slab and Gusseted Bases.

**Unit 4 Beams**

Design Procedure, laterally supported and laterally unsupported beams, Built-Up Sections, Web Crippling, Web Buckling, Curtailment of Flange Plates

**Unit 5 Member Subjected To Combined Forces**

Design of Member Subjected to combined forces, Eccentricity of Load, Interaction Formulae. Eccentrically Loaded Base Plates.

Name of Text Books:

Design of Steel Structures – Arya, A.S., Ajmani, J.I. (Nem Chand & Bros., Roorkee, U.P.)

Design of Steel Structures – Punmia, Jain & Jain (Laxmi Publications)

Name of Reference Books:

I.S. code of practice on steel structures

Design of Steel Structures – Duggal S.K. (Tata McGraw Hill)

Design of Steel Structures (Vol. - I & II) – Ram Chandra (Standard Book House, New Delhi)

Design of Steel Structures – Dayaratnam (Wheeler Publishing, New Delhi)

Design of Steel Structures – E.H.Gaylord and C.N. Gaylord (McGraw Hill, New York)

Steel Structures: Design and Behaviour – C.G.Salmon and J.E.Johnson (Harper and Row, New York)

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

Environmental Engineering - II

Code: CE- 612

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**

Sewage and Sewerage, definitions and some common terms, object of sewage disposal.

System of sanitation: Conservancy systems, Water system, sewage system-combined, separate and partially separate, patterns of collection system.

Amount of sewage-Estimation of domestic and storm sewage, variations in the quantity of sewage, Design of sewers (Only circular sewer) Manholes, Pumping stations, Wet well capacity.

**Unit 2**

Characteristics of sewage-physical, chemical and biological characteristics, fundamentals of aerobic & anaerobic process. Sewage treatment-preliminary treatment systems, Racks and screens, comminuters, Grit chambers. Primary treatment systems-Plain sedimentation, detention time and over-flow rates, types of inlets and outlets, onsite wastewater treatment- septic tank, Imhoff tank, oxidation pond .

**Unit 3**

Secondary treatment systems-(i) Attached growth process-Trickling filters, standard and high rates, efficiency (NRC) formula, operational problems of trickling filters (ii) Suspended growth process, principle of suspended growth process, Activated sludge process, Oxidation ditch aeration and mixing techniques, Operational problems of activated sludge systems, stabilisation tools aerobic, anaerobic and facultative lagoon.

**Unit 4**

Sewage sludge treatment-Importance, amount and characteristics of sludge, sludge digestion, Anaerobic digestion, aerobic digestion, sludge drying beds. Sewage disposal: disposal by dilution, self purification of polluted streams, factors affecting self purification, Sag curve, disposal on land surfaces. Stream standards, Effluent standards.

**Unit 5**

Industrial Waste Management- Theories of waste treatment (Volume reduction, strength reduction, new Equalization and proportioning) Summary of Industrial waste, its origin, character and treatment.

Solid waste management, source and characteristics, environmental and health implications, refuse characteristics, collection methods, disposal of solid waste by land filling, composting and incineration methods. Collection and disposal of refuse, Composting of refuse.

**Name of Text Books:**

1. Environmental Engineering – Peavy & Rowe (Tata McGraw Hill, New Delhi).
2. Waster Water Engineering – S.K. Garg (Khanna Publication).

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

Name of Reference Books:

1. Environmental Science and Engineering – Henry and Heinke (Pearson Education).
2. Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).
3. Introduction to Environmental Science – Y Anjaneyulu (B S Publications).
4. C P H E E O Manual on Sewerage Treatment.

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

Quantity Surveying and Cost Evaluation

Code: CE- 613

Total Theory Periods per Week: 4      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

[12 Marks]

General

Introduction to quantity surveying, methods of measurements and units of measurements of various items of work, Principles of estimating, different types of estimates, procedure for computation of stage I estimate.

General Terms

Administrative approval, technical sanction, Competent authority, Deposit works, suspense account, imprest account, indent of stores, muster roll. Measurement book, material at site account, stock account, establishment charges, contingencies.

Unit 2

[32 Marks]

Quantity estimate

Types, data required for estimation detailed estimates of civil engineering works. Buildings, canals, roads steel works, water supply and sanitary works.

