Gurugram University Gurugram

Curriculum for UG Degree Course

in

Civil Engineering

(Engineering & Technology)

Gurugram University Gurugram

GENERAL COURSE STRUCTURE & CREDITDISTRIBUTION

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S.No.	Category	Breakup of Credits (Total 160)
1	Humanities and Social Sciences including Management courses	14
2	Basic Science courses	19
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	20
4	Professional core courses	77
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects – Electives from other technical and /or emerging subjects	09
7	Project work, seminar and internship in industry or elsewhere	17
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	Non-credit
9	**Total**	**168**

SEMESTER WISE SUMMARY OF THE PROGRAM

S.No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	23	900	19.5
2.	II	28	1000	22.5
3.	III	26	1000	22
4.	IV	28	1100	23
5.	V	27	1050	24
6.	VI	30	1150	24
7.	VII	27	900	24
8.	VIII	12	500	9
	Total	201	7600	168

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

CREDIT DISTRIBUTION IN THE FIRST YEAR OF UNDERGRADUATE ENGINEERING PROGRAM

Bachelor of Technology Semester-I

Subject	**Lecture (L)**	**Tutorial (T)**	**Laboratory/ Practical (P)**	**Total credits (C)**
Communication Skills in English	2	0	0	2
Mathematics-I	3	1	0	4
Basic of Electrical and ElectronicsEngineering or Chemistry	3	0	0	3
Programing for problem solving using C	3	0	0	3
Basics of Environmental Science	2	0	0	2
Communication Skills in English(P).	0	0	2	1
Basic of Electrical and ElectronicsEngineering P or Chemistry (P)	0	0	2	1
Programing for problem solving using C	0	0	2	1
Workshop Practices (P) or Engineering Drawing	1	0	3	2.5
Sports (Audit Course) Compulsory	0	0	2	0

ENGINEERING PROGRAM

Bachelor of Technology Semester-II

Subject	**Lecture (L)**	**Tutorial (T)**	**Laboratory/ Practical (P)**	**Total credits (C)**
Mathematics-II	3	1	0	4
Human Value & Soft Skills	2	0	2	3
Basic of Electrical and Electronics Engineering or Chemistry	3	0	0	3
Physics	3	1	0	4
Civil Engineering Material	3	1	0	4
Basic of Electrical and Electronics Engineering (P) or Chemistry (P)	0	0	2	1
Physics (P)	0	0	2	1
Workshop Practices (P) or Engineering Drawing	1	0	3	2.5

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

S. No.	Code No.	Course Title	Hours Per week			Total Credits	Semester
			L	T	P		
1		Communication Skills inEnglish	2	0	2	3	I
2		Basics of EnvironmentalScience	2	0	0	2	I
3		Human Value & SoftSkills	2	0	2	3	II
4		Economics for Engineers	3	0	0		III
5		Organizational Behavior	3	0	0	3	IV
					Total Credits	**14**	

BASIC SCIENCE COURSES (BSC)

S. No.	Code No.	Course	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Physics	3	1	2	5	I
2		Mathematics-I	3	1	0	4	I
3		Mathematics-II	3	1	0	4	II
4		Chemistry	3	0	2	4	II
5		Mathematics -III	3	1	0	4	III
					Total Credits	**21**	

ENGINEERING SCIENCE COURSE (ESC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Programing for problem solving using C	3	0	2	4	I
2		Workshop Practices (P)	1	0	3	2.5	I
3		Basic of Electrical and Electronics Engineering	3	0	2	4	II
4		Civil Engineering Material	3	1	0	4	II
5		Engineering Drawing	1	0	3	2.5	II
					Total Credits	**17**	

PROFESSIONAL CORE COURSES (PCC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Building Construction and Materials	3	0	2	4	III
2.		Engineering Mechanics	3	0	2	4	III
3.		Fluid Mechanics-I	3	0	2	4	III
4.		Surveying-I	3	1	2	4	III
5.		Fluid Mechanics-II	3	0	2	4	IV
6.		Design of Concrete Structure	3	0	0	3	IV
7.		Structural Analysis	3	0	2	4	IV
8.		Surveying-II	3	0	2	4	IV
9.		Material Testing & Evaluation	3	0	2	4	IV
10.		RCC Drawing Lab	0	0	2	1	IV
11.		Hydro and Water Resource Engineering	3	0	0	3	V
12.		Transportation Engineering	3	0	1	4	V
13.		Soil Mechanics	3	0	1	4	V
14.		Water Supply and Treatment	3	0	0	3	V
15.		Design of steel structure	3	0	2	4	V
16.		Engineering Geology	3	0	2	4	V
17.		Survey Camp	0	0	0	1	V
18.		Irrigation & Hydraulic Structures	3	0	0	3	VI
19.		Foundation Engineering	3	0	2	4	VI
20.		Estimation ,Costing and Valuation	3	0	2	4	VI
21		Irrigation Drawing Lab	0	0	2	1	VI
22		Computer aided Civil Engineering Design	0	0	2	1	VI
23		Construction Planning and Management	3	0	0	3	VII
24		Advanced Steel Structure	3	0	0	3	VII
25		Irrigation Drawing Lab	0	0	2	1	VII
					Total Credits	79	

PROFESSIONAL ELECTIVE COURSES (PEC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1		Program Elective - I	3	0	0	3	VI

2		Program Elective - II	3	0	0	3	VI
3		Program Elective - I	3	0	0	3	VII
4		Program Elective - II	3	0	0	3	VII
					Total Credits	**12**	

OPEN ELECTIVE COURSES (OEC)

S. No.	**Code No.**	**Course Title**	**Hours Per Week**			**Total Credits**	**Semester**
			L	**T**	**P**		
1		Open Elective -I	4	0	0	4	VI
2		Open Elective -II	4	0	0	4	VII
3		Open Elective- III	3	0	0	3	VII
					Total Credits	**11**	

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE

Sl. No	**Course Code**	**Course Title**	**Semester**	**Hours per week**			**Total Credits**
				Lecture	**Tutorial**	**Practical**	
1.		**Practical Training-I**	V	0	0	2	1
2.		**Seminar-I**	VI	0	0	2	1
3.		**Practical Training-II**	VII	0	0	2	1
4.		**Project Work I /Industrial Training Synopsis**	VII	0	0	6	3
5.		**Seminar-II**	VIII	0	0	2	1
6.		**MOOCS Course**	VIII	0	0	4	2
7.		**Project Work II /Industrial Training**	VIII	0	0	12	6
						Total Credits	**15**

Semester wise Structure and Curriculum for

UG Course in

Civil Engineering
(Engineering & Technology)

Gurugram University

Scheme of Studies and Examination
Bachelor of Technology (Civil Engineering)
Semester-III

Sr. No.	Course Code	Course Title	Hours per week	Contact hours per week	**Credit**	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Class work	Theory	Practical	Total	
1.		Economics For Engineers	3-0-0	3	3	30	70	-	100	3
2.		Building construction and materials	3-0-0	3	3	30	70	-	100	3
3.		Mathematics III	3-0-0	3	3	30	70	-	100	3
4.		Engineering Mechanics	3-0-0	3	3	30	70	-	100	3
5.		Fluid Mechanics-I	3-0-0	3	3	30	70	-	100	3
6.		Surveying -I	3-0-0	3	3	30	70	-	100	3
7.		Building Drawing lab	0-0-2	1	1	50	-	50	100	3
8.		Engineering Mechanics Lab.	0-0-2	1	1	50	-	50	100	3
9.		Fluid Mechanics Lab.	0-0-2	1	1	50	-	50	100	3
10.		Surveying Lab.	0-0-2	1	1	50	-	50	100	3
				TOTAL	**22**				1000	

Course Name	**:**	**ECONOMICS FOR ENGINEERS**	
Course Code	**:**		**External marks: 70**
Credits	**:**	**3**	**Internal marks: 30**
L-T-P	**:**	**3-0-0**	**Total marks: 100**

Course Objectives:

1. Acquaint the students to basic concepts of economics and their operational significance.
2. To stimulate the students to think systematically and objectively about contemporary economic problems

COURSE CONTENT

UNIT-1

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, **Elasticity of Demand**- meaning, factors effecting it, its practical application and importance.

UNIT-2

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-4

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), **Privatization** - meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions,

Difference between Commercial & Central Bank.

Course Outcomes: By the end of this course the student will be able to:

1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

Suggested Books:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

BUILDING CONSTRUCTION AND MATERIALS			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To provide the students an overview of the profession of Civil Engineering.
- To give the students an illustration of the Civil Engineering, properties of various building material, basic requirements of a building and explain the building construction aspects.

COURSE CONTENT

UNIT-I

Module 1: Masonry Construction

Introduction, Various terms used in brick masonry, classification of bricks, composition, bonds in brick work, laying brick work, structural brick work, reinforced brick work, Defects in brick masonry, Stone masonry and its classification, composite masonry, Glass block masonry.

UNIT-II

Module 2: Timber, paints and varnishes

Classification of timber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, advantages of plywood and fiber boards, Important Indian timbers; Basic constituents of paints, types of paints, constituents of varnishes, characteristics and types of varnishes.

UNIT-III

Module 3: Roofs, Floors and Tiles

Types of roofs, various terms used, roof trusses-king post truss, queen post truss etc. Floor structures, ground, basement and upper floors, various types of floorings. Doors and Windows: Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows. **Tiles:** Manufacturing of tiles, Terra-cotta and its types, uses of terracotta.

Unit-IV

Module 4: Damp-Proofing, Water-Proofing and Fire protection

Dampness and its causes, prevention of dampness, materials used, amp-proofing treatment in buildings; Water proofing: water- proofing treatment of roofs; Fire protection: Fire resisting

construction, fire protection requirements for buildings. Sound insulation and Acoustics materials.

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Explain the importance of Civil Engineering in the infrastructural development of the society.
- They will be able to illustrate the types and properties of various building materials.
- To be aware of various traditional building materials and also the emerging materials in the field of Civil Engineering construction.
- To select suitable type of flooring, Plastering, varnishes with their application.
- They should be able to describe the basic requirements to construct a building.

Suggested Books:

- Building Construction By Sushil Kumar, Standard Pub., N. Delhi
- Building Material By Rangawala
- Construction Engineering By Y.S. Sane
- Building Construction By Gurcharan Singh, Standard Pub., N. Delhi

Course Name	**:**	**Mathematics III**	
Course Code	**:**		**External marks: 70**
Credits	**:**	**4**	**Internal marks: 30**
L-T-P	**:**	**3-1-0**	**Total marks: 100**
Course Objectives:			

Course Objectives:

At the end of this course, the student should be able to learn the behaviour of civil engineering determinate structures under static and moving loads by analytical/experimental techniques and software tools. The student should also be able to acquire the ability to interpret and evaluate experimental results.

COURSE CONTENT

Unit-I

Transform Calculus: Fourier Series and Fourier Transforms : Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and consine series. Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes) Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac-delta function.

Unit-II

Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions, application to flow problems. Integration of complex functions. Cauchy- Integral theorem and formula.Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi circle only). Probability Distributions and Hypothesis Testing: Conditional probability, Bayes theorem and its applications, expected value of a random variable. Properties and application of Binomial, Poisson and Normal distributions

Unit-III

Numerical Methods-I: Solution of Polynomial and Transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules

Unit-IV

Numerical Methods – II: Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicatorcorrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-

Nicholson methods), Finite difference explicit method for wave equation.

Course Outcomes: By the end of this course the student will be able to:

1. To solve field problems in engineering involving partial differential equations
2. To find roots of polynomial and transcendental equations using numerical methods and conduct numerical integration
3. To deal with the Laplace transform and its application
4. To classify algebraic structure of any mathematical problem.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
4. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand and Company
5. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI.
6. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
7. C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill.
8. K. H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill.
9. J. L. Hein, Discrete Structures, Logic and Computability, Jones and Bartlett.

ENGINEERING MECHANICS			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- Students should be able to identify and analyse the basic structural elements.
- Students can apply the concepts of analysis for the design of various civil engineering structures.
- Covers the relationship between stress and strain on deformable solids, principal stresses, maximum shearing stress, and the stresses acting on a structural member.
- To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.

COURSE CONTENT

UNIT-A

Module 1: Simple Stresses and Strains

Properties of Materials, i.e. tensile test, idealized stress- strain diagrams, isotropic, linear, elastic, Visco- elastic and plastic materials, Concept of stresses and strains, St.Venant's principle, relationship between elastic constants, Poisson's Ratio, Hoop stress, Stress and extension of uniform bar and tapered bar under its own weight and due to load, stresses produced in compound bars due to axial loads, Factor of Safety, Thermal stress and strain calculations, Shear stresses and shear strain, Complementary shear stress.

Module 2: Compound stress and strains

Normal stress, tangential Stresses, Stresses induced due to Uniaxial loads, stresses induced by state of simple shear, stresses induced due to biaxial loads, Mohr's Circle (Graphical Method), Principal stresses and principal planes, Maximum shear stresses, Proof stress.

UNIT-B

Module 3: Shear Force and Bending Moment in Beams and Frames

Type of loads, Shear force and bending moment, relation between Shear force and bending moment, Definition and Sign conventions, axial force, Shear force and Bending moment diagrams

Module 4: Bending stresses and Shear stresses in Beam

Pure bending, bending stresses, combined bending and direct stresses, Middle Third rule, composite beams, Variation of shear stresses for various cross-sections of a beam.

UNIT-C

Module 5: Torsion and Thin Cylinder
Torsion equation, its applications to the hollow and solid circular shafts, comparison of solid and hollow Shafts, shafts in series and parallel. Combined torsion and bending of circular shafts. Introduction to thin cylinder, Stresses in thin cylinder vessels subjected to internal pressure Circumferential stresses (Hoop Stresses), longitudinal stress.

Module 6: Column and Strut
Criteria for stability of columns, Buckling of columns, Euler's formula for various end restraints, Rankine's formula, eccentrically loaded struts, struts with initial curvature, struts with lateral loading.

UNIT-D

Module 7: Analysis of Plane Trusses
Different types of trusses, Analysis of plane determinate trusses by method of joints, method of UNITs and analysis of Space Trusses using Tension Coefficient Method.

Module 8: Failure Theories
Theories of failure: maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, distortion energy theory, comparison of the failure theories.

Course Outcomes:

At the end of the course, the students will be able to

- Identify different materials and their behaviour.
- Analyse various civil engineering structures under different loading conditions.
- Apply the principles of structural mechanics in design structural elements.
- Apply the concepts of failure theories for design of structures.

Suggested Books:

- Strength of Material by G.H. Ryder, MacMillan Publishers India Ltd.
- Mechanics of Materials by E.J. Hearn, Elsevier Publications.
- Mechanics of Materials by Punmia and Jain, Laxmi Publications (P) Ltd.
- Mechanics of Materials by R.C.Hibbeler, Pearson Higher Education.
- Strength of Materials by Timoshenko and Young,, East West Press.
- Mechanics of materials by V Gupta, Narosa publishing house.

Fluid Mechanics-I			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- Introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- To provide the students a first level exposure related to fluid statics, kinematics and dynamics.
- To provide the knowledge for measurement of pressure, computations of hydrostatic forces on structural components, concepts of Buoyancy and their applications in many engineering problems.
- Topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

COURSE CONTENT

UNIT A

Module 1: Basic Concepts and Definitions

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, cavitations; surface tension, capillarity, Bulk modulus of elasticity, compressibility, types of fluids

UNIT B

Module 2: Fluid Statics

Fluid Pressure: Pressure density height relationship, pressure at a point, Pascal's law, gauge and absolute pressure, Pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, pressure gauges,

Module 3: Hydrostatic pressure and force

Hydrostatic pressure and force: horizontal, vertical and inclined surfaces, centre of pressure. Buoyancy and stability of floating bodies, metacentric height

UNIT C

Module 4: Fluid Kinematics

Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; rotation and circulation; Stream line, path line, streak line and stream tube; stream function, velocity

potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Module 5: Fluid Dynamics
Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; limitations of Bernoulli's equation, Practical applications of Bernoulli's equation: Venturimeter, Orifice meter and Pitot tube

UNIT D

Module 6: Boundary Layer Analysis
Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries, Local and average friction coefficients Separation and Control.

Module 7: Dimensional Analysis and Hydraulic Similitude
Dimensional analysis, Buckingham theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modelling, similar and distorted models.

COURSE OUTCOMES:

- Understand the broad principles of fluid statics, kinematics and dynamics
- Understand definitions of the basic terms used in fluid mechanics
- Understand classifications of fluid flow
- Be able to apply the continuity, momentum and energy principles
- Be able to apply dimensional analysis

SUGGESTED BOOKS:

- Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth
- Introduction to Fluid Mechanics by Robert W.Fox & Alan T.McDonald 3 Fluid Mechanics Through Problems by R.J.Garde
- Engineering Fluid Mechanics by R.J.Garde & A.G.Mirajgaoker
- Fluid Mechanic and Hydraulic machines R.K. BANSAL

Surveying-I			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To understand the importance of surveying in Civil engineering.
- To study the basics of linear, angular and direction measurements using chain/tape, theodolite and compass.
- To study the method of determination of height of points using various levelling method and tacheometer.
- To study the significance of Plane Table surveying in preparation of map and setting of different types of curves.

COURSE CONTENT

UNIT A

Module 1: Basics of Surveying and Linear measurement

Definition, principles of surveying, objectives and classifications, Instruments used for measuring distance, chaining, errors in chaining, tape corrections and examples, concept of Geoids and reference spheroids.

Module 2: Compass Surveying

Types of compass- prismatic and surveyor's compass, Bearings and meridians, declination, local attraction, errors and adjustments, Methods of compass traversing, checks in traversing, adjustment of closed traverse and examples.

UNIT B

Module 3: Levelling

Terms used in levelling, types of levels and staff, principles of levelling, temporary adjustments of levels, reduction of levels and booking of staff readings, examples.

