B. Tech (Under Graduate) Scheme

Sr. No.	Code	Course Title	Teaching Schedule				Credits
			L	T	P	Total	
Third Semester							
1	CET-201	Structural Analysis-I	3	2	-	5	4
2	CET-203	Building, Construction Materials & Drawing	3	-	2	5	5
3	CET-205	Fluid Mechanics-I	3	2	-	5	4
4	CET-207	Surveying-I	3	1	-	4	3.5
5	CET-209	Engineering Geology	3	1	-	4	3.5
6	MAT-201	Mathematics III	3	1	-	4	3.5
7	CET-211	Structural Mechanics-I(P)	-	-	2	2	1
8	CET-213	Fluid Mechanics-I(P)	-	-	2	2	1
9	CET-215	Surveying-I(P)	-	-	3	3	1.5
Total			19	7	9	35	27

Sr. No.	Code	Course Title	Teaching Schedule				Credits
			L	T	P	Total	
Fourth Semester							
1	CET-202	Structural Analysis-II	3	2	-	5	4
2	CET-204	Design of Steel Structures-I	4	-	2	6	4
3	CET-206	Fluid Mechanics-II	3	2	-	5	4
4	CET-208	Soil Mechanics	3	2	-	5	4
5	CET-210	Surveying-II	3	1	-	4	3.5
6	CET-212	Fluid Mechanics-II(P)	-	-	2	2	1
7	CET-214	Soil Mechanics(P)	-	-	2	2	1
8	CET-216	Surveying-II(P)	-	-	2	2	1
9	CET-218	Engineering Geology(P)	-	-	2	2	1
10	HUT-211	Organisational Behaviour	2	1	-	3	2.5
Total			17	8	10	35	26

Sr. No.	Code	Course Title	Teaching Schedule				Credits
			L	T	P	Total	
Fifth Semester							
1	CET-301	Structural Analysis-III	3	2	-	5	4
2	CET-303	Design of Concrete Structures-I	4	2	-	6	5
3	CET-305	Hydrology	3	2	-	5	4
4	CET-307	Geotechnology-I	3	2	-	5	4
5	CET-309	Water Supply and Treatment	3	1	-	4	3.5
6	HUT-301	Business Management	3	1	-	4	3.5
7	CET-311	Environmental Engineering (P)	-	-	2	2	1
8	CET-313	Concrete Lab(P)	-	-	2	2	1
9	CET-315	Geotechnology (P)	-	-	2	2	1
10	CET-317	Survey Camp	-	-	-	-	3
Total			19	10	6	35	30

Sr. No.	Code	Course Title	Teaching Schedule				Credits
			L	T	P	Total	
Sixth Semester							
1	CET-302	Design of Steel Structures-II	3	-	2	5	4
2	CET-304	Irrigation Engineering-I	3	2	-	5	4
3	CET-306	Water Resources & Systems Engineering	3	2	-	5	4
4	CET-308	Geotechnology-II	3	2	-	5	4
5	CET-310	Transportation Engineering-I	3	1	-	4	3.5
6	CET-312	Project Planning & Management	3	1	-	4	3.5
7	CET-314	Transportation Engineering-I (P)	-	-	2	2	1
8	CET-316	Structural Mechanics-II(P)	-	-	2	2	1
9	CET-318	Computer Applications (P)	-	-	3	3	1
10	CET-320	Seminar	-	1	-	1	0.5
Total			18	9	8	35	26.5

Sr. No.	Code	Course Title	Teaching Schedule				Credits
			L	T	P	Total	
Seventh Semester							
1	CET-401	Design of Concrete Structures-II	4	-	-	4	4
2	CET-403	Industrial Waste Water Treatment	3	1	-	4	3.5
3	CET-405	Transportation Engineering-II	3	1	-	1	3.5
4	CET-407	Sewerage & Sewage Treatment	2	1	-	3	2.5
5	CET-409	Concrete Structures-II(Drg,)	-	-	3	3	1.5
6	CET-411	Environmental Engineering-II (P)	-	-	3	3	1
Departmental Elective							
7	CET-413	Elements of Earthquake EngineeringOR	3	1	-	4	3.5
8	CET-415	Rock Mechanics OR					
9	CET-417	Advanced Traffic Engineering OR					
10	CET-439	Rural Water Supply & SanitationOR					
11	CET-441	River Mechanics & Flood Control					
Open Elective							
12	CET-419 to CET-425	Any one subject from the subjects listed in the attachment	3	1	-	4	3.5
Project I							
13	CET-427	Geotechnical Engineering OR	-	-	4 (2)*	4 (2)*	9
14	CET-429	Transportation Engineering OR					
15	CET-431	Environmental Engineering OR					
16	CET-435	Water Resources Engineering OR					
17	CET-437	Structural Engineering OR					
18	CET-445	Geoinformatics					
19	CET-433	Practical Training Report	-	-	-	-	3
20	CET-443	Seminar	-	1	-	1	1
Total			18	5	8(6)*	31(29)*	36