Unit 3

[12 Marks]

Analysis of rates

Purpose and principles factors affecting the rates of items of works, Analysis of rates of different items such as cement concrete of different proportions, brick masonry in different mortars, flooring (tiles, mosaic, cement concrete flooring). Use of Schedule of rates.

Specifications

Purpose and basic principles, types of specifications: brief and detailed specifications for various items of works.

Unit 4

[12 Marks]

Contracts

General requirements of contract, types of contract, conditions, termination of contract. Brief idea about types of tender, tender notice, earnest money, security deposit, liquidated damages, arbitration, escalation.

Unit 5

[12 Marks]

Valuation of property

General, object of valuation, definitions of terms related to valuation, methods of determining value of property, development method of valuation, concept of capitalized value and year purchase, depreciation, lease, mortgage, easement.

Name of Text Books:

Estimating and Costing in Civil Engineering – B.N. Dutta (UBS Publishers, New Delhi)

Estimating and Costing and specifications – M. Chakrabarty (UBS Publishers, New Delhi)

Name of Reference Books:

Textbook of Estimating and Costing – G.S. Birdi (Dhanpat Rai Publications)

Valuation of real properties – S.C. Rangwala (Charotar Publication)

A Textbook of Estimating and Costing – Kohli & Kohli (S. Chand & Co.)

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

Geotech Engineering - II

Code: CE- 614

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 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, additional earth pressure due to surcharge and earthquake loading.

**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, rafts on sand using penetration and load test data, estimation of settlement of footing for rigid and flexible, proportioning of footings.

**Unit 4 WELL AND PILE FOUNDATIONS**

Various types of caissons situations where adopted, elements of wells, types, method of construction, Tilt and shift, remedial measures, bearing capacity and settlement, Terzaghi's lateral stability analysis, 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, response of block foundations under vertical vibrations, 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.



## Introduction of Rock mechanics – RQD, Rock Properties related to design considerations

### Name of Text Books:

Basic and applied Soil Mechanics (Revised Edition) – Gopal Rajan and Rao A.S.R. (New Age, 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 Engineering in Theory and Practice (Vol-II) – Alam Singh (Asia Publishing House, New Delhi)

Foundation Engineering (2nd Edition) – Peck,R.B., Hanson (W.E. and Thornburn. W.H. Johan Wiley, New York 1976)

Foundation design and Construction (5th Edition) – Tomlinson, M.J. (ELBS, Singapore. 1988)

Foundation Analysis and Designing – J.E. Bowles (McGraw Hill, New Delhi)

Soil Engineering in Theory and Practice (Vol. - II) – Alam Singh (Asia Publishing House, New Delhi, 1981)

Physical Methods of Soil Characterisation – J. Behari (Narosa Publishing Hall, New Delhi)

# National Institute of Technology Raipur (CG)

## Civil Engineering Department

### Sixth Semester

Construction Planning and Management

Code: CE- 615

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 : Objectives and functions of project management, project feasibility reports, Planning for construction projects, Cost control in construction-importance, objectives of cost control, cost control systems.

Economics of Project management : Economic analysis of engineering projects, economic studies, sensitivity analysis, Introduction to Management Information System (MIS)- definition, outline of MIS.

Unit 2 Scheduling : Scheduling Job layout and Line of balance, project management through networking, Bar Chart, Linked bar chart, Work-break down structures, Activity-on-arrow diagrams, CPM: Critical Path, Probabilistic activity durations; Event based network, PERT Network: Time-cost Study, Crashing; Resources allocation.

Unit 3 Safety and Quality Control : Importance, causes of Accidents safety measures, responsibility for safety, safety benefits to various parties. Quality control in construction: Importance, Elements of quality, Quality Assurance Techniques, Quality Control Circles. Total Quality Management in construction, Introduction, Elements of TQM, Approaches to total quality, difference between traditional management and TQM, Applications and constants of TQM in construction process.

Unit 4 Economics of Project management : Economic analysis of engineering projects, economic studies, sensitivity analysis, Introduction to Management Information System (MIS)- definition, outline of MIS.