Module 4: Geodetic Trigonometric levelling

Height and distances- base of the object accessible and inaccessible, geodetical observation, correction due to curvature and refraction, axis signal correction, difference in elevation between two points.

UNIT C

Module 5: Plane Table Surveying

Plane table accessories, methods of plane table surveying, sources of error, advantages and disadvantages of plane table surveying; contouring and characteristics of contour lines, locating contours, interpolation of contours, contour maps.

Module 6: Contouring

Contouring and characteristics of contour lines, locating contours, Methods of contouring, interpolation of contours, Uses of contour.

UNIT D

Module 6: Theodolite Surveying

Theodolite, parts of theodolite, Temporary adjustment of Theodolite, measurement of horizontal and vertical angles by different methods, theodolite traversing, adjustments of closed traverse.

Module 8: Tachometric surveying

Principle of of tacheometric surveying, different instrument used in tacheometry, stadia and tangential method of tacheometry, tacheometric constants and their determinations, examples.

COURSE OUTCOMES:

At the end of the course, the students will be able to

- To carry out surveying in the field for various civil engineering projects, prepare a contour map and plan of the area.
- Taking accurate measurements with different surveying instruments.
- Adjustment of traverse, and understand the process of setting of different curves for road and railway designs.

SUGGESTED BOOKS:

- Surveying volume I and II: B C Punmia.
- Engineering Surveying (Sixth Edition): W. Schofield.
- Text Book of Surveying: C. Venkataramiah.
- Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany.
- Various Online resources including NPTEL.

Building Drawing Lab.			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To understand the principles of planning and bylaws.
- To draw plan, elevation and section of bond in brick work, walls and foundations, load bearing and framed structures.
- To prepare detailed working drawing for different parts of a building.

COURSE CONTENT

LIST OF EXPERIMENTS

1. Cavity Wall.
2. Different Bonds in brick work.
3. Grillage foundation.
4. Preparation of building drawing mentioning its salient features including the following details: a) Ground floor plan b) Two sectional Elevations c) Front and Side Elevations
5. Plan and sectional Elevation of different Stair-Cases.
6. Plan and sectional Elevation of different Doors and Windows.
7. Plan and sectional Elevation of different Ventilators.
8. Plan and sectional Elevation of Floors.
9. Plan and sectional Elevation of different roofs.

Course Outcomes:

At the end of the course, the students will be able to

- Student's ability to perform basic sketching techniques will improve.
- Students will be able to draw orthographic projections and sections.
- Student's ability to use architectural and engineering scales will increase.
- To prepare drawings for doors, windows, floors etc.
- To use various Symbols, Conventions and Abbreviations for building drawing,
- Prepare detail planning for single and two storied residential building and public building.

ENGINEERING MECHANICS LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- Structural Analysis experiments help to understand, to know the practical behaviour of the physical structures like beams, roof truss etc.
- A proper structural analysis of these structures helps the students to solve the practical problems.
- Different structural apparatus like Simply Supported Beam, Curved Member of different shape, Pin Joint Truss are studied in the laboratory.

LIST OF EXPERIMENTS

1. To determine elastic properties of a beam.
2. Torsion of cylindrical rods (Shaft).
3. To determine and analyse deflection of curved beams.
4. Experimental and analytical study of behaviour of struts with various end conditions.
5. To determine deflection of trusses – Horizontal and vertical deflection of various joints of a pin jointed truss.
6. Experimental and analytical study of a 3bar pin jointed Truss.
7. Experimental and analytical study of an elastically coupled beam.
8. To plot stress- strain curve for mild steel – Demonstration.

COURSE OUTCOMES:

At the end of the course, the students will be able to

- To acquire the knowledge about stresses and strains.
- To get knowledge about loading systems, types of supports and beams and understand the behaviour of different structural system for different loading and deflection.
- Able to calculate the about forces, moments and deflections.
- To verify and compare different theoretical and experimental theorems.
- Analyse and assess the behaviour and serviceability of the structures using analytical/experimental methods.

Fluid Mechanics-I Lab.			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

COURSE OBJECTIVES:

- To understand the physical processes of fluid more closely.
- Various apparatus like, Verification of Bernoulli's theorem apparatus, venturimeter & Orifice meters, orifice & mouth piece apparatus Flow over notches apparatus, vortex flow apparatus etc helps to understand different process.

LIST OF EXPERIMENTS

1. Verification of Bernoulli's Theorem
2. Calibration of V notch
3. Calibration of Rectangular notch
4. Calibration of Trapezoidal notch
5. Study of Pressure Measuring Devices
6. Determination of Metacentric height
7. Hydrostatics Force on Flat Surfaces/Curved Surfaces
8. Venturimeter
9. Orifice meter
10. Determination of coefficient C_d, C_v, and C_c

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Verification of Bernoulli's theorem.
- Calibration of different notches, venturimeter and orifice meter.
- Determination of different coefficient and their verification.
- Study the different property of fluid flow.

Surveying-I Lab			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To use of Chain for linear measurement and traversing.
- To use of different compass for determination of directions and for traversing.
- To use different levels and determine the reduced levels, elevation and depressions of ground.
- To prepare maps using plane table by applying different methods.

LIST OF EXPERIMENTS

1. Chain Traversing
2. Compass Traversing
3. Fly Levelling
4. Cross sectioning
5. Profile levelling
6. Plane Table surveying: Radiation and Intersection
7. Resection- 2 and 3-point problem with plane Table
8. Contouring and preparation contour map.
9. Use of tangent clinometer

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Use conventional surveying tools such as chain/tape, compass, plane table, levels in the field for various civil engineering applications.
- Enter observation in field book, adjusting and plotting a traverse.
- To calculate the earth work for cutting and filling.
- To prepare contour maps of a small area and its importance in Civil Engineering.

Gurugram University

Scheme of Studies and Examination
Bachelor of Technology (Civil Engineering)
Semester-IV

Sr. No.	Course Code	Course Title	Hours per week	Contact hours per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Class work	Theory	Practical	Total	
1.		Organization Behavior	3-0-0	3	3	30	70	-	100	3
2.		Fluid Mechanics-II	3-0-0	3	3	30	70	-	100	3
3.		Design of concrete structure	3-0-0	3	3	30	70	-	100	3
4.		Structural Analysis	3-0-0	3	3	30	70	-	100	3
5.		Surveying-II	3-0-0	3	3	30	70	-	100	3
6.		Material Testing and Evaluation	3-0-0	3	3	30	70	-	100	3
7.		Fluid Mechanics-II lab	0-0-2	2	1	50	-	50	100	3
8.		Structural Analysis Lab	0-0-2	2	1	50	-	50	100	3
9.		Surveying-II Lab.	0-0-2	2	1	50	-	50	100	3
10.		Material Testing & Evaluation Lab.	0-0-2	2	1	50	-	50	100	3
11.		RCC Drawing Lab.	0-0-2	2	1	50	-	50	100	3
				TOTAL	**23**				1100	

Note:

1. Students will be allowed to use non-programmable scientific calculator. However, sharing of Calculator and other materials will not be permitted in the examination.

2. (A) each student has to undergo practical training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc and its evaluation shall be carried out in the V semester on the basis of seminar, viva-voce, report and certificate of practical training obtained by the student.

Course Name	**:**	**ORGANIZATIONAL BEHAVIOUR**	
Course Code	**:**		**External marks: 70**
Credits	**:**	**3**	**Internal marks: 30**
L-T-P	**:**	**3-0-0**	**Total marks: 100**

Course Objectives:
The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

COURSE CONTENT

UNIT – 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT – 2

Introduction of organization:-
Meaning and process of Organization, Management v/s Organization;
Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.
Individual Processes and Behavior-**Personality**- Concept, determinants and applications; **Perception-** Concept, process and applications, **Learning-** Concept ,theories ; **Motivation-** Concept, techniques and importance

UNIT - 3
Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership.
Communication – Meaning, process, channels of communication, importance ,barriers and overcome of communication..

UNIT - 4
Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes: By the end of this course the student will be able to:
1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Suggested Books:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

Fluid Mechanics-II			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To introduce the students to various hydraulic engineering problems like laminar flow, open channel flows, flow through pipes, hydraulic jump and its applications.
- At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering

COURSE CONTENT

UNIT A

Module 1: **Laminar Flow**
Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.

Module 2: **Turbulent Flow**
Reynolds experiment, Transition from laminar to turbulent flow, Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes

UNIT B

Module 3: Flow through Pipes
Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, siphon, power transmission through pipes, Analysis of pipe networks: water hammer in pipes and control measures, branching of pipes.

UNIT C

Module 4: Open Channel Flow: Uniform flow
Definition, Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channel flow.
Uniform Flow- Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient 'n', Most economical section of channel, Computation of Uniform flow, Normal depth.
Module 5: Open Channel Flow: Non-Uniform Flow

Specific energy, Specific energy curve, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Channel Transitions, Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile

UNIT D

Module 6: Hydraulic Jump
Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump,

Module 7:
Surges, Positive and negative surges, Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,

COURSE OUTCOMES:

- The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
- They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
- They will have knowledge in hydraulic jump and its applications.

SUGGESTED BOOKS:

- Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth,
- Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
- Open channel Flow, K. Subramanya, Tata McGraw Hill.
- Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
- Burnside, C.D., “Electromagnetic Distance Measurement,” Beekman Publishers, 1971
- Fluid Mechanic and Hydraulic machines R.K. BANSAL

DESIGN OF CONCRETE STRUCTURE			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- The aim of this course is to provide students with a thorough understanding of the design of reinforced concrete structures.
- To become familiar with professional and contemporary issues in the design and fabrication of reinforced concrete members.
- Be able to identify and interpret the appropriate relevant industry design codes.
- The course focuses on understanding the behaviour of reinforced concrete components and systems subjected to gravity as well as lateral loads.
- Topics covered will include: design of beams, Column and slabs, detailing of reinforcement, design of foundation and retaining wall.

COURSE CONTENT

UNIT-A

Module 1: Design methodology in Reinforced Concrete & Working stress Method
Working stress and limit state methods, Limit state v/s working stress method, Building codes, Normal distribution curve, Characteristic strength and Characteristics loads, Design values, Partial safety factors and Factored loads, Stress-Strain relationship for concrete and steel. Working Stress Method: Basic assumptions, permissible stresses in concrete and steel, design of singly and doubly reinforced rectangular and flanged beams in flexure, steel beam theory, inverted flanged beams, design examples.

Module 2: Limit State Method
Basic assumptions, Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement and design examples. Continuous Beams both method -Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear.

UNIT-B

Module 3: Concrete Reinforcement and Detailing

Requirements of good detailing, Cover to reinforcement, Spacing of reinforcement, Reinforcement Splicing, Anchoring reinforcing bars in flexure and shear, Curtailment of reinforcement. Analysis and Design of sections in shear, bond and torsion, Diagonal tension, shear reinforcement, Development length, Anchorage and flexural bond, Torsional stiffness, equivalent shear, Torsional reinforcement, Design examples.

Module 4: Serviceability Limit State

Control of deflection, Cracking, Slenderness and vibrations, Deflection and moment relationship for limiting values of span to depth, Limit state of crack width, Design examples.

UNIT-C

Module 5: Slabs

General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Non-rectangular slabs, Openings in slabs, Design Examples.

Module 6: Retaining Walls

Classification, Forces on retaining walls, Design criteria, Stability requirements, Proportioning of cantilever retaining walls, counter fort retaining walls, criteria for design of counter forts, Design examples.

UNIT-D

Module 7: Columns

Effective length, Minimum eccentricity, Short columns, under axial compression, Uniaxial and biaxial bending, Slender columns. Design examples.

Module 8: Footings

Isolated and wall footings, Design examples. Foundations-Combined footings, raft foundation, design of pile cap and piles, under reamed piles, design examples.

Course Outcomes:

At the end of the course, the students will be able to

- Recognize the design philosophy of reinforced concrete structures.
- Be able to analyze reinforced concrete structural systems under gravity and lateral loads.
- Be able to design different elements of reinforced concrete structural systems subjected to gravity and lateral loads.
- Be able to analyze and design a complete structural system through a comprehensive design project.

- Summarize the fundamental mechanics of reinforced concrete and the empirical assumptions made for analysis.
- Be able to produce a complete project document and present in a concise and complete manner to include structural drawings and structural calculations.
- Design basic structural elements (beams, columns and slabs) according to the design approach of IS:456.

SUGGESTED BOOKS:

- Design Of Reinforced Concrete Structures By P.Dayaratnam, Oxford & IBH Pub.,N.Delhi.
- Design of Reinforced Concrete-Limit State Design By A.K.Jain, Nem Chand & Bros.,Roorkee.
- Design of Reinforced Concrete by I.C.Syal & A,K,Goel, A.H,Wheeler & Co.Delhi.Reinforced Concrete Design by S.N.Sinha, Tmh Pub.,N.Delhi.
- Sp-16(S&T)-1980, Design Aids For Reinforced Concrete to IS:456, BIS, N.Delhi.
- Reinfirced cement concrete design by Neelam Sharma , S.K.Kataria & sons, N.Delhi.
- Sp-34(S&T)-1987 Handbook on Concrete Reinforcement And Detailing`, BIS, N.Delhi.

STRUCTURAL ANALYSIS			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination: hrs	**3**

COURSE OBJECTIVES:

- To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and Design Engineering Systems.
- Covers the relationship between stress and strain on deformable solids, principal stresses, maximum shearing stress, and the stresses acting on a structural member.
- Applies analysis to members subjected to axial, bending, and Torsional loads.
- Learn to evaluate internal forces, moments and corresponding stresses in beams through problem solving sessions using different methods.
- This course provides foundation knowledge, skills and their application which are relevant to subsequent courses in Civil Engineering.

COURSE CONTENT

UNIT-A

MODULE 1: Deflection of Statically determinate structures

Deflection of determinate beams by Double Integration Method, Conjugate Beam Method and Moment Area Methods, Principle of Virtual work (Unit load method) and Castigliano's theorem.

MODULE 2: Deflection of Statically determinate Frame & Truss

Deflection of determinate pin jointed trusses and rigid jointed frames by principle of virtual work, Strain Energy and Castiglino's theorem. Williot Mohr diagram method and Maxwell's laws of reciprocal theorem

UNIT-B

MODULE 3: Influence Line

Influence lines for reactions, BM & SF for simply supported beam and Panelled Girders. Influence lines for forces in trusses with top horizontal and curved both, Reversal of stresses, Use of influence lines for calculating design forces due to dead load and moving live loads. Influence lines using Muller Breslau principle.

UNIT-C

MODULE 4: Arches
Determination of horizontal thrust, shear force and bending moment diagram for:
1. Two Hinged Arches **2**. Three Hinged Arches **3**. Fixed Arches

MODULE 5: Column Analogy Method & Cable and Suspension Bridge
Elastic centre, properties of analogous column, application to beam & frames. Introduction of Cable and suspension Bridge uniformly loaded cables, Temperature stresses, and three hinged stiffening Girder and two hinged stiffening girder

UNIT-D

MODULE 6: Indeterminate Structures & Deflection methods
Introduction to Indeterminate Structures, Determination of kinematic and static indeterminacy of beams, frames and trusses, Slope Deflection and Moment Distribution Methods- Analysis of continuous beams & portal frames, Portal frames with inclined members.

Course Outcomes:

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

- Helps to determine the deflections and rotations produced by the three fundamental types of loads: axial, Torsional, and flexural.
- Identify the internal forces and moments in beams to develop shear force and bending moment diagrams. Assess section properties, bending and deflections in beams.
- Use various classical methods for analysis of indeterminate structures.
- Determine the effect of support settlements for indeterminate structures.
- Apply the concepts of ILD and moving loads on structures.
- Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames
- Apply the methods of indeterminate truss analysis demonstrate the behaviour of arches and their methods of analysis.

Suggested Books:

- Statically Indeterminate Structures by C.K. Wang, McGraw Hill Book Co., New York.
- Advanced Structural Analysis by A.K. Jain, Nem Chand & Bros., Roorkee.
- Indeterminate Structures by R.L. Jindal, S. Chand & Co., New Delhi.
- Theory of Structures, Vol. I, by S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

SURVEYING-II			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To understand the principle of surveying on very large scale by locating precise horizontal controls.
- To learn about surveying applications in setting out works.
- To learn about determining absolute positions of a point using celestial measurements.
- To learn about different types of errors in measurements and their adjustment.
- To introduce the basic concept of photogrammetry, Remote sensing, and GIS.

COURSE CONTENT

UNIT A

Module 1: Curves

Classification of curves, elements of simple circular curve, location of tangent points- chain and tape methods, instrumental methods, Examples; types of transition curves; Vertical Curves: Necessity and types of vertical curves, setting out of a vertical curve by tangent correction, chord gradient and sight distance method.

UNIT B

Module 2: Survey Adjustment and computations

Definitions, types of error, weight of an observation, law of weights, most probable values, principle of least squares, method of correlates, normal equation, adjustment of triangulation figures by method of least squares.

UNIT C

Module 4: Elements of Photogrammetry

Introduction, types of photographs, aerial camera, scale of a photograph, height displacements of vertical photographs, flight planning and its uses, crab and drift, number of photographs, relief displacements, Stereoscopic vision and stereoscopes, height determination from parallax measurement, flight planning, principle of photo interpretation, photogrammetric monitoring.

UNIT D

Module 5: Introduction to remote sensing and Geographical Information System (GIS)

Definition of Remote Sensing, types of remote sensing, remote sensing system and components. EMR source and characteristics, active and passive remote sensing, EMR propagation through medium, EMR interaction with objects, Spectral signature, Satellite orbits and platforms: Geostationary and sun synchronous satellites, Applications of remote sensing in civil engineering.

Geographical Information System (GIS):Definition and Objectives, Components of GIS, Spatial data models: Raster and Vector.