Sr. No.	Code	Course Title	Teaching Schedule				Credits
			L	T	P	Total	
Eighth Semester							
1	CET-402	Bridge Engineering	3	1	-	4	3.5
2	CET-404	Railway & Airport Engineering	3	1	-	4	3.5
3	CET-406	Irrigation Engineering-II	3	1	-	1	3.5
4	CET-408	Estimation & Accounts	-	-	2	2	1.5
Departmental Elective II							
5	CET-410	Ground Water Engineering OR	3	2	-	5	4
6	CET-412	Environmental Impact Assessment OR					
7	CET-442	Geosynthetics Engineering OR					
8	CET-444	Transportation Planning OR					
9	CET-446	Introduction to FEM OR					
10	CET-448	Advanced Engineering Geology					
Open Elective II							
11		Environmental Studies	4	-	-	4	3.5
12	CET-422	Transportation Engg.-II(P)	-	-	2	2	1
13	CET-424	Irrigation Engineering, Design and Drawing (P)	-	-	2	2	1.5
Project II							
14	CET-426	Structural Engineering OR	-	-	4 (2)*	4 (2)*	3
15	CET-428	Water Resource Engineering OR					
16	CET-436	Geotechnical Engineering OR					
17	CET-438	Environmental Engineering OR					
18	CET-440	Transportation Engineering OR					
19	CET-450	Geoinformatics					
20	CET-432	Comprehensive Viva-Voce	-	-	-	-	3
21	CET-434	General Fitness & Professional Aptitude	-	-	-	-	3
Total			16	3	12(10)*	29(27)*	37

* teaching load

LIST OF OPEN ELECTIVE-I FOR VII SEMESTER

Sr.	Course No.	Name of Subject	Remarks
1.	CET-419	Hydro Electric Power Development	
2.	CET-421	Concrete Technology	
3.	CET-423	Environmental Engg.	
4.	CET-425	Machine Foundations	
5.	COT-471	Fundamentals of Software Engg.	
6.	COT-473	Fundamentals of Database Systems	
7	COT-475	Fundamentals of Computer Hardware Technologies	
8.	COT-477	Artificial Intelligence	
9.	ET-461	Non-Conventional Energy Sources	
10.	ET-463	System Modeling and Control	Only for C and M
11.	ET-465	Fault Tolerance and Reliability Engg.	
12.	ET-467	Illumination Engg.	
13.	ET-469	Microprocessors and Applications	Only for C and M
14.	ET-431	Transducers and Applications	Only for C and M
15.	ECT-431	e-Business	
16.	ECT-433	Radio and TV Engineering	

17.	ECT-435	Acoustic Engineering	
18.	ECT-437	Measurement Systems	
19.	ECT-439	Basic Communications Engg.	
20.	MET-429	Industrial Robotics	
21.	MET-431	Cryogenic Engg.	
22.	MET-433	Industrial Noise and Control	
23.	MET-435	Computer graphics and product Design	
24.	MET-437	Piping Engg.	
25.	MET-439	Process Equipment Design	
26.	MET-441	Industrial Engg. And Organization	Not for M.
27.	CHT-463	Metals and Alloys	
28.	HuE-461	Modern Trends in Management	
29.	HuE-463	Industrial Social Responsibility	
30.	HuE-467	Development and Planning in Indian Economy	
31.	HuE-475	Advance Communication Skills in English	
32.	MaE-467	Advanced Mathematics-I	
33.	PhE-465	Lasers	
34.	PhE-467	Ultrasonics	