Unit 5 Construction Equipments and Management : Classification of construction equipments, earth moving equipments: Power shovel, hoe, dozer, dumper, trailers and tractor, rollers, sheet foot rollers, pumps, hauling equipments, hoisting equipments, aggregate and concrete production equipments: Weight batcher, Mixer, Vibrator, Batching Plant, Concrete pump, Cranes, Lifting equipment, pile driving equipments, time and motion studies, waiting line theory, Need for mechanisation, financing aspects, factors affecting selection of construction equipments, cost of owning and operating the construction equipment, role of operation research in equipment management, equipment maintenance.

Name of Text Books:

Construction Engineering and Management – S. Seetharaman (Umesh Publications, New delhi, 1997)

PERT & CPM – Punmia, B.C. and Khandelwal, K.K. (Laxmi Publications, New Delhi 1997)

Construction Management and Planning – Sen Gupta & Guha (Tata McGraw Hill)

Name of Reference Books:

Construction Planning Equipment and Methods – Peurify/ Schexnayder, 6th Edition (Tata McGraw Hill)

PERT & CPM – Sreenath, I.S. (East West Press, New Delhi, 1975)

Construction Management and Accounts – Vazirani, V.N. & Chandola, S.P. (Khanna Publishers, New Delhi, 2002)

Construction Planning and Management – Gahlot & Dhir (New Age Publishers)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Sixth Semester**  
**Modern Construction Materials**

CE 6161

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

Concretes : High strength and High performance concrete-Fiber Reinforced concrete

Unit 2

Metals : New Alloy steels-Aluminium and its products-Other alloys

Unit 3

Composites : Plastics-Reinforced polymers-FRP-Cellular cores

Unit 4

Other Materials : Water proofing compounds-Non -weathering Materials-Flooring and Facade Materials

Unit 5

Smart and Intelligent Materials : Brief outline and uses

Name of Text Books:

Civil Engineering Materials (2nd Edition) – Shan Somayaji (Prentice Hall Inc., 2001)

Materials for Civil and Construction Engineers – Mamlouk, M.S. and Zaniewski, J.P. (Prentice Hall Inc., 1999)

Name of Reference Books:

Materials for Civil and Highway Engineers (4th Edition) – Derucher, K.Korfiatis. G. and Ezeldin, S. (Prentice Hall Inc., 1999)

High Performance Concrete – Aitkens (McGraw Hill, 1999)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Sixth Semester**  
**Composite Materials**

CE 6161

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, Historical background, Technological Applications, Composites – various reinforcement and matrix materials, Classification of composites.

**Unit 2**

Forms of fibre reinforcement, Comparisons of composites with R.C.C. and metals, Strength and stiffness properties, Effective moduli.

**Unit 3**

Fibre reinforced composite materials, Manufacturing Technique, Cost and Weight advantages.

**Unit 4**

Behaviour of uni-directional, cross-ply, angle-ply and other composites-strength and stiffness, anisotropy, Generalized Hooks law.

Laminates-Laminated Plates, Analysis, Strength and design with composites, Fibre reinforced Pressure vessels.

**Unit 5**

Laminates-Laminated Plates, Analysis, Strength and design with composites, Fibre reinforced Pressure vessels.

**Name of Text Books:**

Mechanics of Composite Materials – Robert M.Jones (Taylor & Francis, Philadelphia, 1998)

Fibre Reinforced Composites – P.K. Mallick (Marcel Dekker, Inc., New York, 1993)

**Name of Reference Books:**

Introduction to Design and Analysis with Advanced Composite Materials – Stephen R. Swanson (Prentice Hall, New Jersey, 1997)

Stress Analysis of Fiber-Reinforced Composite Materials – M.W. Hyer (WCB McGraw Hill, New York, 1998)

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

Advanced Concrete Technology

CE 6161

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 Concrete Making Materials :**

Methods of combining aggregates, specified gradings, Types of Fibers. Hydration of cement, Structure of hydrated cement, Special cements, Industrial and other waste

**Unit 2 Properties of Concrete and Admixtures :**

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength. Durability of concrete, Effect of temp on concrete, freeze and thaw Water Chemical admixtures, Mineral admixture.

**Unit 3 Concrete Mix Design :**

Principles of concrete mix design, Methods of concrete mix design, Testing of concrete.