Course Outcomes:

- Students would be able to know about advanced methods of locating horizontal controls.
- Set out various civil engineering structures, learn about different types of time and solution of astronomical triangle.
- Apply corrections to the measurements for different errors, and understand the difference between aerial photograph and satellite images and their use in map making.

Suggested Books:

- Chang.T.K. 2002: Geographic Information Systems, Tata McGrawHill
- Punmia, B.C. 2005: Surveying I and II, Luxmi Publications
- Charles D. Ghilani: Adjustment Computations: Spatial Data Analysis (Fifth Edition)
- Paul R Wolf: Elements of Photogrammetry
- G S Srivastava: An introduction to Geoinformatics
- Basudeb Bhatta: Remote Sensing and GIS
- G. L. Hosmer: Text-book on Practical Astronomy
- Various Online resources including NPTEL

Material Testing and Evaluation			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**3-0-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To provide the students an knowledge about various engineering materials.
- To understand the properties of ingredients of concrete.
- To study the behaviour of concrete under different states.
- To study about the concrete design mix.
- To understand special concrete and their use.
- To know various heavy construction projects and the equipments used for these.

COURSE CONTENT

UNIT-A

Module 1: Introduction to Engineering Materials

Cements, M-Sand, Concrete (plain, reinforced and steel fibre/glass fibre- reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics and Refractories, Bitumen and asphaltic materials, Glass and Plastics, Structural Steel and other Metals

Module 2: Limes, cement and mortars

Lime: classification of lime, manufacturing, testing of lime, storage of lime, Cement: cements composition, types of cement, manufacturing of ordinary portland cement, special types of cement, storage of cement, testing of cement. Mortars: Proportions of lime and cement mortars, mortars for masonry and plastering.

UNIT-B

Module 3: Concrete making materials

Proportions of cements, aggregates, water and admixtures; properties of fresh and hardened concrete, variability of concrete strength, extreme weather concreting, prestressed concrete; Durability of concrete - alkali aggregate reaction, reinforcement corrosion, freezing and thawing, etc.

Module 4: Mix Design

Principles of concrete mix design, basic considerations, Factors in the choice of mix design, outline of mix design procedure, ACI mix design practice, USBR method, British mix design method IS guidelines.

UNIT-C

Module 5: Steel and its testing

Types of steel, mechanical behaviour and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; tensile test – standards for different material (brittle, quasi-brittle, elastic and so on); Bending and torsion test, procedure and standards, Strength of ceramic, Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; concept of fracture mechanics; fracture toughness testing.

UNIT-D

Module 6: Testing and Evaluation Procedures

Testing of concrete mixes, description for various concrete, steels, aggregates ; Elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Shrinkage, Creep.

Module 7: Construction equipments and Heavy Construction

Construction of large structures, dams, bridges, multi storeyed buildings etc, Construction Equipments - crushers, hot mix, plants, dozers etc, Introduction to heavy construction equipment.

Course Outcomes:

At the end of the course, the students will be able to

- To explain various type of constructions in Civil Engineering.
- Design the concrete mix using ACI and IS code methods.
- Determine the properties of fresh and hardened of concrete.
- Design special concretes and their specific applications ensure quality control while testing/ sampling and acceptance criteria.

SUGGESTED BOOKS:

- Handbook of mix design - BIS
- Concrete Technology by M.S. Shetty.
- Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth- Heinemann
- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
- Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
- Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
- E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
- American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)

FLUID MECHANICS-II LAB.			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks: 100**	

COURSE OBJECTIVES:

- To understand the flow measurement in a pipe flow.
- To determine the energy loss in pipe flow.
- To study the loss due to pipe fittings.
- To measure the discharge in a open channel flow etc.

LIST OF EXPERIMENTS

1. To determine the coefficient of drag by Stokes law for spherical bodies.
2. To study the phenomenon of cavitations in pipe flow.
3. To determine the critical Reynolds number for flow through commercial pipes.
4. To determine the coefficient of discharge for flow over a broad crested weir.
5. To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
6. To study the scouring phenomenon around a bridge pier model
7. To study the scouring phenomenon for flow past a spur.
8. To determine head loss due to various pipe fittings.

COURSE OUTCOMES:

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

- Measure discharge in pipes determines the energy loss in conduits.
- Carry out discharge measurements in open channel etc.

STRUCTURAL ANALYSIS LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- Structural Analysis experiments help to understand, to know the practical behaviour of the physical structures like beams, different arches, roof truss etc.
- A proper structural analysis of these structures helps the students to solve the practical problems.
- Different structural apparatus like Two-Hinge Arch, Three- Hinge Arch are studied in the laboratory.

COURSE CONTENT

UNIT-A

1	To verify moment area theorem regarding slope and deflection in a beam
2	To verify Maxwell's Reciprocal Theorem.
3	Begg`sdeformeter- verification of Muller Breslau principle
4	Experiment on a two – hinged arch for horizontal thrust and influence line for horizontal thrust
5	Analytical and experimental study of three hinged arch
6	Experimental and analytical study of unsymmetrical bending of a cantilever beam
7	Sway in portal frames – Demonstration

Course Outcomes:

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

- Various experimental and analytical studies for different structural members and their comparison.
- Demonstration of frame.
- Able to calculate the about forces, moments and deflections.
- To understand the Able to calculate the deflection of springs
- To verify and compare different theoretical and experimental theorems.

SURVEYING-II LAB.			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To study and use of theodolite for angle measurements
- To use tacheometer for horizontal and vertical distances.
- To draw simple circular curves.
- To measure base line measurement.
- To study total station and its use for measuring distance, elevation and coordinates.

LIST OF EXPERIMENTS

1. Study various parts of a theodolite
2. Measurement of horizontal and vertical angles with theodolite
3. Measurement of Tachometric constants.
4. Calculating horizontal distance and elevations using tachometer.
5. Exercise of triangulation including base line measurement.
6. Setting out simple circular curves by deflection angle method.
7. Study the various parts of a total station.
8. Measurements of distance, elevation, coordinate with total station.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Use the theodolite for measuring angles and use of tacheometer to determine distance and elevation.
- Draw simple circular curves.
- Calculate base line measurement and importance of triangulation.
- Use a total station to measure distance, elevation and coordinates.
- Use total station to plot a map of given area with software.

Material Testing & Evaluation Lab.			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To determine important properties of cement with different tests.
- To study the various test on aggregates and concrete.

LIST OF EXPERIMENTS

1. Standard consistency of cement using Vicat`s apparatus.
2. A) Fineness of cement by Sieve analysis and Blaine`s air permeability method.
   B) Fineness modulus of coarse and fine aggregates.
3. Soundness of cement by Le-Chatelier`s apparatus.
4. Setting time of cement, initial and final of cement.
5. Compressive strength of cement.
6. A) Measurement of specific gravity of cement.
   B) Measurement of Heat of Hydration of cement.
7. Moisture content and bulking of fine aggregate.
8. Workability of cement concrete by (a) Slump test (b) Compaction factor test (c) Flow table test.
9. Compressive strength of concrete by (a) Cube test, (b) Cylinder test
10. Indirect tensile strength of concrete-split cylinder test.

Course Outcomes:

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

- To able understand the importance of testing of cement, sand and aggregate.
- Able to perform different tests of concrete to check their suitability.
- Study of various properties of cement, aggregate and concrete for any project work.
- To check the suitability of material for practical application.

RCC Drawing Lab.			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

COURSE OBJECTIVES:

- To understand the principles of planning and bylaws.
- To draw plan, elevation and section of RC Slabs, Beams, Columns and Footings and Portal Frame.
- To prepare detailed working design of a small RCC framed building

LIST OF EXPERIMENTS

RCC Drawing: Reinforcement details from the given data for the following structural elements with bar bending schedules

(i) Drawing No. 1: RC Slabs - One way slab, Two way slab and Cantilever Slab.

(ii) Drawing No.2 : Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups)

(iii) Drawing No.3 : Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings.

(iv) Drawing No. 4 : Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.

(v) Drawing No. 5 : Design of a small RCC framed building using Limit State method of design including preparation of necessary working drawing.

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various RCC structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show form work for RCC as well as placement of reinforcement in various structural members. Commentary on BIS:456 may be referred along with code for relevant clauses.

Course Outcomes:

After going through this course, the students will be able to

Understand material properties and design methodologies for reinforced concrete structures.

- Assess different type of loads and prepare layout for reinforced concrete structures.
- Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members.
- Analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase.
- Assessment of serviceability criteria for reinforced concrete beam and slab.

- Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format.

Gurugram University

Scheme of Studies and Examination

B.TECH (Civil Engineering) – 5th Semester

Sr. No.	Course Code	Course Title	Hours per Week	Contact Hours per Week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Internal Assessment	External Examination	Practical	Total	
1.		Hydrology and Water Resource Engineering	3-0-00	3	3	30	70	-	100	3
2.		Transportation Engineering	3-0-0	3	3	30	70	-	100	3
3.		Soil Mechanics	3-0-0	4	3	30	70	-	100	3
4.		Water Supply and Treatment	3-0-0	3	3	30	70	-	100	3
5.		Design of Steel Structure	3-0-0	4	3	30	70	-	100	3
6.		Engineering Geology	3-0-0	3	3	30	70	-	100	3
7.		Transportation Engineering Lab	0-0-2	2	1	50	-	50	100	3
8.		Soil Mechanics Lab	0-0-2	2	1	50	-	50	100	3
9.		Design of Steel Structure Drawing Lab	0-0-2	2	1	50	-	50	100	3
10.		Engineering Geology Lab	0-0-2	2	1	50	-	50	100	3
11.		Survey camp	-	-	1	-	-	50	50	3
12.		Practical Training-I	-	-	1	-	-	GRADE	* Refer note 1	
		TOTAL			**24**				**1050**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Gurugram University

Scheme of Studies and Examination

B.TECH (Civil Engineering) – 6th Semester

Sr. No.	Course Code	Course Title	Hours per Week	Contact Hours per Week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Class work	Theory	Practical	Total	
1.		Irrigation And Hydraulic Structures	3-0-0	3	3	30	70	-	100	3
2.		Foundation Engineering	3-0-0	3	3	30	70	-	100	3
3.		Estimation ,Costing and Valuation	3-0-0	3	3	30	70	-	100	3
4.		**Professional** Elective-I	3-0-0	3	3	30	70	-	100	3
5.		**Professional** Elective-II	3-0-0	3	3	30	70	-	100	3
6.		Open Elective-I	3-0-0	3	3	30	70	-	100	3
7.		Environmental Engineering Lab.	0-0-2	2	1	50	-	50	100	3
8.		Foundation Engineering lab	0-0-2	2	1	50	-	50	100	3
9.		Irrigation Drawing LAB	0-0-2	2	1	50	-	50	100	3
10.		Estimation,Costing and Valuation LAB	0-0-2	2	1	50	-	50	100	3
11.		Computer aided Civil Engineering Design	0-0-2	2	1	50	-	50	100	3
12.		Seminar-I	0-0-2	2	1	-	-	50	50	3
		TOTAL			**24**				**1150**	

	Course Code	Course Title
****Elective –I**		1. Waste Water Treatment
		2. Advanced Concrete Structure

	Course Code	Course Title
****Elective –II**		1. Pre-Stressed Concrete
		2. Repair & Rehabilitation Of Structure

	Course Code	Course Title
****Open Elective –I**		1. Environmental impact assessment and life cycle analyses
		2. Earthquake Engineering

Note:

1. Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

HYDROLOGY AND WATER RESOURCE ENGINEERING			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To provide knowledge in the hydrological cycle, precipitation, evapo transpiration, infiltrationand its measurements.
- To understand the physics of translate of rainfall into run off modelling of various runofftechniques.
- To estimate the floods.
- To develop ability to apply the analytical and numerical techniques to ground and surface water models.
- To understand hydrographs and its methods.

COURSE CONTENT

Unit-I

Module 1: Introduction

Hydrologic Cycle, Water-Budget Equation, History of Hydrology and its Application in Engineering, World Water Balance, Sources of Hydrological Data.

Module 2: Precipitation

Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth Area-Duration Relationships, Frequency of Point Rainfall, Intensity-Duration-Frequency Curves, Probable Maximum Precipitation (PMP), Rainfall Data in India.

Unit-II

Module 3: Hydrological Abstractions

Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapotranspiration and its Measurement, Evapotranspiration Equations, Potential Evapotranspiration over India, Actual Evapotranspiration, Interception, Depression Storage, Infiltration Process, Initial Loss, Infiltration Capacity, Factors Affecting Infiltration, Measurement of Infiltration, Infiltration Indices.

Module 4: **Runoff**

Types of Runoff, Runoff Characteristics of Streams, Runoff Volume , Factor Affecting Runoff, Rainfall-Run off Relationships, Estimation of Runoff, SCS-CN Method of Estimating Runoff Volume, Flow Duration Curve, Flow-Mass Curve, Measurement of Stage of Runoff by-Staff Gauge,

Wire Gauge, Automatic Stage Recorder and Stage Hydrograph; Stream Flow Measurement by Direct and Indirect Methods.

Unit-III

Module 5: Hydrograph

Discharge Hydrograph, Components and Factors Affecting Shape of Hydrograph, Effective Rainfall, Base Flow Separation, Unit Hydrograph(UH)-Definition, Assumptions and its Derivation; Unit Hydrograph of Different Durations, Use and Limitations of UH, Snyder`S Synthetic UH

Module6: Floods and its Estimation

Introduction to Floods, Estimation of Floods by: Rational Methods, Empirical Formulae, Unit Hydrograph Technique, Flood Frequency Studies- Gumbel`s Method, Graphical Method.

Unit-IV

Module 7: Water Resource Planning-I

Role of Water in National Development, Water Resources and their Assessment , Planning Process, Environmental Consideration in Planning, System Analysis in Water Planning, Common Issues in Project Planning.

Module 8: Water Resource Planning-II

Functional Requirements in Multipurpose Projects, Multipurpose Planning, Basin Wise Planning, Long Term Planning, Reservoir Planning-Dependable Yield, Sedimentation in Reservoir, Reservoir Capacity, Empirical-Area Reduction Method.

Course outcomes

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

- Demonstrate the concepts of hydrograph, unit hydrograph and flood estimation.
- Estimate the hydrological parameters.
- Carry out statistical and probability analysis of hydrological data.
- Demonstrate the concepts of hydrological systems.
- Gain the basic knowledge of water resource planning.

References:

- Engineering Hydrology by K.Subramanya.
- Hydrology by H.M.Raghunath.
- Water Resources Engineering by Linseley and Franzini
- Optimisation Theory and Applications by S.S.Roy
- Water Resources Systems Planning & Economics by R.S.Varshney.

TRANSPORTATION ENGINEERING			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To understand the importance of transportation and characteristics of road transport.
- To know about the history of highway development, surveys and classification of roads.
- To study the geometric design of highways.
- To study about traffic characteristics and design of intersections.
- To know about the pavement materials and design.
- To know about the different type of bituminous material and design.

COURSE CONTENT

UNIT-I

Module 1: Highway development and planning

Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

Module 2: Geometric design of highways

Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

UNIT-II

Module 3: Traffic engineering & control

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

UNIT-III

Module 4: Pavement materials

Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

UNIT-IV

Module 5: Design of pavements

Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavementscomponents and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

Course Outcomes

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

- Carry out surveys involved in planning and highway alignment.
- Design cross-section elements, sight distance, horizontal and vertical alignment.
- Implement traffic studies, traffic regulations and control, and intersection design.
- Determine the characteristics of pavement materials.
- Design flexible and rigid pavements as per IRC

References:

- Khanna, S.K. and Justo, C.E.G., Veeraragavan A., "Highway Engineering", Nem Chand & Bros.
- Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", Nem Chand & Bros.
- Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
- G.V.Rao, Principles of Transportation and Highway Engg, Tata McGraw Hill Pub.

SOIL MECHANICS			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives:

- To provide Civil Engineering students with the basic knowledge regarding soil formation and composition.
- To explain the importance of three phase system of soil and how soil is properties estimated using three phase system.
- To impart knowledge on the various factors governing the Engineering behaviour of soils and carry out soil classification.
- To explain role of water in soil behaviour and how soil stresses, permeability and quantity of seepage are estimated.
- To determine shear parameters and stress changes in soil due to foundation loads.
- To estimate the magnitude and time-rate of settlement due to consolidation.

COURSE CONTENT

Unit-I

Module 1: Soil Formation and its Basic Soil Properties

Scope of Soil Mechanics, Types of Soil, Origin of Soil and its Formation, Inter-Particle Forces, Soil Structure and Fabric, Major Soil Deposits of India, Three Phase System, Weight-Volume Relationships, Index Properties, Particle Shape and Size, Grain Size Analysis: Sieve Analysis and Hydrometer Analysis; Grain Size Distribution Curves, Consistency of Soils: Sensitivity, Thixotropy, Activity; Consistency Limits and their Determination.

Module 2: Classification and Permeability of Soils

Necessity of Classification, Classification on the Basis of Grain Size and on the Basis of Plasticity, Plasticity Chart, Textural Classification, Unified Soil Classification, IS Classification System Soil. Permeability, Darcy`s Law and its Validity, Discharge Velocity and Seepage Velocity, One Dimensional Flow, Factors Affecting Permeability, Laboratory and Field Determination of Permeability, Indirect Methods, Permeability of Stratified Deposits.

Unit-II

Module 3: Effective Stress Concept

Principle of Effective Stress, Effective Stress under Hydrostatic Conditions and Under Hydro-Dynamic Conditions, Effective Stress in The Zone of Capillary Rise, Seepage Pressure, Quicksand Condition, Seepage Through Soil: Two Dimensional Flow, Flownets, Properties and Utilities of Flownet, Uplift Pressure, Piping, Protective Filter.

Module 4: Compressibility and Compaction

Definitions, Role of Moisture and Compactive Effort in Compaction, Moisture Density Relationship, Compaction in Laboratory and Field Conditions, Compactive Effect on Soil Properties, Compaction of Cohesionless Soils, Moderately Cohesive Soils and Clays, Field Control of Compaction.