LIST OF OPEN ELECTIVE-II FOR VIII SEMESTER

Sr.	Course No.	Name of Subject	Remarks
1.	CET-414	River mechanics & Flood Control	
2.	CET-416	Geosynthetics Engg.	
3.	CET-418	Introduction to Finite Element Method	
4.	CET-420	Transport Planning	
5.	COT-472	Fundamentals of Operating Systems	
6.	COT-474	Fundamentals of Computer Networks	
7.	COT-476	Object Oriented Software Engg.	
8.	COT-478	Expert Systems	
9.	COT-480	Security and Cryptography	
10.	ET-462	Energy Management and Conservation	(All except E)
11.	ET-464	Robotic Dynamics and Control	
12.	ET-466	Reliability Centered Maintenance	
13.	ET-468	Process Instrumentation & Control	
14.	ET-470	ANNs and Fuzzy logic	
15.	ET-472	Control and Guidance	
16.	ET-474	Artificial Intelligence and Expert Systems	
17.	ECT-436	IC Fabrication Processes	
18.	ECT-438	Op-amp Applications	
19.	ECT-440	Theory and Application of DSP	
20.	ECT-442	Mobile Communication	
21	MET-428	Non-Conventional Energy Systems	
22.	MET-430	Value Engg.	
23.	MET-432	Pneumatics & Hydraulics Control	
24.	MET-434	Material Handling	
25.	MET-436	Computer Modeling & Software Engg.	
26.	MET-438	Air Pollution and its Control	
27.	ChT-464	Polymer Technology	
28.	HuE-462	Entrepreneurship	
29.	Hue-464	Human Resource Management	
30.	*	*Intellectual Property Rights	
31.	MaE-468	Advanced Mathematics-II	
32.	PhE-468	Non-Destructive Testing	
33.	PhE-470	Transducers & their Applications	

('*' Subject to the final approval of BOS AS & Hum.)

B.Tech (UG) Syllabus

CET-201	STRUCTURAL ANALYSIS-I	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of rigid body mechanics

Corse Outcome: After the completion of the course, students are able:

CO1	To define and evaluate the different kinds of stresses and strains by analytical as well as graphical methods.
CO2	To study the buckling behavior of the axially and transversely loaded beam-columns and its analyses.
CO3	To define and reason about fundamental structural concepts such as shear force, bending moment relations, functions. To draw Shear force and Bending Moment Diagrams for determinate beams.
CO4	To analysis the three hinge arches.
CO5	To evaluate deflections of different types of beams.
CO6	Determine the static indeterminacy and kinematic indeterminacy of trusses and to analyse the trusses by using methods of joints or method of sections.

Detailed Syllabus:

1. **Analysis of stresses and strains:**
   Analysis of simple states of stresses and strains, elastic constraints, bending stresses, theory of simple bending, flexure formula, combined stresses in beams, shear stresses, Mohr's circle, Principle stresses and strains, torsion in shafts and closed thin walled sections, stresses and strains in cylindrical shells and spheres under internal pressure.
2. **Theory of Columns:**
   Slenderness ratio, end connections, short columns, Euler's critical buckling loads, eccentrically loaded short columns, cylinder columns subjected to axial and eccentric loading.
3. **Bending moment and shear force in determinate beams and frames:**
   Definitions and sign conventions, axial force, shear force and bending moment diagrams.
4. **Three hinged arches:**
   Horizontal thrust, shear force and bending moment diagrams.
5. **Deflections in beams:**
   Introduction, slope and deflections in beams by differential equations, moment area method and conjugate beam method, unit load method, principle of virtual work, Maxwell's Law of Reciprocal Deflections, Williot’s Mohr diagram
6. **Analysis of statically determinate trusses:**
   Introduction, various types, stability, analysis of plane trusses by method of joints and method of sections, analysis of space trusses using tension coefficient method.