**Unit 4 Special Concrete :**

Light weight concrete, Fly ash concrete, Silica fumes etc, Fibre reinforced concrete, Polymer Concrete, Super plasticised concrete, Epoxy resins and screeds for rehabilitation - Properties and Applications - High performance concrete, Green concrete, SCC.

**Unit 5 Concreting Methods :**

Process of manufacturing of concrete, methods of transportation, placing and curing - Extreme weather concreting, special concreting methods, Vacuum dewatering - underwater concrete, special form work.

**Name of Text Books:**

Properties of Concrete – Neville, A.M., (Pitman Publishing Limited, London)

Concrete Technology – Shetty M.S., (S.Chand and Company Ltd. Delhi)

Concrete Technology – M.L. Gambhir (Tata McGraw Hill)

**Name of Reference Books:**

Light Weight Concrete Academic Kiado – Rudhani G. (Publishing Home of Hungarian Academy of Sciences, 1963)

Concrete Technology – R.S. Varshney (Oxford, IBH Publishers)

**National Institute of Technology Raipur (CG)**  
**Civil Engineering Department**  
**Sixth Semester**  
**Advanced Strength of Materials**

CE 6161

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

Stresses and Strains in three dimensions, Theories of failure.

Unit 2

Beams on elastic foundations, infinite, semi-infinite and finite beams.

Unit 3

Bending of curved beams in the plane of loading-crane hooks and chain links.

Unit 4

Bending of curved beam out of its initial plane, Saint Venant's equations and equations of equilibrium.  
Bending of circular beams subjected to symmetric loading.

Unit 5

Torsion of non-circular members, St. Venant's theory, Torsional stresses in elliptical, triangular shafts.  
Approximate solutions for rectangular section, Membrane analogy, Torsion of hollow sections, Torsional stresses in thin walled open and closed sections, Plastic, yielding of circular shafts.  
Bending of thin plates, Assumptions of plate theory, GDE for deflection of plates, Boundary conditions.  
Solutions for rectangular plates, Navier's and Levy's solutions, circular plates, Membrane theory of shells of revolution and cylindrical shells.

Name of Text Books:

Name of Reference Books:

Boresi, A.P. and Sidebottom, O.M., " Advanced Mechanics of Materials", John Willey and Sons, 1985.

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

**Modern Surveying Techniques**

CE 6162

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**

**MODERN SURVEYING EQUIPMENT**

E.D.M. Instruments – Geodimeter, Tellurometer, Distomat, Total Station, Applications of Lasers in distance and angular measurements, Introduction of Electronic navigation and Position Fixing – different systems and their Characteristics.

**UNIT 2**

**GLOBAL POSITIONING SYSTEM**

Global Positioning System – working principle and methods, Different Approaches to use GPS and their accuracies, Advantages of GPS in Navigation, Survey, Planning and Mapping.

**UNIT 3**

**GEOGRAPHIC INFORMATION SYSTEM**

Geographic Information System – data requirement and database creation; Use of field data, maps, aerial and satellite data; Advantages of GIS.

**Unit 4**

**GIS Analysis**

Types of GIS analysis, map topology, map feature elements, queries, features in a topographic base map, base map accuracy standards.

**Unit 5**

**Surveying Mapping through Software**

Introduction of ARC Info, ARC View, ARC Gms, Intergraph, MGE, Modular GIS Environment, Map Info and Geomedia web map, etc.

**Name of Text Books:**

Surveying (Vol - I, II & III) – Arora, K.R. (Standard Book House, Delhi, 1993)

Elements of Photogrammetry – Wolf, P.R. (McGraw Hill Book Company, New Delhi,)

**Name of Reference Books:**

Solving Problems in Surveying – Bannister, A. and Baker, R. (Longman Scientific Technical, U.K., 1994)

Electronic Distance Measurement – Burnside, C.D. (Oxford, BSP Professional Books, London, 1991)

Engineering Surveying Technology – Kennie, T.J.M. and Petrie, G. (Blackie & Sons Ltd., London, 1990)

Electronic Surveying in Practice – Laurilla, S.H. (John Wiley & Sons, New York, 1983)

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

**Remote Sensing and its Applications**

CE 6162

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

REMOTE SENSING

Introduction and definition of Remote Sensing terminology, Photogrammetry, Types of Photographs, Geometry of Photographs, Stereophotogrammetry.