Unit-III

Module 5: Vertical Stress below Applied Loads

Boussinesq`s Equation, Vertical Stress Distribution Diagrams, Pressure Bulb, Vertical Stress Beneath Loaded Areas, Newmark`s Influence Chart, Westergaard`s Analysis, Contact Pressure, Approximate Stress Distribution Methods for Loaded Areas.

Module 6: Consolidation

Consolidation Process and its Types, Components of Total Settlement, One-Dimensional Consolidation Test, Typical Void Ratio-Pressure Relationships for Sands and Clays, Consolidation Parameters, Normally Consolidated and Over Consolidated Clays, Casagrande`s Graphical Method of Estimating Pre-Consolidation Pressure, Terzaghi`s Theory of One- Dimensional Consolidation, Determination of Coefficients of Consolidation, Time Rate of Consolidation.

Unit-IV

Module 7: Shear Strength

Mohr Stress Circle, Mohr-Coulomb Failure-Criterion, Relationship Between Principal Stresses at Failure, Drainage Conditions, Shear Strength Parameters and their Determination, Advantages and Disadvantages of Different Shear Tests, Shear Strength Characteristics of Clay and Sand, Partially Saturated Soils.

Module 8: Earth Pressure

Types of Lateral Earth Pressure, Rankine`s Active, Passive States of Plastic Equilibrium and Rankine`s Theory, Coulomb's Wedge Theory, Coulomb`s Active and Passive Earth Pressure Theory, Culmann`s Graphical Construction.

Course Outcomes

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

- Solve three phase system problems.
- Able to carry out soil classification.
- Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram.
- Estimate the stresses under any system of foundation loads.
- Solve practical problems related to consolidation settlement and time rate of settlement.

References:

- Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publishers Distributors, N. Delhi
- Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain; Laxshmi Publications (P) Ltd, N. Delhi.
- Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New Age International (P) Ltd., N. Delhi.

- Soil Engineering. in Theory and Practice, Vol .I, Fundamentals and General Principles by Alam Singh, CBS Publications, N.Delhi.
- Engineering Properties of Soils by S.K.Gulati, Tata-Mcgraw Hill,N.Delhi.
- Geotechnical Engineering. by P. Purshotam Raj, Tata Mcgraw Hill.
- Principles of Geotechnical Engineering by B.M. Das, PWS KENT, Boston.

WATER SUPPLY AND TREATMENT			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To quantify the water demands and its variations.
- To analyze the different characteristics of water.
- To study the different units of treatment.
- To deal with water supply and water distribution to consumers.
- To develop basic knowledge about the water pollution and its control.

COURSE CONTENT

Unit-I

Module 1: Introduction

Water Supply System – Planning, Objectives, Design Period, Population Forecasting, Water Demands and its Variations, Sources of Water and their Characteristics, Development and Selection of Source, Intakes and their Types.

Module 2: Water Characteristics

Sources of Impurities, Type of Impurities in Water and their Sanitary Significance, Physical, Chemical and Bacteriological Analysis of Water, Indian and Global Standards of Water Quality, Effluent Standards.

Unit-II

Module 3: Water Treatment

Necessity of Water Treatment , Flow Diagram of Different Treatment Units; Constructional Details, Working and Operation of Preliminary Units, Aeration Units, Sedimentation Units and their Types, Features and Design Aspects; Mixing Basins, Flocculation; Filtration – Mechanisms, Characteristics and Design of Slow and Rapid Sand Filtration Unit; Disinfection - Theory, Methods and Practices.

Module 4: Advanced Water Treatment

Water Softening, Desalination- R.O. Plant, Demineralization, Adsorption, Ion Exchange, Membrane Systems; Iron and Manganese Removal, Defluoridation, Dissolved Solids Removal.

Unit-III

Module 5: Water Conveyance System

Methods of Supply - Intermittent and Continuous, Pipes and Conduits for Water- Pipe Materials, Laying, Jointing and Testing of Pipes, Valves and Appurtenances

Module 6: Pumps and Pumping Stations

Need of Pumping, Terminology used, Classification of Pumps, Different Type of Pumps used in Water Supply, Power of Pumping, Total Lift of Pump, Location of Pumping Station, and Site Selection.

Unit-IV

Module 7: Water Distribution System

Requirements of Water Distribution, Type of Distribution System, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System and their Merits and Demerits; Distribution Reservoir-Functions and Determination of Storage Capacity, Water Distribution Network- Layout, Capacity, Pressure Requirements, A nalysis; Leak Detection and Maintenance of Water Distribution Network.

Module 8: Water Pollution and Control

Sources of Water Pollution, Types and their Effects, Preventive Measures and Control of Water Pollution, Description of Legislation Related to Water Pollution Control.

Course Outcomes

At the end of the course, the students will be able to

- Understand the sources of water and characterization of water including physical, chemical and biological water quality parameters.
- Develop basic knowledge about the transmission, storage and distribution of water.
- Knowledge of water pollution and its control.
- Recommend the degree of treatment required for the water.

References:

- Water Supply Engineering: S.R. Kshirsagar.
- Water Supply Engineering: S.K. Garg.
- Water Supply Engineering: B.C. Punmia.
- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie 8. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

DESIGN OF STEEL STRUCTURE			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
- To study and design of various connections.
- To understand behaviour of flexural members and the design laterally restrained and unrestrained beams.
- To impart practical knowledge of steel structures and their application.

COURSE CONTENT

Unit-I

Module 1: Introduction

Stress Strain Curve for Steel, Composition and Properties of Structural Steel, Types of Steel Structures, Types of Sections, Stresses in Structural in Steel, Design Consideration, Codes and Specification, Introduction of Design Philosophies, Different Kind of Loads and their Combination.

Module 2: Connections

Terminology, Various Types of Connections and their Joints-Riveted, Bolted, Pin, Welded Connections; their Design for Different Loads, Modes of Failure

Unit-II

Module 3: Design of Tension Member

Types of Tension Members, Factors Affecting Strength of Tension Member, Design of Tension Members, Lug Angles, Splices, Gussets as per Indian Codal Provision.

Module 4: Design of Compression Members

Behaviour of Compression Members, Types of Compression Member, Effective Length, Slenderness Ratio, Sections Used for Compression Member, Flexural-Torsional Buckling, Prevention of Buckling Failure, Design of Compression Members, Design of Built Up Columns- laced and battened columns including the design of lacing and battens, Design of Compression Members Composed of Two Components Back-To-Back.

Unit-III

Module 5: Design of Beams

Different Types of Sections in Beams, Lateral Stability of Beam and Factors Affecting Lateral Stability, Design of Laterally Supported and Unsupported Beams, Web Buckling, Web Crippling, Diagonal Buckling, Torsional Buckling, Effect Of Holes In Beams.

Module 6: Design Column Bases and Footings

Types of Column, Bases-Slab Bases, Gusset Base, Design of Base plate and Gusseted Base, Design of Bases for Eccentrically Loaded Columns, Anchor Bolts and Shear Connectors, Grillage Foundation

Unit-IV

Module 7: Plastic Analysis and Design

Plastic Analysis- Scope, Theory and General Requirement, Ultimate Load-Carrying Capacity of Tension Members, Compression Members, Flexural Members, Shape Factor, Load Factor, Mechanisms, Plastic Collapse, Condition in Plastic Analysis, Method of Analysis, Plastic Analysis And Design of Steel Beams and Simple Portal Frames.

Module 8: Design of Gantry Girder

Loading Consideration, Selection Criteria of Gantry Girder, Specification, Design of Gantry girder

Course Outcomes

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

- Apply the IS code of practice for the basic design of steel structural elements.
- Design compression and tension members using simple and built-up sections.
- Analyze the behaviour of bolted connections and design them.
- Design welded connections for both axial and eccentric forces
- Students will be able to understand the basic of steel structure with practical aaplication.

References:

- Design of steel structures, A.S.Arya&J.L.Ajmani, Nemchand& Bros., Roorkee.
- Design of steel structures (LSM), N,.Subramanian, Oxford Publication.
- Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
- Design of steel structures, S.M.A.Kazmi&S.K.Jindal, Prentice Hall, New Delhi.
- Design of steel structures, S.K.Duggal, TMH Pub, New Delhi.

ENGINEERING GEOLOGY			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To make the students familiar interior of Earth.
- To aware about different geological maps, different organizations related with geological study.
- To provide knowledge about geological forces and formation of Superficial Deposits.
- To make students study various minerals
- To aware about the basics of various types of rocks and their formation
- To provide adequate knowledge about geological considerations in civil engineering projects

COURSE CONTENT

Unit-I

Module 1: Introduction

Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data.

Module 2: Physical Geology

External and Internal Geological Forces Causing Changes; Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.

Unit-II

Module 3: Mineralogy

Origin and Composition of Minerals, Physical Properties of Minerals, Susceptibility of Minerals to Alteration, Rock Forming Minerals, Megascopic Identification of Common Primary and Secondary Minerals.

Module 4: Petrology

Rock Formation Processes, Ternary Diagram, Igneous Petrology- Volcanic Phenomenon, Types of Volcanic Eruption, Chemical and Mineralogical Composition, Texture and its Types, Sedimentary Petrology- Mode of Formation, Mineralogical Composition, Texture and its Types; Metamorphic Petrology- Agents and Types of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures and Textures.

Unit-III

Module 5: Structural Geology

Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field.

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Module 6: Properties of Rock Masses

Sub Surface Investigations of Rocks and Engineering Characteristics of Rocks Masses; Field and Laboratory Tests on Rocks, Stress Deformation and Bearing Capacity of Rocks, Important Variables Influencing Rock Properties and Behaviour, Measurement of Velocity of Sound in Rock.

Unit-IV

Module 7: Geology of Dam and Reservoir Site

Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions.

Module 8: Geological Hazards

Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Course Outcomes

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

- To identify different minerals, their physical properties and rock forming minerals.
- To understand the basics of various types of rocks and their formations, texture, composition.
- To determine different geological forces and formation of Superficial Deposits.
- Conduct geological survey by knowing the interior of Earth.
- To study different geological maps with geological symbols.
- To acquire the knowledge about geological considerations in civil engineering projects.

References:

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes

TRANSPORTATION ENGINEERING LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To understand the characterization of highway materials as per IRC/IS codes.
- To learn the mix designs of granular, bituminous and CC mixes
- To learn the use of modern equipment for traffic studies and pavement evaluation

List of Experiments

1. To determine the flakiness index and elongation index of aggregates.
2. To determine the California Bearing Ratio (CBR) value of soil and aggregate.
3. To determine the impact value of aggregate and composite material.
4. To determine the crushing strength of aggregate and composite material.
5. To determine the abrasion and attrition value of aggregate by using:
    a) Los Angeles abrasion test
    b) Dory abrasion test.
6. To determine the water absorption of aggregate.
7. Traffic volume and speed study using videography technique.(Demonstration only)
8. To determine the softening point of paving bitumen.
9. To determine ductility of bitumen.
10. To determine the viscosity of bituminous material.
11. To determine the bituminous mix design by Marshall's method.

Course Outcomes

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

- Gain Engineering knowledge of the subject and apply it for judging the suitability of highway materials.
- Make investigations, use modern test tools and develop solutions to use highway materials for sustainable development that preserves the environment.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant IS/IRC specifications.

References:

- Khanna,S.K. and Justo, C.E.G.,Veeraragavan A.,"Highway Engineering",Nem Chand &Bros.
- Khanna,S.K. and Justo,C.E.G.,"HighwayMaterialTestingManual",NemChand& Bros.
- Kadiyali,L.R.,"TrafficEngineeringandTransportationPlanning",Khanna Publishers.

SOIL MECHANICS LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To estimate index properties of soil.
- To estimate consistency limit of fine grained.
- To estimate shear strength of soils by direct shear test & unconfined compressive test.
- To estimate the engineering properties of the soils by density test, permeability test and consolidation test

List of Experiments

1. Visually classify the soil and to determine the moisture content (water content) of a given soil sample.

2. Determination of specific gravity of given soil sample.

3. To classify the coarse grained soil by sieve analysis using particle size distribution curve.

4. To determine liquid limit and plastic limit.

5. To determine field density of soil by
    a. Sand replacement method
    b. Core cutter method
6. To determine the optimum moisture content and maximum dry density of soil by Standard Proctor Test.

7. To determine the coefficient of permeability of soil sample at desired density by suitable method.

8. To determine the Unconfined compressive strength of cohesive soil sample.

9. To determine the shear strength parameters of the given granular soil sample at known density and moisture content by Direct shear test.

10. To determine the shear strength parameters of fine grained soil sample by unconsolidated undrained (UU) Triaxial test.

Course Outcomes

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

- Determine index properties of soils.
- Students will learn and acquire knowledge to classify soils.
- To understand the techniques, skills and modern engineering tools necessary for engineering practice.
- Determine engineering properties of soils solutions.
- Classify soil by physical observation of the soils.
- Carry out interpolation among the estimated soil design parameters.

References:

- Soil Testing for Engineers by S.Prakash, PK Jain, Nem Chand & Bros.,Roorkee.
- Engineering Soil Testing by Lambi, Wiley Eastern.
- Engineering Properties of Soils and their Measurement by J.P.Bowles, McGraw Hill.
- Soil Engineering in Theory and Practice, Vol.II,
- Geotechnical Testing and Instrumentation by Alam Singh, CBS Pub.

DESIGN OF STEEL STRUCTURES DRAWINGS			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To draw various steel connection.
- To draw various beam and column connections.
- Drawing of girders, different trusses and joints.
- To draw various steel members i.e. tension and compression members.

List of Experiments

1. To Prepare Detailed Drawing for various types of Bolted Connection.
2. To Prepare Detailed Drawing for various types of Welded Connection.
3. To Prepare Detailed Drawings for Laced And Battened Columns.
4. To Prepare Detailed Drawings of Built Up Beams.
5. To Prepare Detailed Drawing of Column Bases–Slab Bases–Gusset Base.
6. To Prepare Detailed Drawings of Grillage Foundations.
7. To Prepare Detailed Drawing of Beam to Column Connections.
8. To Prepare Detailed Drawings of Gantry Girder.
9. To Prepare Drawing of Plate Girder.
10. To Prepare Drawing of Circular and Rectangular Water Tank.
11. To Prepare Drawing of various types of Roof Trusses.

Course Outcomes

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

- Understand the study of drawing for various components like connection, trusses, girders, joints etc.
- Implementation of design in drawing forms with by laws.
- Apply relevant Indian Standard provisions to ensure safety and serviceability of structural steel elements.

References:

- Structural design & Drawing, S. Krishnamurthy, Volume-3.
- Design & Drawing of steel Structure, Sajjan V. Wagh.
- Structural design & Drawing, reinforced concrete & Steel, N. Krishna Raju.
- Steel Structures (Design & Drawing), A.K. Upadhayay.

ENGINEERING GEOLOGY LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To study and identify different minerals with their physical properties.
- To aware about different types of rocks and rock forming minerals.
- To study the different geological formations.

List of Experiments

1. To Study physical properties of minerals.
2. To study and identify different minerals: Silica group, Feldspar group, Carbonate group and Pyroxene group.
3. To study and identify rocks forming silicate and ore minerals.
4. Identification of Igneous Petrology: Acidic Igneous rock: Granite and its varieties, Pumice, Scoria, Pegmatite and Volcanic Tuff.
5. Identification of Sedimentary Petrology: Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.
6. Identification of Metamorphic Petrology: Marble, Slate etc.
7. To determine Dip and strike of formations using
    a) Clinometer
    b) Brunton compass
8. Geological cross sections and Study of topographical features from Geological maps with identification of symbols.
9. Study of models of Geological structures and outcrops patterns of different types of rocks and landforms.

Course Outcomes

At the end of the course, students would be able to:

- To identify different materials and their physical properties.
- To identify different types of rocks on the basis of their formation.
- To identify geological symbols and make geological maps.
- To measure geological formations of different types.

References:

- A textbook of Geology by P.K Mukherjee
- Engineering and General Geology by Prabin Singh.

SURVEY CAMP			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**-**
L-T-P	**0-0-0**	**Total marks:**	**50**

Course Objectives

- Survey camp emphasizes on field application of basic survey task such as triangulation, base line measurement, leveling, contouring and topographic surveying of land using plane table methods.
- It imparts knowledge of projection of land features on a plane sheet on a chosen scale.
- To make the student capable of drawing survey site plans and maps independently of a chunk of land of hilly area.

COURSE CONTENT

The survey camp is to be carried out by the students at suitable site. Different group of students will be asked to survey a particular area by using appropriate instruments issued to them. They will use different methods of surveying i.e. leveling, base line measurement, contouring, triangulation, plane table method to locate different control points. The students will plot important objects and features of the area under consideration on plane table sheet and prepare topographic map of the area.

Course Outcomes

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

- Use instruments like Auto level, Total station, Tachometer and other important survey instrument.
- They will gain experience of preparing site maps of the objects in the area under consideration with contours.
- Make significant survey decisions on survey works whenever necessary especially when facing problems at sites.
- To carry out engineering survey work confidently.

Reference Books

- Punmia B.C., Surveying, Volume 1, Laxmi Publications.
- Punmia B.C. Surveying, Volume 2, Laxmi Publications.
- N N Basak, Surveying and Levelling TMH Private Ltd.