References:

1. Strength of Materials Part-I, S.Timoshenko, Affiliated East-West Press, New .Delhi
2. Mechanics of Materials, Popov Nagarjan & Lu, Prentice Hall of India, New Delhi
3. Mechanics of Solids, Prasad, V. S. Gakgotia Pub., New Delhi.
4. Elementary Structural Analysis, Jain, A. K., Nem Chand & Bros, Roorkee.
5. Elementary Struictural Analysis, Wibur & Nooris, McGraw Hill Book Co., Newyork.
6. Structural Analysis, Bhavikatti,S.S.,Vikas Pub.House,N.Delhi.
7. Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi, 1996.
8. S.B.Junarkar and H.J.Shah, Mechanics of Structures, Charotar Publishers, Anand, 1998.
9. Beer and Johnston, Mechanics of Materials, McGraw Hill International Edition, 1995.
10. E.P.Popov, Engineering Mechanics of Solids, Prentice Hall of India Pvt. Ltd., 1998.

CET-203	BUILDING CONSTRUCTION, MATERIALS & DRAWING	CC	3 0 2	5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: None

Corse Outcome: On completion of the course, the students will be:

CO1	Able to identify the various building materials with symbols.
CO2	Able to identify the properties of building materials.
CO3	Made acquainted with the manufacturing process of basic construction materials.
CO4	Made acquainted with the masonry construction and finishes
CO5	Aware of building services, acoustics, DPC, etc.

Syllabus:

A. CONSTRUCTION

1. Masonry Construction:

Introduction, various terms used, stone masonry-Dressing of stones, Classifications of stone masonry, safe permissible loads, Brick masonry-bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick work, Defects in brick masonry, composite stone and brick masonry, glass block masonry.

2. Cavity and Partition Walls:

Advantages, position of cavity, types of non-bearing partitions, constructional details and precautions, construction of masonry cavity wall.

3. Foundation:

Functions, types of shallow foundations, sub-surface investigations, geophysical methods, general feature of shallow foundation, foundations in water logged areas, design of masonry wall foundation, introduction to deep foundations i.e. pile and pier foundations.

4. Damp-Proofing and Water-Proofing:

Defects and causes of dampness, prevention of dampness, materials used, damp-proofing treatment in buildings, water proofing treatment of roofs including pitched roofs.

5. Roofs and Floors:

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.

6. Doors and Windows:

Locations, sizes, types of doors and windows, fixures and fastners for doors and windows.

7. Acoustics, Sound Insulation and Fire Protection:

Classification, measurement and transmission of sound, sound absorber, classification of absorbers, sound insulation of buildings, wall construction and accoustical design of auditorium, fire-resisting properties of materials, fire resistant construction and fire protection requirements for buildings.

MATERIALS

1. Stones:

Classification, requirements of good structural stone, quarrying, blasting and sorting out of stones, dressing, sawing and polishing, prevention and seasoning of stone.

2. Brick and Tiles:

Classification of bricks, constituents of good brick earth, harmful ingredients, manufacturing of bricks, testing of bricks.

Tiles: Terra-cotta, manufacturing of tiles and terra-cotta, types of terra-cotta, uses of terra-cotta.

3. Limes, Cement and Mortars:

Classification of lime, manufacturing, artificial hydraulic lime, pozzolona, testing of lime, storage of lime, cements composition, types of cement, manufacturing of ordinary Portland cement, testing of cement, special types of cement, storage of cement.

Mortars: Definition, proportions of lime and cement mortars, mortars for masonry and plastering.

4. Timber:

Classification of timber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, plywood, fiberboard, masonite and its manufacturing, important Indian timbers.

5. Ferrous and Non-Ferrous Metals:

Definitions, manufacturing of cast iron, manufacturing of steel from pig iron, types of steel, marketable form of steel, manufacturing of aluminium and zinc.

6. Paints and Varnishes:

Basic constituents of paints, types of paints, painting of wood, constituents of varnishes, characteristics and types of varnishes.

7. Plastic:

Definition, classification of plastics, composition and raw materials, manufacturing, characteristics and uses, polymerisation, classification, special varieties.

C. DRAWINGS

1. Typical drawings of:

a) Cavity Wall
b) Bonds in brick work
c) Grillage foundation

2. Preparation of building drawing mentioning its salient featutres including the following details:

a) Ground floor plan
b) Two Sectional Elevations
c) Front and Side Elevations
d) Plan and Sectional Elevation of stair case, doors/ windows/ ventilators, floor and roof.

References:

1. Building Construction, Sushil Kumar, Standard Pub., N. Delhi
2. Building Material, Rangawala
3. Construction Engineering, Y.S. Sane
4. Building Construction, Gurcharan Singh, Standard Pub., N. Delhi.