UNIT 2

IMAGE PROCESSING SYSTEMS

Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation ground truth collection and verification, advantages of multiband and multiband images.

UNIT 3

INITIAL STATISTICS EXTRACTION

Digital Satellite data products and their characteristics, Histogram and its utility, Enhancement, Different methods of digital satellite data interpretation.

UNIT 4

Radiometric and Geometric Correction in Image Processing

Introduction, radiometric correction of remotely sensed data, correction for sensor system, detector error, spatial interpolation using coordinate transformations, intensity interpolation.

Unit 5

Micro Wave Remote Sensing

Introduction, the radar principle, radar removal advantages, synthetic aperture radar (SAR), interpreting SAR images.

Name of Text Books:

Campbell, J.B., "Introduction to Remote Sensing", The Guilford Press, Lond, 1986.

Wolf, P.R., "Elements of Photogrammetry", McGraw Hill Book Company, New Delhi, 1986.

Name of Reference Books:

Curran, P.J., "Principles of Remote Sensing", Longman, London, 1985.

Engman, E.T. and Gurney, R.J., "Remote Sensing in Hydrology", (Chapman and Hall, London, 1991).



**National Institute of Technology Raipur (CG)**

**Civil Engineering Department**

**Sixth Semester**

**GIS and its Applications**

CE 6162

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 Concept of GIS**

Introduction, Information systems, spatial and non-spatial information, Geographical concepts and terminology, Advantages of GIS, Basic components of GIS, Commercially available GIS hardware and software, organisation of data in GIS.

**Unit 2**

**GIS Data**

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

**Unit 3**

**Data Management**

Data Management, Data Base Management System (DBMS), Various data Models, Run – length encoding, Quadtrees, Data Analysis – Data layers, analysis of spatial and non-spatial data, Data overlay and modelling, smart features of DBMS.

**Unit 4**

**Applications of GIS**

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

**Unit 5**

**Case Study**

A case study in GIS implementation, the consultant, the client, the initial applications, types of GIS analysis used for case study.

**Name of Text Books:**

Introduction to Remote Sensing – Campbell, J.B. (The Guilford Press, London, 1986)

Remote Sensing and Geographic Information Systems – Legg, C.A. (Ellis Horwood, London, 1992)

**Name of Reference Books:**

Principles of Geographic Information System for Land Resources Assessment – Burrough, P.A. (Monograph on Soil Resources Survey No. 12, Claredon, Press, Oxford, 1988)

Remote Sensing in Hydrology – Engaman, E.T. and Gurney, R.J. (Chapman and Hall, London, 1991)

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

**Computational Hydraulics**

CE 6163

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, significance of computational hydraulics, discrete forms of the laws of conservation of mass, momentum and energy, examples of free surface flows.

**Unit 2**

Continuous forms of the conservation laws, lateral inflow's 1-D expansions and contractions, homogeneous and stratified fluid flows.

**Unit 3**

Method of characteristics – Characteristics and invariants, regions of state, computation of hydraulic jump, indeterminary conditions, the linearised method of characteristics.

**Unit 4**

Difference forms of conservation laws, weak solutions applications, storm-sewer networks, diffusion problems, river morphology, linear wave propagation.

**Unit 5**

Numerical methods – Finite difference method with example 1-D horizontal flow.

**Name of Text Books:**

Computational Hydraulics – Brebbia, C.A. and Ferrante, A.J. (Butterworth & Company (Publishers) Ltd., London, 1983)

Applied Hydraulic Transients (2<sup>nd</sup> Edition) – Chaudhary, M.H. (Van Nostrand Reinhold Company Inc., New York, 1987)

**Name of Reference Books:**

Unsteady Flow in Open Channels (Vol. - I & II) – Mahmood, K. and Yeyjevieh, V. (Water Resources Publications, Fort Collins, Colorado, U.S.A., 1975)

Computational Hydraulics – M.B. Abbott (Pitman Publication Company)

Engineering Applications of Computational Hydraulics – M.B. Abbott & J.A. Gunge (Pitman Books Ltd.)