Gurugram University

Scheme of Studies and Examination

B.TECH (Civil Engineering) – 6th Semester

Sr. No.	Course Code	Course Title	Hours per Week	Contact Hours per Week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Class work	Theory	Practical	Total	
1.		Irrigation And Hydraulic Structures	3-0-0	3	3	30	70	-	100	3
2.		Foundation Engineering	3-0-0	3	3	30	70	-	100	3
3.		Estimation ,Costing and Valuation	3-0-0	3	3	30	70	-	100	3
4.		**Professional** Elective-I	3-0-0	3	3	30	70	-	100	3
5.		**Professional** Elective-II	3-0-0	3	3	30	70	-	100	3
6.		Open Elective-I	3-0-0	3	3	30	70	-	100	3
7.		Environmental Engineering Lab.	0-0-2	2	1	50	-	50	100	3
8.		Foundation Engineering lab	0-0-2	2	1	50	-	50	100	3
9.		Irrigation Drawing LAB	0-0-2	2	1	50	-	50	100	3
10.		Estimation,Costing and Valuation LAB	0-0-2	2	1	50	-	50	100	3
11.		Computer aided Civil Engineering Design	0-0-2	2	1	50	-	50	100	3
12.		Seminar-I	0-0-2	2	1	-	-	50	50	3
		TOTAL			**24**				**1150**	

	Course Code	Course Title
****Elective –I**		1. Waste Water Treatment
		2. Advanced Concrete Structure

	Course Code	Course Title
****Elective –II**		1. Pre-Stressed Concrete
		2. Repair & Rehabilitation Of Structure

	Course Code	Course Title
****Open Elective –I**		3. Environmental impact assessment and life cycle analyses
		4. Earthquake Engineering

Note:

2. Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester

and its evaluation shall be carried out in 7th Semester.

IRRIGATION AND HYDRAULIC STRUCTURE			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To make the students conversant with introduction to irrigation and national policies.
- To understand the basic methods of irrigation and soil water relation.
- To expose the students to water logging and land reclamation.
- To provide adequate knowledge regarding river training and canal outlet.
- To have adequate knowledge of drainage work.

COURSE CONTENT

Unit-I

Module 1: Irrigation and Water Requirement of Crops

Scope and Necessity of Irrigation, Different Water Resources, Development of Irrigation in India, Benefits of Irrigation, National Water Policy
Crops and Crop Seasons in India, Field Capacity, Wilting Point, Duty and Delta, Soil-Water Relationship- root zone soil water, infiltration, frequency of irrigation; Methods of Irrigation

Module 2: Canal Regulation and Cross Drainage Works

Canal Fall- Necessity and Location, Types of fall, Design of fall , Cross Regulator and Distributory Head Regulators,Silt Control Devices, Canal Escapes and its Types.
Cross Drainage Works - Classification, Site Selection Criteria, Factors Affecting the Selection of Cross Drainage Works, Hydraulic Design of- aqueducts, syphon aqueducts, super passage, canal syphon and level crossing.

Unit-II

Module 3: Canal Outlets

Essential Requirements for an Outlet, Classification and Types of Outlets, Salient Features and Design: Pipe Outlet, APM Outlet and Open Flume Outlet; Flexibility Proportionality, Setting and Sensitivity of Outlet.

Module 4: Spillways and Energy Dissipations

Essential Requirements of Spillway and Spillway's Capacity, Types of Spillways and their Suitability, Ogee Spillways, Chute, Side Channel, Shaft and Syphon Spillways, Energy Dissipaters and its types ; Stilling Basins, USBR and IS Stilling Basins.

Unit-III

Module 5: River Training

Objectives and Classification of River Training Works, Methods and Planning of River Training, Marginal Embankments, Guide Banks, Spurs, Cut Offs, Bank Protection and Launching Apron.

Module 6: Water Logging and Drainage

Water Logging- Effects, Causes & Preventive Measures, Land Drainage, Essential Requirements of a Drain, Classification of Drains, its Operation and Maintenance.

Unit-IV

Module 7:Dams

Planning and investigations of reservoir and dam sites, Choice of dams, Dam construction problems, Forces acting on gravity dams, modes of failure and design criteria for structural stability of gravity dams, seepage line in a homogenousearth dam, equipotential lines, path lines.

Module 8: Hydraulic structure

Stream lines, critical exit gradient, need of weirs and barrage,Factors controlling the design of weirs and barrages and its components. Design of weirs.

Course Outcomes

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

- Learn historical development of irrigation in India and the policies framed
- Learn about various methods of irrigation
- Understand water logging effects and methods of land reclamation
- Know about river training, classification and requirement of canal outlets and cross drainage works.

References:

- Garg, S. K., “Irrigation Water Power & Water Resources Engg.” Standard Publishers & Distributors, Delhi, latest edition
- Modi, P.N. “Irrigation, Water Resources and Water Power Engg.” Standard Book House, N. Delhi latest edition
- Arora, K R “Irrigation Water Power & Water Resources Engg.” Standard Publishers & Distributors, Delhi, latest edition
- Sharma, S.K., Principles and Practice of Irrigation Engineering, S.Chand & Co., latest edition
- Punmia, B.C., “Irrigation and Water Power Engg.” Standard Publishers, latest edition

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FOUNDATION ENGINEERING			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination: 3 hrs	

Course Objectives

- To emphasize the importance of soil investigations.
- To provide the knowledge for carrying out field investigations and to indentify soils in geotechnical engineering practice.
- To identify factors controlling soil behaviour and methods of dewatering.
- To understand different types of foundations and their importance in field.
- To identify different parameters for determining the bearing capacity of soil.
- To explain under which conditions deep foundation is needed and how to estimate pile and pile group capacity.
- To understand dynamic loading on soil foundation system and provide knowledge to lay out caissons and well foundation.

COURSE CONTENT

Unit-I

Module 1: Sub-Surface Exploration

Scope and Objectives, Stages in Soil Exploration, Depth and Lateral Extent of Exploration, Guidelines for Various Types of Structures, Ground Water Observations, Methods of Bore Holes, Soil Sampling and Disturbance, Major Types of Samplers, Sounding Methods-SPT, SCPT, DCPT and their Interpretation, Geophysical Methods, Pressure-Meter Test, Exploration Logs.

Module2: Drainage and Dewatering

Ditches and Sumps, Well Point Systems, Shallow Well System, Deep Well Drainage, Vacuum Method, Electro-Osmosis, Consolidation by Sand Piles.

Unit-II

Module 3: Shallow Foundations

Types of Foundations, Depth of Foundation, Types of Shallow Foundations and their Relative Merits, Design Criteria for Structural Safety of Foundation: i) Location of Footing, ii) Shear Failure Criterion, iii) Settlement Criterion. Modes of Shear Failure, Rankine's Analysis Tergazi's Theory, Skempton's Formula, Meyerhoff's Bearing Capacity Theory, Effect of G.W.T. , Effect of Eccentricity on Bearing Capacity, Inclined Load, IS Code Recommendations.

Module 4: Settlement of Foundations

Various Causes of Settlement of Foundation, Allowable Bearing Pressure Based on Settlement, Elastic and Consolidation Settlement, Allowable Settlement According to IS Code Method, Plate Load Test and its Interpretation, Conventional Procedure of Proportioning of Footings, Situation Suitable for the Shallow Foundations.

Unit-III

Module 5: Bearing Capacity of foundations

Design Bearing Capacity, Bearing Capacity from Penetration Tests, Factors Affecting Bearing Capacity, Methods of Improving Bearing Capacity, Raft Foundations, Bearing Capacity of Raft in Sands and Clays, Various Methods of Designing Rafts, Seismic Considerations, Floating Foundations.

Module 6: Pile Foundations

Necessity of Pile Foundations, Classification of Piles, Selection Criteria, Load Capacity, Static Analysis, Analysis of Pile Capacity in Sands and Clays, Dynamic Analysis, Pile Load Tests, Negative Skin Friction, Batter Piles, Lateral Load Capacity, Uplift Capacity of Single Pile, Under-Reamed Pile, Batter Pile. Group Action in Piles, Pile Spacing, Pile Group Capacity, Stress on Lower Strata, Settlement Analysis, and Design of Pile Caps.

Unit-IV

Module 7: Drilled Piers and Caisson Foundations

Drilled Piers- Types, Uses, Bearing Capacity, Settlement and Construction Procedure; Caissons- Types, Bearing Capacity, Settlement and Construction Procedure

Module 8: Well Foundations

Shapes, Depth of Well Foundations, Components, Factors Affecting Well Foundation Design Lateral Stability, Construction Procedure, Sinking of Wells, Rectification of Tilts and Shifts, Recommended Values of Tilts & Shifts as per IS: 3955

Course Outcomes

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

- To understand the importance of soil investigation and carry out sub-surface explorations for any civil engineering construction.
- To evaluate Bearing capacity factors and estimate bearing capacity using suitable methods.
- To do proper foundation proportioning for any kind of shallow foundation system.
- To estimate pile and pile group capacity for any kind of soils including group efficiency.
- To determine safe bearing capacity for various foundation system by considering shear and settlement criterion.

References:

- Murthy, V.N.S, A text book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi, latest edition
- Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, latest edition
- Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational Ltd. Publishers- N.Delhi, latest edition
- Nainan P Kurian, Design of foundation Systems Principles and Practices, Narosa, latest edition
- Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore, latest edition
- Donald P. Coduto, Man-Chu Ronald Yeung and William A. Kitch, Geotechnical Engineering, Principles and Practices, PHI Learning Private limited, latest edition
- P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, latest edition

Course code					
Category	Professional Elective course				
Course title	**Estimation, Costing and Valuation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 6th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

The objective of this Course is

- To analyze cost/revenue data and carry out make economic analyses in the decision making process to justify or reject alternatives/projects on an economic basis.
- Prepare engineering students to obtain professional licensure.
- To function in the business and management side of professional engineering practice.
- To preparation estimate of the civil engineering works.
- To preparation specification of construction items.

COURSE CONTENT

Unit-I

Module 1: Introduction

Purpose of estimating and valuation, Principle of estimation, unit of measurement, item work, Different kinds of estimates, Different methods of estimation.Introduction to estimates of other Civil engineering structures.

Module 2: Building Estimate

Estimation of quantity of load bearing structure with single room & two rooms,Estimation of quantity single storied residential building. Estimation of materials in multi-storey buildings with different sections of walls, foundation, floors and roofs, reinforced brick work, R.C.C works, finishing works and Lump sum items, Estimates of canals, dams, barrages and other structures.

Unit-II

Module 3: Specification

Objectives and Necessity of specification,Types of specification, General specification, Specification ofdifferent construction materials, Specification as per building classification,Language of specific writing.Specification of Works:Detailed specification for earthworks, cement, concrete, brickwork, flooring, D.P.C, R.C.C, cement plastering, painting and other finishing.

Module 4:Market Survey

Traditional and modular materials, Market survey of construction materials, Wages of labour, Tool‟s plant and equipment of construction.

Unit-III

Module 5: Rate Analysis

Prerequisites, factors affecting rate analysis, over head expenses, Procedure for rate analysis: schedule of rates, labour requirement for different works, material requirement for different works, Rate analysis of different Items of work (Earth work, Concrete works, R.C.C works, Reinforce Brick work, plastering, painting, finishing).

Module 6:Abstracting and Billing

Purpose of abstract, preparation of abstract, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction. Billing – maintenance of muster roll,record of bills, vouchers and receipt book

Unit-IV

Module 7: Tendersand Contracts

Tender notice and documents, acceptance of tender, Earnest money, security money, retention money, Contract-contractor: terms and conditions of contract, Agreement, Form of Contract, Responsibility of owner, Architect, Contractor and Engineer.Preparation of pay bill, measurement of work for payment of contractors, different types of payment – first &final, running advance and final payment.

Module 8: Valuation

Purpose of valuation, principles of valuation,Types of property, Depreciation, Sinking fund, Lease hold and free hold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value and year‟s purchase. valuation of a building – cost method, rental – return method.

Course Outcomes:

At the end of the course, students shall be able:

- To understand the methodology of Cost-driven design optimization.
- To get understanding of contract models, contract plans and specifications.
- The students will learn the purpose and importance of valuation

Referenced Books:

1. Dutta BN – Estimating &costing.
2. Chakraborty – Estimate costing &specification in civil engg.
3. Kohli &kohli – A text book on estimating &costing (Civil) with drawings Ambala ramesh Publications.

WASTE WATER TREATMENT			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To learn basics of sewage collection and design of sewers
- To learn the basics of sewage composition and its characteristics
- To have adequate knowledge about various sewage treatment processes and its design
- To provide adequate information on various disposal standards for treated effluents

COURSE CONTENT

Unit-I

Module 1: Introduction

Importance and Necessity of Sanitation, Terms used in sanitation- Sullage, Sewage, Sewer and Sewerage, Sewerage Systems and their Suitability, Dry Weather Flow, Factors Affecting Dry Weather Flow, Flow Variations and their Effects on Design of Sewerage System.

Module 2: Design of Sewers

Types of Sewers and their Hydraulic Design, Material used for Sewer Construction, Joints and Sewer Appurtenances, Layout, Construction and Testing of Sewer Lines, Velocity in Sewers, Storm Water Sewers

Unit-II

Module 3: House Drainage

Principles of House Drainage, Types of Pipes used for Drainage , Classification and Functions of Traps, Sanitary Fitting, System of Plumbing, House Drainage Plan and Ventilation of House Drainage.

Module 4: Wastewater Characteristics

Quality Parameters- Physical, Chemical and Biological Characteristics, Oxygen Demand, Indian Standards for Disposal of Effluents into Inland Surface Sources and on Land, Guidelines for Reuse of Treated Wastewater

Unit-III

Module 5: Primary Sewage Treatment

Objectives, Flow chart of Conventional Treatment Units and their Efficiencies, Preliminary Treatment, Screening and Grit Removal Units, Principle, Types and Design of Primary Sedimentation Tank, Coagulation Aided Sedimentation Tank, Flocculation,

Module 6: Secondary Sewage Treatment

Concept of Organic Matter Removal, Aerobic and Anaerobic Treatment Processes, Activated Sludge Process, Conventional and Extended Aeration Systems, Trickling Filters, Aerated Lagoons, septic tank, Waste Stabilization Ponds, Oxidation Ditches, Up-Flow Anaerobic Sludge Blanket Process.

Unit-IV

Module 7: Sludge Treatment

Objectives, Sludge Digestion, Digestion and Disposal of Primary and Secondary Sludge, Factors Affecting Sludge Digestion, Thickening of Sludge, Anaerobic Digestion of Sludge, Sludge Digestion Tank, Sludge Conditioning and Dewatering, Sludge Drying Bed

Module 8: Sludge Disposal

Standards of Wastewater Disposal, Modes of Disposal of Treated Sludge, Self-Purification of Streams, Oxygen Sag Curve, Sewage Farming, Sodium Hazards, Soil Dispersion System

Course Outcomes

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

- Estimate quantity of sewage and design sewerage system
- Determine the various characteristics of sewage
- Design various sewage treatment units
- Plan reuse of treated effluent and select appropriate disposal option

References:

- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Wastewater Engineering, Collection, Treatment and Disposal: Metcalf and Eddy
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
- Sewage and Sewage Treatment: S.K. Garg.
- Sewage and Sewage Treatment: S.R. Krishansagar.
- Waste Water Engineering: B.C. Punmia.
- Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi

ADVANCED CONCRETE STRUCTURE			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

At the end of this course, the student should be able to impart understanding of designing specialized RCC structures. To prepare the detailed structural drawings for execution purpose

COURSE CONTENT

Unit-I

Module1: Continuous Beams

Basic Assumptions, Moment of inertia, Settlements, Modification of Moments, Maximum Moments and Shear, Design Examples.

Module2: Curved Beams

Analysis for Torsion, Redistribution of Moments for Single and Multi-Span Beams, Design of Circular Beams Supported on Symmetrically Placed Columns, Semi-Circular Beams Supported on Equally Spaced Column , Design examples.

Unit-II

Module 3: Flat Slab

Advantages of Flat Slab, General Design Considerations, Indian Code Recommendations, Approximate Direct Design Method, Equivalent Frame method, Design of Flat Slabs, Openings in Flat Slab

Module 4: Yield Line Theory

Basic Assumptions, Yield Line Patterns and Failure Mechanisms, Ultimate Load on Slab, Design Example.

Unit-III

Module 5: Liquid Retaining Structure

Design Concepts of Liquid Retaining Structures, Design of Tanks Resting on Ground, Underground Tanks and Overhead Service Reservoirs, Staging and Foundation Design.

Module 6: Stair Case

Various Types of Staircases, General Notes on Design of Stair, Design Examples.

Unit-IV

Module 7: Design of Joints

Types of Joints, Joints in Multi-Storied Buildings, Forces Acting on Joints, Design of Joints for Strength, Anchorage Requirement in Joints, Detailing of Reinforcement in Joints.

Module 8: Building Frames

Introduction, Members Stiffness, Torsion in Buildings, Design Loads on Building Frames Including Wind and Earthquake Loads, Earthquake Resistant Design using Software, Introduction to IS: 13920 and Concepts of Ductile Detailing in Building Frames, Design and Detailing for Ductility, Design Examples.

Course Outcomes

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

- Design advanced RCC structures.
- Prepare detailed structural drawings for the designed RCC structures using software.

References:

- “Advanced Reinforced Concrete Design”, P.C. Varghese, Prentice Hall of India Pvt. Ltd.
- “Plain & Reinforced Concrete,”Jain& Jai Krishan (Vol. I & Vol-II), Nem Chand and Bros.
- “Reinforced Concrete Structures”, Syal and Goel, S. Chand & Company Pvt. Ltd.
- “Reinforced Concrete Design”, S.U. Pillai&Devdas Menon, Tata McGraw Hill.
- "Reinforced Concrete Limit State Design"' A.K. Jain, Nem Chand and Bros.

REPAIR & REHABILITATION OF STRUCTURE			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
*-		**Duration of Examination:**	**3 hrs**

Course Objectives:

This course has been designed with an aim to give the students an insight into the subject of concrete repair, its protection and strengthening

COURSE CONTENT

Unit-I

Module 1: Introduction

Overview of Distress, Deterioration in Concrete Structures, Global Scenario of Distressed Structures, Need for Repairs and Upgrading of Structures, Process for Durable Concrete Repair

Module 2: Deterioration of concrete structures

Types of Deterioration - causes & symptoms, mechanism & micro-structure of concrete, Physical and Chemical Deterioration and its factors, Deterioration due to Water Leakage, Fire – detection & mitigation, Deterioration due to Ageing and Inadequate Maintenance, Design & Construction Deficiencies like Overloading.