Computational Hydraulics: An Introduction –Vreugdenhill, C.B., 1989 (Springer-Verlag, Berlin)

Computational Hydraulics – Abbot, M.B. & A.W. Minns, 1994 (Ashgate Publication)

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

**Instrumentation in Fluid Mechanics**

CE 6163

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**

Need for instrumentation in various fluid flow processes, types of measurements: pressure, velocity, temperature, discharge, water levels, force, shear stress, basic principles of transducers, microprocessors and data-acquisition systems, calibration of instruments.

**Unit 2**

**Pressure Measurements**

Manometers, capacitance and inductance transducers, non-contact probes.

**Unit 3**

**Velocity measurements**

Pitot tube, Pitosphere and Pitocylinder, current meter, Hot wire anemometer, Laser-Doppler anemometer.

**Unit 4**

**Discharge Measurement**

Venturimeter, orifice meter, bend meter, electromagnetic and ultrasonic flow meters, rotameer, weirs and flumes, tracer techniques, Hot wire anemometer and thermistors.

**Unit 5**

**Other Measurements**

Water level recorders direct and indirect measurement of shear stress, force transducers, use of tracers in dispersion and diffusion studies.

**Name of Text Books:**

Instrumentation: Devices and Systems – Rangan C.S., Sharma G.R. and Mani V.S.S. (Tata McGraw Hill Publishing Company)

**National Institute of Technology Raipur (CG)**

**Civil Engineering Department**

**Sixth Semester**

**Water Power Engineering**

CE 6163

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**

Water Power, its development and use, relation of water power and hydrology.

**Unit 2**

**Water Power Estimate**

Collection and analysis of stream flow data, mass curve, flow duration curves, construction and utility of these curves, effect of storage and pondage, estimates of available water power.

**Unit 3**

**Water Way**

Intake, gates, valves, cannels, surges and its effects, penstocks, classification, design, criteria, economical diameter, water hammer, surg tank.

**Unit 4**

**Hydraulic Turbines**

Classification of turbines, Francis, Kaplan and Pelton Turbines, Component parts and their function, Draft tubes and their theory, Similarity laws and specific speed unit, Quantities, performance curves, Governing of turbines, selection of turbines, cavitation in turbines.

**Unit 5**

**Power House and Equipment**

Location of power house, general arrangement of Hydroelectric unit, Number and size of units, Power house substructure, Pumped storage plant.

**Name of Text Books:**

Water Power Engineering – M.M. Dandekar, K.N. Sharma (Vikas Publishing House Pvt. Ltd.)

Water Power Engineering – Deshmukh (Dhanpat Rai & Sons)

**Name of Reference Books:**

Irrigation and Water Power Engineering – B.C. Punmia (Laxmi Publication)

Hydro Electric Engineering – Creager and Justin (Willay Institutional)

Hydro Electric Engineering Practice – Brown, J.G. (Blackie and Sons Ltd., London)

Irrigation and Water Power Engineering – Dr. P.N. Modi (Standard Book House)

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

**Expansive Soil**

CE 6164

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 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 mineralogy 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.

**Name of Text Books:**

1. Design Aids in Soil Mechanics and Foundation Engineering – S.R. Kaniraj (Tata McGraw Hill, New Delhi)
2. Foundation Engineering – Dr. B.J. Kasmalkar (Pune Vidyarthi Griha Prakashan, Pune).

**Name of 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.: Geotechnical Engineering, Tata McGraw-Hill Publishing 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)

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

**Geosynthetics and Reinforced Soil**

CE 6164

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 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, 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.

**Text Book:**

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

**Reference Books:**

1. Terzaghi, K. and Peck B., "Soil Mechanics in Engineering Practice", John Wiley & Sons, New York, 2<sup>nd</sup> Edition, 1967.
2. Das B. M., "Advanced Soil Mechanics", Taylor & Francis Publishers, 2<sup>nd</sup> Edition, 1997.
3. Gopal, Ranjan and A.S.R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 2<sup>nd</sup> 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, 5<sup>th</sup> ed., 2005.