Unit-II

Module 3: Visual deterioration of structures

Types of Cracks, Causes & Characteristic of Cracking in Various Structural Components, Measurement of Cracks and Interpretation of the Cracking Phenomena

Module 4: Conditional/damage assessment & Evaluation of structures

Structural Assessment- importance, objective, various stages, conditional evaluation of the structure, Damage Assessment Procedure, Preliminary & Detailed Investigation – scope, objectives, methodology & rapid visual inspection of structures , Damage Assessment Allied Tests (Destructive, Semi-Destructive and Non-Destructive), Field & Laboratory Testing Procedures- strength, corrosion activity, performance & Integrity, Durability.

Unit-III

Module 5: Repairs of concrete structures

Repairing Materials- criteria, selection of repair materials, methodology, performance requirements, preparatory stage of repairs, different types of repair materials & their application and repair techniques

Module 6: Retrofitting/Strengthening

Need for Retrofitting, Design Philosophy of Strengthening Structures, Conventional and Advanced Techniques Available for Strengthening, Seismic Retrofit of Concrete Structures- deficiencies in

structure requiring seismic retrofit and its design philosophy, Latest Techniques to Enhance the Seismic Resistance of Structures.

Unit-IV

Module 7: Protection & maintenance of structures

Importance of Protection & Maintenance, Categories of Maintenance, Building Maintenance, Corrosion Mitigation Techniques

Module 8: Structural health monitoring (SHM)

Definition and Motivation for SHM, Basic Components of SHM and its Working Mechanism, SHM as a Tool for Proactive Maintenance of Structures

Course Outcomes

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

- Identify and define all the terms and concepts associated with deterioration of concrete structures.
- Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.
- Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.
- Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

References:

- Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M.Monterio.
- Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
- Concrete Technology by M.L.Gambhir, Tata McGraw-Hill Education, Third Edition
- V. M. Malhotra, Nicholas J. Carino 2004 “Handbook on Nondestructive Testing of Concrete”
- “Repair and Strengthening of Concrete structures” , FIP guide, Thomas Telford, London.
- Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
- Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

PRE-STRESSED CONCRETE			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students.
- Students will be introduced to the design of pre-stressed concrete structures subjected to flexure and shear.
- To make them familiar with design of typical pre-stressed concrete structural elements and to have a knowledge of the codal provisions.

COURSE CONTENT

Unit-I

Module 1: Material Properties and Prestressing Systems

Introduction of Prestressing system- history, types, source, advantages and its limitations, Prestressing Systems and Devices
Materials properties- Constituents of Concrete and their Properties, Stress-Strain Curves for Concrete, Constituents of Prestressing Steel and their Properties, Types of Prestressing Steel, Stress-Strain Curves for Prestressing Steel, Relaxation of Steel, Fatigue, Codal Provisions.

Module 2: Losses in Prestress

Elastic Shortening, Pre-Tensioned & Post-Tensioned - Axial & Bending Members, Losses in Prestress - Friction, Anchorage Slip, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-Dependent Loss, Force Variation Diagram.

Unit-II

Module 3: Analysis and Design for Shear and Torsion

Analysis for Shear- Introduction, Types of Cracks, Components of Shear Resistance, Modes of Failure, Effect of Prestressing Force, Stress in an Uncracked Beam, Design and Detailing Requirement for Shear, Design of Transverse Reinforcement.
Analysis for Torsion-Introduction, Crack Pattern Under Pure Torsion, Components of Resistance for Pure Torsion, Modes of Failure, Effect of Prestressing Force for Torsion, Stresses in an Uncracked Beam, Design and Detailing Requirement for Torsion, Design of Longitudinal Reinforcement and Transverse Reinforcement.

Module 4: Calculations of Deflection and Crack Width

Factors Influencing Deflections, Short Term Deflections of Uncracked Members, Prediction of Long Term Deflections due to Creep and Shrinkage, Check for Serviceability Limit State of Deflection. Deflection due to Gravity Loads and Prestressing Force, Total Deflection, Determination of Moment of Inertia, Calculation of Crack Width, Method of Calculation, Limits of Crack Width.

Unit-III

Module 5: Analysis of Members

Analysis of Members under Axial and Flexural Load- Based on Stress, Force and Load Balancing Concept. Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, Variation of Stress in Steel Condition at Ultimate Limit State, Analysis of Rectangular Sections, Flanged Sections, Partially Pre-Stressed Sections, Un-Bonded Post-Tensioned Beams.

Module 6: Design of Members

Design of Members for Axial Tension, Flexure Type I and Type II, Choice of Sections, Determination of Limiting Zone, Post-Tensioning in Stages, Magnel's Graphical Method, Guyon's Method

Unit-IV

Module 7: Composite and Continuous Beams

Analysis and Design of Composite Beams – Methods of Achieving Continuity in Continuous Beams, Analysis for Secondary Moments, Concordant Cable and Linear Transformation, Calculation of Stresses, Principles of Design.

Module 8: Miscellaneous Structures

Design of Tension and Compression Members, Tanks, Pipes and Poles, Partial prestressing – definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

Course Outcomes

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

- Analyse prestressed concrete members
- Design prestressed concrete members using codal provisions
- Design for shear and torsion of prestressed concrete members
- Design end blocks and provide detailing of reinforcements
- Design composite members and other applications
- Design continuous members

References:

- Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, latest edition
- Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, latest edition
- Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, latest edition
- IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,

ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSES			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
OPEN ELECTIVE-I		**Duration of Examination:**	**3 hrs**

Course Objectives

- To understand and evaluate the impact of any activity (large or small scale) on the surrounding environment
- To introduce about mitigation strategies to protect the environment leading to sustainability
- To understand the intricacies of Life Cycle Analysis and apply basic knowledge for coherent existence

UNIT-I

Module 1
Introduction Definition, Objective with legal aspect of Environmental Impact Assessment (EIA)

Module 2
Methodology for EIA with Base Line Studies, Screening , Scoping and Public Consultation

UNIT-II

Module 3
EIA Analysis Data Collection & Environmental Impact Analysis, preparation of EIA report

Module 4
EIA Mitigation and Audit- Mitigation and Impact Management with various case studies, Environmental Audit

UNIT-III

Module 5
Introduction to Life Cycle Analysis (LCA): History, Definition, Standards and structure of LCA Goal and Scope of LCA: System of a product with boundary, unit process and functional unit

Module 6
Life Cycle Interpretation and Inventory: Limitation of LCA, Identification of significant issues, Evaluation, Reporting, Critical Review. Inventory: Data Collection, Data Bases, Allocation, Validation

UNIT-IV

Module 7
LCA Impact Assessment and Practice: Categories, Classification, Normalization, LCA Management, Life Cycle thinking, Sustainability

Module 8
Introduction: Definition, Objective with legal aspect of Environmental Impact Assessment (EIA)

Course Outcomes

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

- To understand and evaluate the impact of any activity (large or small scale) on the surrounding environment
- To be able to formulate mitigation strategies to protect the environment leading to sustainability
- To be able to understand the intricacies of Life Cycle Analysis and apply basic knowledge for coherent existence

Reference Book

1 Environmental Impact Assessment R. R. Barthwal, New Age International Publication
2 Environmental Impact Assessment Canter McGraw Hill Publications
3 Environmental Impact Assessment: Theory and Practice M. Anji Reddy B. S. Publication
4 Environmental Impact Assessment: Theory and Practice Peter Wathern CRC Press
5 Life Cycle Assessment (LCA): A Guide to Best Practice Walter Klöpffer , Birgit Grahl Wiley Publishers
6 Environmental Life Cycle Assessment Olivier Jolliet, Myriam Saade-Sbeih, Shanna Shaked, Alexandre Jolliet, Pierre Crettaz, CRC Press
7 Life Cycle Student Handbook Mary Ann Curran, Scrivener Publishing, Wiley

EARTHQUAKE ENGINEERING			
Course Code		**External marks:**	**70**
Credits	**3**	**Internal marks:**	**30**
L-T-P	**2-1-0**	**Total marks:**	**100**
OPEN ELECTIVE-II		**Duration of Examination:**	**3 hrs**

Course Objectives

- To provide a coherent development to the students for the courses in sector of earthquake engineering.
- To present the foundations of many basic engineering concepts related earthquake Engineering
- To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
- To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

UNIT-I

Module 1

Seismology: Earth's Interior and Plate Tectonics; Causes of Earthquakes and Seismic Waves; Measurement of Earthquakes and Measurement parameters;
Modification of Earthquake due to the Nature of Soil; Seismic Hazard Analysis

Module 2

Earthquake Inputs: Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Concept of Response Spectrums of Earthquake; Combined D-V-A Spectrum and Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard Spectrums; Predictive Relationships for earthquake parameters;

UNIT-II

Module 3

Dynamics for Earthquake Analysis: Equations of Motion for SDOF and MDOF Systems; Undamped Free Vibration of SDOF and MDOF Systems; Mode Shapes and Frequencies of MDOF System; Rayleigh Damping Matrix; Direct Time Domain Analysis of MDOF System; Direct Frequency Domain Analysis of MDOF System; Modal Analysis in Time and Frequency Domain

Module 4

Response Analysis for Specific Ground Motion: Equations of Motion for Single and Multi- Support Excitations and Solutions; Equations of Motion in State Space and Solutions; Computational Steps for the Solutions using MATLAB; Time History Analysis of 3D Tall Buildings.

UNIT-III

Module 5

Response Spectrum Method of Analysis: Concept of Equivalent Lateral Force for Earthquake; Modal Combination Rules; Response Spectrum Method of Analysis of Structures and Codal Provisions; Response Spectrum Method of Analysis for Torsionally Coupled Systems; Response Spectrum Method of Analysis for Non-Classically Damped Systems;

Module 6

Seismic Soil - Structure Interaction: Fundamentals of Seismic Soil-Structure Interaction; Direct Method of

Analysis of Soil-Structure 6 Interaction using FEM and Use of ABAQUS, Substructuring Method of Analysis of Soil- Structure Interaction Problem

UNIT-IV

Module 7

Inelastic Response of Structures for Earthquake Forces: Fundamental Concepts of Inelastic Response Analysis for Earthquake Forces; Solutions of Incremental Equations of Motions for SDOF Systems; Solutions of Incremental Equations of Motions for MDOF Systems; Push over Analysis; Concepts of Ductility and Inelastic Spectrum;

Module 8

Base isolation for earthquake resistant design of structures: Base isolation concept, isolation systems and their modelling; linear theory of base isolation; stability of elastomeric bearings; codal provisions for seismic isolation, practical applications.

IS Codes Used

1. IS1893: Part I (2016),
2. IS 13920: 2016
3. IS 4326

Course Outcomes

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

- To provide a coherent development to the students for the courses in sector of earthquake engineering.
- To present the foundations of many basic engineering concepts related earthquake Engineering
- To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
- To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

Reference Book Name

1 Earthquake resistant design of Structures Agarwal and Shrikhande PHI

2 Earthquake-resistant design of structures S.K. Duggal, Oxford University Press.

3 Elements of Eathquake Engineering Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra South Asian Publishers

4 Earthquake Resistant Design D. J. Dowrick John Willey & Sons

ENVIRONMENTAL ENGINEERING LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To quantify the water and wastewater pollutant.
- To analyze the physical characteristics of water and wastewater.
- To analyze the chemical characteristics of water and wastewater

List of Experiments

1. Determination of Turbidity of water by using suitable method
2. Determination of pH of given water sample.
3. Determination of Hardness of given water sample.
4. Determination of Residual Chlorine in given sample of water
5. Determination of Total Suspended and Dissolved Solids in given water sample.
6. Determination of Bio –chemical oxygen demand of waste water sample.
7. Determination of chemical oxygen demand of waste water sample.
8. Determination of Conductivity of given water sample.
9. Determination of Chlorides of given water sample
10. Determination of Alkalinity and Acidity of a given water sample.
11. Determination of Dissolved Oxygen of given waste water sample.

Course Outcomes

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

- Quantify the water and wastewater pollutant.
- Estimate the physical characteristics of water and wastewater.
- Analyze the chemical characteristics of water and wastewater

References:

- Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal.
- Clair Sawyer and Perry McCarty and Gene Parkin, “Chemistry for Environmental Engineering and Science”, McGraw-Hill Series in Civil and Environmental Engineering.
- Guide manual: Water & wastewater analysis, Central Pollution Control Board, Govt. of India.
- APHA standard methods for the examination of water and wastewater
- Water supply engineering, S.K. Garg

FOUNDATION ENGINEERING LAB			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To aware the students about hydrometer method.
- To estimate the relative density and maximum dry density of soils.
- To aware the importance of SPT, consolidometer and Triaxial test for selection of foundation.
- To estimate shear strength parameters of soil by Triaxial shear test.
- To estimate consolidation parameters of clayey soil.
- To aware about the importance of sampling and aware about the significance of plate load test.

List of Experiments

1. To determine grain size analysis using Hydrometer method.
2. To determine relative density of granular Soils.
3. To determine shrinkage limit of fine grained soil
4. To determine shear strength properties for consolidated drained conditions using Triaxial test.
5. To determine shear strength properties for consolidated undrained condition using Triaxial test.
6. To determine consolidation parameters using consolidometer.
7. To determine bearing capacity parameters using Standard Penetration Test.
8. Demonstration of Undisturbed Sampling.
9. Demonstration of cone penetration test.
10. To study of Model Plate Load Test.

Course outcomes

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

- Classify soil using hydrometer method and estimate relative density of soils.
- To perform Triaxial test under different conditions.
- To understand the procedure and calculations of SPT and prepare soil investigation report.
- Carry out interpolation tests to determine consolidation and estimate shear strength parameters.
- To obtain soil sampling by suitable method.
- Determine essential parameters of plate load test.

References:

- Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd. Publishers- N.Delhi, latest edition
- P. Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, latest edition

Course code					
Category	**Professional Elective Course**				
Course title	**Estimation, Costing and Valuation Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 6th**
	0	**0**	**2**	**1**	
External marks:	50 Marks				
Internal marks:	50 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

The subject aims to provide the student with:

1. An introduction to quantity surveying
2. The capability to know analysis and schedule of rates
3. The ability to know specification of materials
4. An understanding about specification of works
5. The introduction to valuation

COURSE CONTENT

1. Prepare the list of items to be executed with units for detailed estimate of a given structure from the given drawing.
2. Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments required to construct the given structure.
3. Study of items with specification given in the HSR (for any ten items).
4. Recording in Measurement Book (MB) for any four items.
5. Prepare bill of quantities of given item from actual measurements (any four items).
6. Calculate the reinforcement quantities from the given set of drawings for a room size of 3m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab).
7. Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).
8. Use the relevant software to prepare detailed estimate of a residential building.

COMPUTER-AIDED CIVIL ENGINEERING DESIGN			
Course Code		**External marks:**	**50**
Credits	**1**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Objectives

- To develop, analyze and design the various structural members in the fields of Civil Engineering using AutoCAD, STAAD Pro.
- To understand the design of structures using IS codes
- To provide the knowledge about methods of analysis and design of RCC and steel frames.

List of Experiments

1. To study the commands used in plans of buildings using AutoCAD.
2. To prepare 2 D architectural drawing
3. To prepare 3 D architectural drawing
4. To prepare the drawing of grillage foundation using Auto cad.
5. To study the commands used in modelling and design of structure using STAAD-Pro.
6. Analysis of 2D Frames.
7. Analysis of 3D Frames.
8. Design of 2D RCC frames and 2D Steel frames according to IS codes.
9. Design of 3D RCC frames and 3D Steel Frames according to IS codes.
10. Design of beams.
11. Analysis of truss frames.

Course Outcomes

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

- To understand and learn the various codal provisions.
- Ability to prepare 2D and 3 D plans of buildings.
- To efficiently analyze and design of beams, truss frames and staircase.
- To perform various methods of analysis of 2D, 3D frames.

References:

- STAAD Pro Manual.
- IS 456, IS 1893, IS 800, IS 870.

SEMINAR-I					
Category	Seminar				
Course code					
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 6th**
	0	**0**	**2**	**1**	
External marks:	50 Marks				
Internal marks:	-				
Total	50 Marks				
Duration of Exam	3 Hours				

COURSE CONTENT

During the semester, the students have to:

- Select a topic relevant to analysis, design, implementation, experimental and managementof a civil engineering system.
- Undertake a critical review of the literature on the chosen topic.
- Prepare and present a technical report.
- Preparing a review paper forpresentation/Publication in national conference/ Internationalconference/ Journals, if possible.

Gurugram University

Scheme of Studies and Examination

B.Tech. (Civil Engineering) – 7th Semester

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam
				L	T	P			Internal Assessme	Theory	Practica l	Tota l	
1	**Professional Core course**		**Construction planning and management**	**3**	**0**	**0**	**3**	**3**	**30**	**70**	**-**	**100**	**3**
2	**Professional Core course**		**Advanced steel structure**	**3**	**0**	**0**	**3**	**3**	**30**	**70**	**-**	**100**	**3**
3	**Professional Elective course**		**Professional Elective III (Refer List-I)**	**3**	**0**	**0**	**3**	**3**	**30**	**70**	**-**	**100**	**3**
4	**Professional Elective course**		**Professional Elective IV (Refer List-II)**	**3**	**0**	**0**	**3**	**3**	**30**	**70**	**-**	**100**	**3**
5	**Open Elective course**		**Open Elective II**	**3**	**0**	**0**	**3**	**3**	**30**	**70**	**-**	**100**	**3**

6	**Open Elective course**		**Open Elective III**	**3**	**0**	**0**	**3**	**3**	**30**	**70**	**-**	**100**	**3**
7	**Professional Core course**		**Irrigation Drawing LAB**	**0**	**0**	**2**	**2**	**1**	**50**	**-**	**50**	**100**	**3**
8	**Mandatory courses (non-credit)**		**Constitution of India**	**3**	**0**	**0**	**3**	**0**			**GRADE**		**Refer Note 1***
9	**Practical Training**		**Practical training –II Viva**					**1**	**50**		**50**	**100**	**3**
10	**Project**		**Industrial Training Synopsis/ Project work-I**	**0**	**0**	**6**	**4**	**4**	**50**		**50**	**100**	**3**
		TOTAL						**24**				**900**	

*__Note: 1.__ Constitution of India is a mandatory non-credit course in which the students will be awarded grades A, B, C, F as per their performance. A: Excellent, B: Good, C: Satisfactory, F: Not Satisfactory. A student who is awarded „F" grade is required to repeat course.

ELECTIVE- II (PEC) –LIST I

S.no	Name of course	Code	L-T-P	Credits
1.	Disaster Management and Mitigation		3-0-0	3
2.	Environmental Management		3-0-0	3
3.	Hydro Power Engineering		3-0-0	3

ELECTIVE- III(PEC) –LIST II

S.no	Name of course	Code	L-T-P	Credits
1.	Ground water engineering		3-0-0	3
2.	Watershed Management		3-0-0	3
3.	River Engineering		3-0-0	3

OPEN ELECTIVE -II (OEC) – LIST III

S.no	Code	Name of course	L-T-P	Credits
1.		Electrical Power Generation	3-0-0	3
2.		Solid and Hazardous waste management	3-0-0	3
3.		Electronic Principles	3-0-0	3

OPEN ELECTIVE- III (OEC) –LIST IV

S.no	Name of course	Code	L-T-P	Credits
1.	Railway and Airport Engineering		3-0-0	3
2.	Traffic Engineering		3-0-0	3
3.	Bridge Engineering		3-0-0	3

Gurugram University

Scheme of Studies and Examination

B.Tech. (Civil Engineering)– 8th Semester

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	Theory	Practical	Total	
1	Seminar		Seminar-II	0	0	2	2	1	50	-	50	100	-
2	MOOCs Course		MOOCs Course	-	-	-	-	2	50		50	100	
3	Industrial Training-II/ Project		Industrial Training-II/ Project-II	0	0	8	8	6	150		150	300	3
		TOTAL						9				500	

Course code					
Category	Professional Core course				
Course title	**Construction Planning and Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

At the end of this course, the students should be able:

- To learn the Basic knowledge of construction management, bar/milestone chart,
- To get knowledge of PERT and CPM, CPM (Cost Model).
- To know the construction equipment‟s and selection of construction equipment‟s.

Note:
Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit -I

Module 1: Introduction

Project Management, Project Planning, Scheduling, Controlling, Methods of Planning and Programming, Bar Carts and Milestone Charts and Network Methods/Techniques.

Module 2: PERT (Programme evolution and review technique)

Time Estimates, Frequency Distribution, Mean, Variance and Standard Deviation, Probability Distribution, Beta Distribution, Expected Time, Time Computation, Network Analysis and Critical Path.

Unit -II

Module3: CPM (Critical path method)

CPM Networks, Earliest Event Time, Latest Allowable Occurrence Time, Earliest Start time, Earliest Finish Time, Latest Start Time, Latest Finish Time, Float, Critical Activity and Critical Path.

Module 4: CPM (Cost model)

Project Cost, Direct Project Cost, Indirect Project Cost, Total Project Cost and Optimum Duration, Slope of Direct Cost Curve and Steps in Time Cost Optimization.

Unit -III

Module 5: Construction Equipment

Classification of Major Equipment, Earth Excavating Equipment, Earth Cutting and Hauling Equipment, Earth Compacting and Grading Equipment, Concreting Plant and Equipment.

Module 6: Selection of construction equipment

Task Considerations, Cost Considerations, Equipment Engineering Considerations and Equipment Acquisition Options.

Unit -IV

Module 7: CPM (Updating)

Updating Process, Data Required for Updating, Steps in the Process of Updating, When to Update. PPT/BOT Techniques and its variance.

Module8: Resources Allocation

Resource‟s usage profiles, Histograms, Resources Smoothing, Resources Levelling and Risk associated in construction project Management.

Course Outcomes:

After completing this course, students should be able:

- Proficient enough to apply the concepts of the construction project management with time and cost estimates.
- Different Cost of the Projects with total cost of the Project and selection of construction equipment‟s

Recommended Book:

1. "Project Planning and Control with CPM/PERT", Dr. B.C. Punmia, Laxmi Publication New Delhi.
2. Construction Project Management", K KCHitkara,Tata McGraw Hills.
3. "Construction Equipments", by Mahesh Verma.
4. Construction Project Management an Integrated Approach", Peter Femings Yes Dec Publishing Pvt. Ltd. Chennai 2011

Course code					
Category	Professional Core course				
Course title	**Advanced Steel Structure**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives

- To impart practical knowledge of advanced steel structures and their application.
- To teach the students advance level design of steel structures.
- To make the students familiar with the relevant IS codes to be used in construction industries.
- To teach the students modern design methods such as design of light gauge steel.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Eccentric and Moment Connections

Beams-Column Connections, Connections Subjected to Eccentric Shear, Bolted Framed Connections, Bolted Seat Connections, Bolted Bracket Connections. Bolted Moment Connections, Welded Framed Connections, Welded Bracket Connections and Moment Resistant Connections.

Module 2: Cold Formed Sections

Brief description of various types of cold-formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, Design of compression and bending elements.

Unit-II

Module 3: Industrial Buildings

Loads, general arrangement and stability, design considerations, design of Purlins, design of roof trusses, industrial building frames, bracings and stepped columns.

Module 4: Towers

Transmission line towers, Microwave towers, Design loads, classification, Design and specification.

Unit-III

Module 5: Design of Water Tanks

Types of water tank, permissible stresses, design of circular, rectangular and pressed steel tanks including staging.

Module 6: Design of Steel Stacks

Types of steel stack, various loads consideration of steel stacks, Design of steel stacks including foundation.

Unit-IV

Module 7: Plate Girder

Elements of plate girder, Design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices, Curtailment of flange plates, Design beam to column connections: Introduction, design of framed and seat connection.

Course Outcomes

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

- Apply the IS code of practice for the advanced design of steel structural elements.
- Design complicated structures like plate girder, Industrial structures and tanks.
- Design light gauge structures too.
- Use relevant IS code for above structural design.
- Students will be able to understand the advanced design of steel structure with practical application.

References:

1. Design of steel structures, A.S.Arya&J.L.Ajmani, Nemchand& Bros., Roorkee.
2. Design of steel structures (LSM), N,.Subramanian, Oxford Publication.
3. Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
4. Design of steel structures, S.M.A.Kazmi&S.K.Jindal, Prentice Hall, New Delhi.
5. Design of steel structures, S.K.Duggal, TMH Pub, New Delhi.

Course code					
Category	Professional Core course				
Course title	**Design of Hydraulic Structures**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

- To understand design processes of hydraulic structures
- To further develop understanding on cross drainage works.
- To further develop understanding on design considerations of Dams
- To develop understanding on seepage conditions.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit- I

Module 1: River training works

Objectives and classifications of river training works, Methods of river training Bends and Meandering rivers, marginal embankments, spurs, cutoffs, bank pitching and launching apron. Design consideration of guide banks.

Module 2: Flood Routing

Flood routing categorization and methods,Basic equations in flood routing, Concept of Hydraulic routing, Hydrologic method of flood routing.

Unit II

Module 3: Design of Cross Drainage Works

Need of cross drainage works and their suitability, Canal regulation structures and design of cross drainage works, canal drops, operation and maintenance of canals.

Module 4: Hydraulic structure

Blight creep and Khosla theory, stream lines, critical exit gradient, need of weirs and barrage, Factors controlling the design of weirs and barrages and its components. Design of weirs.

Unit III

Module 5: Design of Spillways

Need of spillway, Design consideration of main spillway, Design of ogee spillway, crest of spillway and stilling basins.

Module 6: Design of Fall

Location and Necessity of falls, componentsof Sarda type fall and itsdesign, characteristics of sloping glacis falls.

Unit-IV

Module7:Dams

Planning and investigations of reservoir and dam sites, Choice of dams, preparation and protection of foundation and abutments. Dam construction problems, Forces acting on gravitydams, modes of failure and design criteria for structural stability of gravity dams, seepage line in a homogenous earth dam, equipotential lines, path lines, kozeny parabola.

Course Outcomes:

After completing this course, students should be able:
1. To identify the design lines of hydraulic structures
2. To being able to read charts for various designing purposes

Reference Books:

- Garg, S. K., "Irrigation Water Power & Water Resources Engg." Standard Publishers & Distributors, Delhi, latest edition
- Modi, P.N. "Irrigation, Water Resources and Water Power Engg." Standard Book House, N. Delhi latest edition
- Arora, K R "Irrigation Water Power & Water Resources Engg." Standard Publishers & Distributors, Delhi, latest edition
- Sharma, S.K., Principles and Practice of Irrigation Engineering, S.Chand& Co., latest edition
- Punmia, B.C., "Irrigation and Water Power Engg." Standard Publishing.

Course code					
Category	Professional Elective course				
Course title	**Disaster Management and Mitigation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

- To provide basic conceptual understanding of disasters and its relationships with development.
- Provide an understanding of the social nature of natural hazards and disasters
- Increase awareness of hazards and disasters around the world and the unequal social consequences stemming from disaster events.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Introduction: Terminology,Global and Indian scenario, role of engineer, importance of study in human life, long term effects of disaster. Geological Mass Movement and land disasters, Atmospheric disasters, Disaster Mitigation

Unit-II

Nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion, Man-made Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit -III

Damage profile analysis- Uttarkashi/Bhuj/Latur earthquakes, Kerala floods, cyclone Fani and Amphan, Bihar floods, Covid 19, Forest Related disasters, Mining disasters, Atmospheric disasters.

Unit IV

Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Use of Internet and software for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.

Course Outcomes:

After completing this course, students should be able:

- To know natural as well as manmade disaster and their extent and possible effects on the economy.
- To Plan national importance structures based upon the previous history.
- To acquaint with government policies, acts and various organizational structures associated with an emergency.
- To know the simple dos and donts in such extreme events and act accordingly.

Reference Books:

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1309007367, ISBN-13: 978-1309007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

Course code					
Category	Professional Elective course				
Course title	**Environmental Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:
The course should enable the students to:

- Global environmental issues and their Management.
- Green technologies for cleaner production.
- Major principles and steps required in environmental impact assessment.
- Causes of land degradation, biodiversity loss and methods of their management.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

UNIT-I

Global Environmental Problems: Global warming, green-house effect, ozone depletion, acid rain, oil pollution, radiation hazard and control, global climate change. Main clauses and basic steps for Environmental Management System certification. Environmental Laws/Acts.

UNIT-II

Cleaner Production Technologies Need and benefits, cleaner production techniques and options, zero impact manufacturing initiatives CDM and carbon credits/case studies.

UNIT-III

Environment Impact Assessment: Importance for environment management, constituents of environment impact assessment, project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

UNIT-IV

Degradation of Land Resources : Deforestation: Forest land, deforestation and its effects onland use and Environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation problems, erosion, salinization, water logging, land use management & planning.

Course Outcomes:

- An ability to understand the major global environmental issues, their causes, sources, management and laws/polices related to these technologies involved in eco-friendly production and mechanism of carbon credits.
- An ability to understand the major principles of environmental impact assessment.
- An ability to understand the implications of current rules and regulations in relation to environmental impact assessment.
- An ability to understand the causes, implications and management of local environmental issues like land degradation, wasteland and water logging.

Recommended Books:

1. Peavy, Rowe, „Techobanoglous, Environmental Engg.“ Tata McGraw Hill.
2. Mackenzie L. Davis, „Environmental Engg.“ Tata McGraw Hill.
3. Baljeet S. Kapoor; „Environmental Engg. An overview“, Khanna Publishers.
4. Glbert H. Masters, „Environmental Engineering and Science“, Prentice Hall of India Pvt. Ltd.
5. G.N. Panday, G.C. Carney Environmental Engineering, Tata McGraw Hill.
6. P.D. Sharma, Ecology and Environment, Rastogi Publications.

Course code					
Category	Professional Elective course				
Course title	**Hydro Power Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives

The objective of this Course is

- To introduce energy systems and renewable energy resources with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.
- To explore society‟s present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources.
- To introduce basicsof turbine and powerhouse.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction to Energy Sources

Sources of energy, Status of hydropower, thermal vs hydropower, advantages of hydropower, Energy contribution of hydropower in power system.

Module 2: Basics of Hydropower

Electrical load on hydropower, load curves, load factor, capacity factors, utility factors anddiversityfactors, load on hydropower stations, load curves, load duration curves, firm power, secondary power, Prediction of loads.

Unit-II

Module 3: Types of Hydropower Stations

Elements of Hydro power, classification of hydropower stations, run of river plants, General layout of run of river plants, Valley dam plants, storage and pondage.

Module 4: Basic features of Pump Storage Plants

Advantages of pump storage plants, types of pump storage plants, efficiency of pump storage plants, Reversible Turbines.

Unit-III

Module 5: Intakes

Intake structures: functions and their types, Components of intakes: forebay, trash racks, gates and valves, Force required to operate Gates.

Module 6: Water Conveyance System

Classifications of Penstocks, Design criteria of penstocks, anchor blocks, typesof valves, water hammer effects, instantaneous closure of power canal, Surge tank and its classification.

Unit-IV

Module 7: Turbines

Type of turbines, criteria for selection, specific speed of turbines, unit power, unit discharge, cavitation in turbines, Design of the draft tube.

Module 8: Power Houses

General layout and arrangements of hydro-power units, number and size of units, substructure, spacing of units, super-structure, underground power stations.

Course Outcomes:

At the end of the course, students will be able to learn

- Different energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.
- Explore society‟s present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources.
- Basics of turbine and powerhouse.

References:

- Water power Engineering by Dandekar and Sharma.
- Hydropower structures Volume III-By R S Varshney.
- Hydro Power Engineering by Dr Darde P N, Vayu Education,Delhi.
- Hydro-Electric Engineering Practice Vol.I, II& III Brown J.G.
- Water Power Engineering, Borrows, H.K.
- Water Power Development, Vol.I& II, Mosonyi,E.
- Water Power Engineering, M.M.Deshmukh.

Course code					
Category	Professional elective course				
Course title	**Ground Water Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers.
2. To understand the techniques of development and management of groundwater.
3. Some real- world example problems are also been incorporated to give an idea about the complexities and challenges encountered during the management of groundwater processes.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Hydrogeological Parameters

Ground water exploration and methods of investigations, Characteristics of ground water, forms of subsurface water, Global distribution of water, groundwater column, Ground water table fluctuation and its interpretations, Groundwater development and Potential in India, Groundwater balance.

Module 2: Groundwater Management

Database for Groundwater Management, Groundwater budgets, Water bearing formations of Rock and their properties, safe yield, Type of aquifers, Darcy's Law, Aquifer properties.

Unit-II

Module 3: Well Hydraulics

Objectives of Groundwater hydraulics, Governing equation for flow through porous medium - Steady flow, Dupuit assumptions, equilibrium equations for confined and unconfined aquifers, Heim‟s equilibrium formula.

Module 4: Unsteady State Flow

Governing equation for flow through porous medium - unsteady state flow – Jacob method – Chow method- Recovery test-pumping tests, Conjunctive use – Collector well and Infiltration gallery, well loss coefficient, Partially penetrating wells - Wells in a leaky confined aquifer, interference of wells.

Unit-III

Module 5: Water Withdrawals and Uses – water for energy production, water for agriculture, water for hydroelectric generation; flood control, analysis of surface water supply, open wells in unconsolidated formations, sanitary protection of open wells.

Module 6: Tube well

Tube wells types, site selection, components, strains and its types, design of tube wells in different aquifers, drilling operation and its different methods, Construction and working of tube wells, verticality and alignment, development of tube wells, gravel packing, well sickness, corrosion and failure of tube wells, silting of tube well, optimum capacity of well.

Unit-IV

Module 7:Groundwater Conservation

Reclaimed wastewater recharge, Soil aquifer treatment, Aquifer Storage and Recovery, Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use, Contamination source inventory and remediation schemes.

Module 8: Artificial Recharge

Artificial recharge of ground water, recharge techniques induced infiltration, water spreading, flooding, basins, ditching, modification of natural channels, irrigation, recharge pits, shafts, Hydraulics of recharge wells.

Course Outcomes: The students will be able to**.**

- Understand aquifer properties and its dynamics.
- Get an exposure towards well design and practical problems of groundwater aquifers.
- To understand the importance of artificial recharge and groundwater quality concepts.
- Gain knowledge on conservation of groundwater.
- Understand different tube wells and their components.

Recommended Books:

- Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
- Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.
- S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993.
- Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.

Course code					
Category	Professional Elective course				
Course title	**Watershed Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

- To understand different watershed behaviour.
- To be able to interpret runoff data and quantify erosion by using various modelling methods.
- To understand land use classification and impact of land use changes on hydrological cycle parameters.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Introduction and Basic Concepts: Concept of watershed, need for watershed management, different stakeholders and their relative importance, watershed management policies and decision making. Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; Principles of soil erosion- causes and types of soil erosion,estimation of soil erosion from small watersheds. Control of soil erosion, methods of soil conservation-structural and non-structural measures.

Unit-II

Integrated Watershed Management: Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system. Watershed Modeling: Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-runoff process, subsurface flows and groundwater flow.

Unit-III

Social Aspects of Watershed Management: Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies. Use of modern techniques in watershed management: Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management.

Unit-IV

Storm Water, Flood and Drought Management: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage. Drought Management: Drought assessment and classification, drought analysis techniques, drought mitigation planning.