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

Structural Engineering Lab

Code: CE- 621

Total Periods per Week: 3

Total Marks: 50

Teacher's Assessment: 30

End Semester Examination: 20

Experiments to be performed (Min 10 experiments)

1. Introduction to latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
2. Geometrical Modelling of RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
3. Modelling of loads and load combinations on RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
4. Analysis and Interpretation of Results of Analysis of RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
5. Design of RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
6. Interpretation of Results of Design of RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
7. Geometrical Modelling of Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
8. Modelling of loads and load combinations on Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
9. Analysis and Interpretation of Results of Analysis of Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
10. Design of Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
11. Interpretation of Results of Design of Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
12. Design of R.C.C. Column on latest version of a Standard Structural Engineering Design Package such as STAAD.etc
13. Design of R.C.C. Isolated Footing on latest version of a Standard Structural Engineering Design Package such as STAAD.etc
14. Case Study of design of a RCC Multistorey Building on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
15. Case Study of design of a Steel Industrial Building on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

List of Equipments / Machine Required:

Latest Release of Software Package STAAD Pro (Research Engineers International, Kolkata)

Latest Release of Software Package STAAD.etc (Research Engineers International, Kolkata)

Recommended Books:

(1) Reference Manual for Respective Software

(2) Verification Manual of Respective Software

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

Environmental Engineering – II Lab

Code: CE- 622

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 Alkalinity of Sewage / Industrial wastewater sample.
2. To determine Chloride Content of Sewage / Industrial wastewater sample.
3. To determine DO Content of Sewage / Industrial wastewater sample.
4. To determine Estimation of BOD of Sewage / Industrial wastewater sample.
5. To determine Optimum Coagulant Dose Test of Sewage / Industrial wastewater.
6. Determination of Total Solids in Sewage / Industrial wastewater.
7. Determination of Turbidity in Sewage / Industrial wastewater.
8. Determination of COD in Sewage / Industrial wastewater.
9. Determination of Nitrates in Sewage / Industrial wastewater.
10. Determination of Phosphates in Sewage / Industrial wastewater.
11. Microbiological Examination of Sewage / Industrial wastewater.

List of Equipments / Machine Required:

BOD Incubar  
Turbidity meter  
Microscope  
pH meter  
Muffle Furnace  
Hot Air Oven  
Jar Test Apparatus  
Spectrophotometer

Name of Text Books:

Environmental Engineering Lab Manual – Dr. B. Kottaiah & N. Kumaraswamy (Charotar Publications)  
Environmental Science and Engineering – Henry and Heinke (Pearson Education).  
Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).  
Introduction to Environmental Engineering and Science – Masters, G.M. (Prentice Hall of India Pvt. Ltd., 1991)



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

Geotech Engineering II Lab

Code: CE- 624

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 water content dry density relation using light-compaction test.
2. Determination of water content dry density relation using heavy compaction test.
3. To determine California Bearing Ratio for the designing of pavements, laboratory determination of CBR test.
3. To determine in-situ bearing value of subgrade by North Dakota Cone Apparatus.
4. Direct Shear Test on the
  - (1) Dry cohesionless / cohesive soil specimen remoulded / unremoulded
  - (2) Direct shear test – undrained test, direct shear test-consolidated undrained.
5. Triaxial Compression Test (Triaxial compression test): (a) UU, (b) CU, (c) CC.
6. Determination of bearing capacity of soil by Triaxial UU Test.
7. Determination of Unconfined Compression Strength of cohesive soils (Remoulded / Unremoulded)
8. Laboratory Vane Shear Test (Remoulded / Unremoulded)
9. Consolidated test (Remoulded / Unremoulded) Consolidated test (Fixed Ring / Floating Ring).
10. To determine swelling pressure of purely cohesive soil (Remoulded / Unremoulded specimen).
11. Determination of density index (relative density) of cohesionless soils.
12. Determination of bearing capacity of soil by plate load.
11. Study of standard penetration test.
12. Study of cyclic plate load test
13. Study of field vane shear test.
14. Study of field CBR Test
15. Study of ground improvement techniques

List of Equipments / Machine Required:

Light Compaction Mould, Heavy Compaction Mould, Oven, CBR Apparatus, North Dakota Cone Apparatus, Direct Shear Test Apparatus with full accessories, Triaxial Compression Test Apparatus with full accessories, Consolidometer Apparatus, Unconfined Compression Test Apparatus, Swell Pressure Test Apparatus, Standard Penetration Test Apparatus with full accessories, Plate Load Test Apparatus with full accessories, Soil Sampling Tube

Recommended Books:

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

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