Course Outcomes:

At the end of the course, students shall be able:

1. To identify causes of soil erosion.
2. Plan and design of soil conservation measures in a watershed.
3. Plan and design water harvesting and groundwater recharge structures.
4. Plan measures for reclamation of saline soils.

Reference:

1. Murthy, V.V.N. and M.K. Jha Land and Water Management, Kalyani Publishers, 2015
2. Watershed Management by Madan Mohan Das and M.D. Saikia, Prentice Hall of India, 2013
3. Watershed Management Muthy, J. V. S., , New Age International Publishers, 1998

Course code					
Category	Professional Elective course				
Course title	**River Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	**0**	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

- Acquaint the students to basic concepts of rivers and their significance.
- To stimulate the students to think systematically and objectively about contemporary river problems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Introduction: classification of streams, sediment transport and budgets, River morphology and various classification schemes. River basins; erosion from river catchments and its transportation by rivers; Regimes of Flow: Ripple and dune regime, anti-dune regime, importance of regimes of flow, Bed Load Transport:Bedload equations.

Unit-II

Behaviour of Rivers: River channel patterns, Straight River channels, causes, characteristicsand shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Delta formation and control.

Unit-III

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics ofstream restoration. Bio-engineering techniques, Classification review, Natural channel design analysis, Time series, Analysisof flow, Sediment and channel geometry data.

Unit IV

Rivertraining and protection works: Classification of River training, Types of training works, Protection for bridges with reduced waterway, Design of guide bank, Embankment andspurs, other river/flood protection work.

Course Outcomes:

After completing this course, students should be able:

- To realize the significance of river engineering in today life.
- To understand the processes involved in Bio-engineering Techniques.
- To appreciate the role of River Training and Protection Works

Recommended Books:

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson.
4. Principles of River Engineering by (The non-tidel alluvial) PH Jameen.

Course code					
Category	Open Elective Courses (OEC) (Semester-VII) List-III				
Course title	**QUALITY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To understand the concept of QualityEngineering which emphasizes growth, creativity, and analytical thinking.				
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Section A

Basic Concepts of Quality: Definitions of Quality and its importance in industry, Quality function, Quality Characteristics, Quality process, Quality Traits, Applications of Quality Concept, Introduction to quality control, Computer aided quality control, Total quality control(TQC) and its implementation, Elements of TQC, Quality Circle, Objectives of quality circle, Role of management in quality circle, Quality in service organizations, characteristics of a service organization, Important service dimensions, Design of service quality.

Section B

Basic Statistical Concepts: The Concept of variation, Distinction between variables and attributes data, The frequency distribution, graphical representation of frequency distribution, Quantitative description of distribution, the normal curve, concept of probability, laws of probability, probability distributions, hyper geometric distribution, binomial distribution, The Poisson distribution.

Section C

Quality systems: Quality systems, Need for quality System, Need for standardization, History of ISO:9000 series standards and its features, steps to registration, India and ISO:9000, Automated inspection systems technologies, Different forms of Inspection, Industrial inspection.

Section D

Total Quality Management: IntroductionTQM, Concepts, Characteristics of TQM, Relevance of TQM, Approaches to TQM Implementation, TQM philosophies, Taguchi Philosphy, JIT, Kaizen, Six Sigma approach, 5-S approach

Course Outcomes: Upon completion of this course the student will be able to:

CO1 - Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability

CO2 - Use control charts to analyze for improving the process quality.

CO3 - Describe different sampling plans

CO4 - Acquire basic knowledge of total quality management

CO5 - Understand the modern quality management techniques

Text Books:

1. Quality planning and Analysis, Juran and Gryna, TMH, New Delhi
2. Quality Management, Kanishka Bed, Oxford University Press, New Delhi
3. Introduction to SQC, Montgomery DC, 3e, Wiley, New Delhi
4. Fundamentals of quality control and improvement, A Mitra, Mcmillan pub. Company, NY

Reference Books:

1. Fundamentals of Applied Statistics, Gupta and Kapoor, Sultan Chand and Sons, New Delhi.

Course code					
Category	Open elective course				
Course title	**Solid and Hazardous Waste Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

- To understand the sources of solid and hazardous wastes.
- To understand methods of solid and hazardous waste disposal.
- To gain knowledge of E-Waste management.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module:1 Sources and Composition of Municipal Solid Waste

Introduction, Sources and Types of solid waste, Composition of Solid Waste and its Determination, Properties of Municipal Solid Waste

Module:2 Solid Waste Generation and Collection

Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

Unit-II

Module:3 Handling, Separation and Processing of Solid Waste

Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices at site; Waste handling, separation and processing of solid waste at residence, Commercial and industrial site.

Module:4 Disposal of Municipal Solid Waste

Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design, landfill operation, use of old landfill.

Unit-III

Module:5 Hazardous Waste Management

Identification and classification of hazardous solid waste. The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment.

Module:6 Biological Treatment of Solid and Hazardous Waste

Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; oxidative and reductive processes.

Unit-IV

Module:7 Radioactive Waste Management

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

Module:8 Electronic waste management

E waste- Definition, composition; environmental and human health issues, recovery of metals from E waste, E waste management,

Course Outcomes:

After completing this course, students should be able:

- To realize the significance of solid and hazardous waste management in today life
- To understand the processes involved in solid and hazardous waste management
- To comprehend the techniques for various waste management
- To appreciate the role of common/integrated waste management plants

Suggested Books:

1. Basics of Solid and Hazardous Waste Mgmt. Tech. by KantiL.Shah 1999, Prentice Hall.

2. Solid And Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

3. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.

Course code					
Category	**Open Elective Course**				
Course title	**Electronic Principles**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note : Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. Study the basic principles of electronic systems.
2. Understand working of Digital electronics.
3. Understand the working of Display devices.

UNIT 1 SEMICONDUCTOR DIODE: P-N junction and its V-I Characteristics, P-N junction as a rectifier, Switching characteristics of Diode. Diode as a circuit element, the load-line concept, half -wave and full wave rectifiers, clipping circuits, clamping circuits, filter circuits, peak to peak detector and voltage multiplier circuits.

UNIT 2 ELECTRONIC DEVICES: LED, Zener Diode as voltage regulator, BJT, UJT, MOSFET, Thyristor, DIAC, TRIAC.

UNIT 3 DISPLAY DEVICES: LED, LCD, Seven Segment, Sixteen Segment.

UNIT 4 DIGITAL ELECTRONICS: Binary, Octal and Hexadecimal number system and conversions, Boolean Algebra, Truth tables of logic gates (AND, OR, NOT) NAND, NOR as universal gates, Difference between combinational circuits and sequential circuits, Introduction to flipflops (S-R & J-K).

TEXT BOOK: 1.Integrated Electronics: Millman &Halkias ;McGrawHill
2.Modren Digital Electronics: R.P. Jain; McGraw-Hill

REFERENCE BOOKS:1.Electronics Principles: Malvino ;McGrawHill
2.Electronics Circuits: Donald L. Schilling & Charles Belove;McGrawHill
3.Electronics Devices & Circuits: Boylestad&Nashelsky ; Pearson.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand the working of electronic components.
2. Understand the Digital System and various displays.

Course code					
Category	Professional elective course				
Course title	**Railway and Airport Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

At the end of this course, the student should be able:

- To impart understanding about the various types of railways,
- To classify different tunnels and its techniques of excavation.
- To understand airport engineering.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module–1: Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, function and types of rails, rail sections, defects in rails, creep of rails, rail joints and welding of rails, sleepers – types, spacing and density, rail fixtures and fastenings, ballast, sub-grade and embankment.

Module–2: Geometric design of railway track: gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves.

Unit-II

Module– 3: Railway traction and track resistance, stresses in railway track, rails, sleepers, ballast. Points and crossings-turnouts, switches, crossings. Track junctions- types, splits, diamond, gauntlet, scissorcrossovers.

Module– 4: Railway stations: Requirements, classifications, platforms, loops, sidings. Railway

yards – types, required equipments in yards. Signaling and control system – objectives, classification, Interlocking of signals and points.

Unit-III

Module–5: Railway track - construction, drainage, maintenance. Recent developments in railways – high speed trains, modernization in track for high speed, Metro rails, Monorail, automation in operation and control, Safety in railways – accidents and remedial measures.

Module–6: Tunnels- Site selection, Classification, Size and shape of a tunnels, Methods and techniques of underground excavation in tunnels, Alignment of a Tunnel, Mucking, Lighting and Ventilation in tunnel, Drainage of tunnels, Safety in tunnel construction.

Unit-IV

Module–7: Airport Classification on the basic of community size, types of services, Aircraft Characterizes, selection of site and factors affecting site selection of airport, Airport layout plan.

Module–8: Geometric design of Runways, Airport capacity, factors effecting runway capacity, Airport markings and lightings.

Course Outcomes:

After completing this course, students should be able:

- To realize the significance of Railways and tunnels in today life.
- To understand the processes involved in railway and tunnel maintenance.
- To realize the significance of Airports in today life.
- To understand the processes involved design of airports

Recommended Books:

1. Highway Engineering – S.K.Khanna&C.J.Justo, Nemchand& Bros., 7th Edition (2000).
2. Principles and Practices of Highway Engineering – Dr.L.R.Kadiyali&Dr.N.B.Lal – Khanna publishers – (2003).
3. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
4. Airport Engineering Planning and design, Subhash C. Saxena.

Course code					
Category	Professional elective course				
Course title	**Traffic Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

- Acquaint the students to basic concepts of Traffic and their significance.
- To stimulate the students to think systematically and objectively about various traffic problems

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Traffic Characteristics : Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

TrafficStudies: Traffic volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys.

Unit-II

Traffic Accidents : Accident surveys. Causes of road accidents and preventive measures, Capacity and Level of Service: Fundamental diagram of traffic flow, Relationship between speed, volume and density, Level of service, PCU, Design service volume, Capacity of non-urban roads. IRC recommendations, Brief review of capacity of urban roads.

Unit-III

Traffic Control Devices : Signs, Signals, markings and islands. Types of signs, Types of signals, Design of Signal, Intersections at grade and grade separated intersections. Types of grades separatedintersections, Parkingsurveys: On street parking, off street parking.

Unit-IV

Road safety audit, RSA team, RSA Report, Elements of RSA, Detrimental effects of traffic. Vehicular air pollution and Situation in India, Motor vehicle act, Vehicular emission norms in India and abroad. Alternate fuels. Factors affecting fuel consumption.

Course Outcomes:

After completing this course, students should be able:

- To realize the significance of traffic engineering in today life.
- To understand the processes involved in traffic studies.
- To appreciate the role of Traffic regulations.

Recommended Books:

- Principles of Transportation Engineering by Chakroborty& Das, Prentice Hall, India.
- Highway Engg by S.K.Khanna& C.E.G. Justo, Nem Chand Bros., Roorkee.
- Traffic Engg and Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-HillPublishingCo. Ltd. N.Delhi.

Course code					
Category	Professional elective course				
Course title	**Bridge Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**1**	0	**3**	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives

- To understand the load-carrying capacity of various types of bridges, upon learning the structural responses to different kinds of loads.
- To design short and medium span bridges, with confidence using existing codes of practice, taking into account of the structural strength, service life and durability.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Component and classification of bridge, Historical bridges (in India and overseas), short history of bridge development, importance of bridge Investigation: Need for investigations, selection of bridge site, preliminary data to be collected, design discharge and its determination, linear waterway, economical span, vertical clearance above HFL, scour depth, choice of bridge type. Site selection-Soil Exploration for site importance of Hydraulic factors in Bridge Design.

Module 2: Planning and layout of bridges

Hydraulic design - Geological and geotechnical considerations, Standard Specifications: For road bridges, I.R.C. loadings and code provisions for standard specifications. Railway bridges, Railway bridge code. General arrangement drawing. Design aids using computer software systems.

Unit-II

Module 3:Concrete bridges

Bridge deck and approach slabs, Slab design methods, Design of bridge deck systems, Slab-beam systems (Guyon-Massonet and Hendry Jaeger methods), Box girder systems- analysis, design and detailing.

Module 4: Steel and composite bridges

Advantages and disadvantages, Orthotropic decks, Box girders, Composite steel-concrete bridges, Truss bridges- analysis and design.

Unit-III

Module 5: Sub-structure

Piers, Columns and towers,Caissons, Abutments and retaining walls, Analysis and design - Shallow and deep foundations

Module 6: Bridge appurtenances

Expansion joints, Design of joints, Types and functions of bearings, Design of elastomeric bearings, Railings, Drainage system and lighting.

Unit-IV

Module 7: Long span bridges

Design principles of continuous box girders, Curved and skew bridges, Cable stayed and suspension bridges, Seismic resistant design, Seismic isolation and damping devices.

Module 8: Construction techniques

Cast in-situ, Prefabricated, Incremental launching, Free cantilever construction, Inspection, Maintenance and rehabilitation, Current design and construction practices.

Course Outcomes:

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

- Understand the fundamentals and codes of practice of bridge design.
- Design the bridge deck and box girder systems using appropriate method.
- Devise the steel truss and composite steel-concrete bridges.
- Propose the sub-structure components such as pier, abutments and bridge bearings.
- Design the various types of long span bridges, curved and skew bridges.

Referenced Books:

1. Krishna and Raju “Bridge Engineering”.
2. Wai-Fah Chen Lian Duan, "Bridge Engineering Handbook", CRC Press, USA, 2000.
3. R.M. Barker and J.A. Puckett, “Design of Highway Bridges”, John Wiley & Sons, New York, 1997.
4. P.P. Xanthakos, "Theory and Design of Bridges", John Wiley & Sons, New York, 1994.
5. D.J. Victor, “Essentials of Bridge Engineering,” Oxford & IBH Publishing, New Delhi, 2001.

Course code					
Category	**Mandatory courses (non-credit)**				
Course title	**Constitution of India**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	2	**0**	0	**0**	
Class work	-				
Exam	-				
Total	-				
Duration of Exam	-				

Course Objectives:
Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals" constitutional role and entitlement to civil and economic rights as well as the emergence ofnationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in1917 and its impact on the initial drafting of the Indian Constitution.

***Note: 1. MC-317G** is a mandatory non-credit course in which the students will be awarded grades A, B, C, F as per their performance. A: Excellent, B: Good, C: Satisfactory, F: Not Satisfactory. A student who is awarded „F" grade is required to repeat course**.**

COURSE CONTENT

Module– I
Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

Module – II
Federal structure and distribution of legislative and financial powers between the Union and the States.

Module – III
Organs of Governance: President – Qualification and Powers of the President, Governor Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

Module – IV
Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights, Introduction to Right to equality, Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

Course Outcomes:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrivalof Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptutilizationof social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] underthe leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct electionsthrough adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

IRRIGATION DRAWING LAB					
Course code					
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	0	**0**	**2**	**1**	
External marks:	50 Marks				
Internal marks:	50 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

- To understand the principles of planning and bylaws.
- To draw plan, elevation and section of Aqueducts, Beams, Dams and Spillways.
- To prepare detailed working Drawings of Barrages and Weirs

COURSE CONTENT

1. **Drawing No. 1: Drawing of Aqueducts**
2. **Drawing No. 2: Earthen Dams and Concrete Dams drawings**
3. **Drawing No. 3: Drawings of Spillways**
4. **Drawing No. 4: Out let, inlets drawings**
5. **Drawing No. 5: Drawings of Barrages and Weirs**
6. **Drawing No. 6: Drawing of fall**

Gurugram University

Scheme of Studies and Examination

B.Tech. (Civil Engineering)– 8th Semester

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	Theory	Practical	Total	
1	Seminar		Seminar-II	0	0	2	2	1	50	-	50	100	-
2	MOOCs Course		MOOCs Course	-	-	-	-	2	50		50	100	
3	Industrial Training-II/ Project		Industrial Training-II/ Project-II	0	0	8	8	6	150		150	300	3
		TOTAL						9				500	

Course code					
Category	Project				
Course title	**Industrial Training Synopsys/Project Work –I**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	0	**0**	**6**	**3**	
External marks:	50 Marks				
Internal marks:	50 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

The object of Industrial Training Synopsys/Project Work I is to start the project work early in the seventh semester and enable the student to take up investigative study in the broad field of Civil Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the department on an individual basis or in a group, under the guidance of a supervisor. This is expected to provide a good initiationfor the student(s) in R&D work.
The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.
6. Preparing a review paper forpresentation/Publication in national conference/ International conference/ Journals, if possible.

Course code					
Category	**Seminar-II**				
Course title	**SEMINAR**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	0	**0**	**2**	**1**	
External marks:	50 Marks				
Internal marks:	50Marks				
Total	100Marks				
Duration of Exam	3 Hours				

COURSE CONTENT

During the semester, the students have to:

- Select a topic relevant to analysis, design, implementation, experimental and management of a civil engineering system.
- Undertake a critical review of the literature on the chosen topic.
- Prepare and present a technical report.
- Preparing a review paper forpresentation/Publication in national conference/ International conference/ Journals, if possible.

Course code					
Category	Project				
Course title	**Industrial Training/ Project Work –II**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	0	**0**	8	**6**	
Class work	150 Marks				
Exam	150 Marks				
Total	300 Marks				
Duration of Exam	3 Hours				

The students are required to undergo Industrial Training in State/Central PWD, Railways and other Originations or Institutional Project Work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the mid-term progress report at the Institute. The presentation will be attended by a committee. Alternately, the teacher may visit the Industry to get the feedback of the students. The final viva-voce of the Industrial Training or Institutional Project Work will be conducted by an external examiner and one internal examiner appointed by the Institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the Board of Studies in Engg. & Technology.

OR,

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Project work-I or a new topic, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under Project work -I.
2. Review and finalization of the Approach to the Problem relating to the assigned topic.
3. Preparing an Action Plan for conducting the investigation, including team work.
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
5. Final development of product/process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference presentation/Publication in Journals, if possible.
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Assessment of Industrial Training or Institutional Project Work will be based on seminar, viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student from the industry or Institute.