5. Civil engineering Materials and Construction Practices by R.K. GUPTA, Jain Brothers, (New Delhi).
6. Civil engineering Materials by Tech. Teachers Training Institute, Tata Mc Graw Hill (1992).

CET-205	FLUID MECHANICS-I	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: - Knowledge of rigid body mechanics

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

CO1	Solve numerical problems related to pressure measuring instruments, identifying and solving forces on submerged and floating bodies.
CO2	Use conservation of mass principle and its application in various engineering disciplines including its importance in civil engineering.
CO3	Apply fundamental to practical application of Bernoulli's equation and principles in various disciplines including pressure variation study in atmospheric science.
CO4	Analyze momentum fluxes through a control volume and hence calculates forces in moving fluids.
CO5	Apply conservation laws for mass, momentum and mechanical energy in combination to control volumes in ideal fluids and hence calculate hydraulic and energy grade lines.

Syllabus:

1. Introduction:

Fluid properties, mass density, specific weight, specific volume and specific volume and specific gravity, surface tension, capillarity, pressure inside a droplet and bubble due to surface tension, compressibility viscosity, Newtonian and Non-newtonian fluids, real and ideal fluids.

2. Kinematics of Fluid Flow:

Stready & unsteady, uniform and non-uniform, laminar & turbulent flows, one, two & three dimensional. flows, stream lines, streak lines and path lines, continuity equation in differential form, rotation and circulation, elementary explanation of stream function and velocity potential, rotational and irrotational flows, graphical and experimental methods of drawing flownets.

3. Fluid Statics:

Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers, two liquid manometers, pressure on plane and curved surfaces, center of pressure, Buoyancy, stability of immersed and floating bodies, determination of metacentric height, fluid masses subjected to uniform acceleration, free and forced vortex.

4. Dynamic of Fluid Flow:

Euler's equation of motion along a streamline and its integration, limitation of Bernouli's equation, Pitot tubes, venturimeter, Orficemeter, flow through orifices & mouth pieces, sharp crested weirs and notches, aeration of nappe.

5. Boundary layer analysis:

Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, local and average friction coefficient, separation and its control.

6. Dimensional Analysis and Hydraulic Similude:

Dimensional analysis, Buckinghum theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modeling, similar and distorted models.

References:

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

CET-207	SURVEYING-I	CC	3	1	0	3.5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: None

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

CO1	Understand the use of three basic surveying tools: the tape, the level, and the compass.
CO2	Apply geometric and trigonometric principles to basic surveying calculations.
CO3	Efficient in keeping accurate, legible and complete notes in a well-prepared field book.
CO4	Understand field procedures in the basic types of surveys, and the responsibilities of a surveying team.
CO5	Acquire an awareness of the limitations of the basic surveying instruments and the possible errors that could arise.
CO6	Understand the different methods of calculation of areas and volumes of an irregular boundaries.
CO7	Understand the different methods of calculation of heights and distances using angular measurements.
CO8	Set out the curve by linear and angular methods with proper office and field work.

Syllabus:

1. **Fundamental Principles of Surveying:**
   Definition, objects, classification, fundamental principles, methods of fixing stations.

2. **Measurement of distances:**
   Direct measurement, instruments for measuring distance, instruments for making stations, chaining of line, errors in chaining, tape corrections examples.

3. **Compass and Chain Traversing:**
   Methods of traversing, instruments for measurement of angles-prismatic and surveyor's compass, bearing of lines, local attraction, examples.

4. **Leveling:**
   Definition of terms used in leveling, types of levels and staff, temporary adjustment of levels, principles of leveling, reduction of levels, booking of staff readings, examples, contouring, characteristics of contours lines, locating contours, interpolation of contours.

5. **Theodolite and Theodolite Traversing:**
   Theodolites, temporary adjustment of theodolite, measurement of angles, repetition and reiteration method, traverse surveying with theodolite, checks in traversing, adjustment of closed traverse, examples.

6. **Plane Table Surveying:**
   Plane table, methods of plane table surveying, radiation, intersection, traversing and resection, two point and three point problems.

7. Tacheometry:

Uses of tacheometry, principle of tacheometric surveying, instruments used in tacheometry, systems of tacheometric surveying-stadia system fixed hair method, determination of tacheometric constants, tangential systems, examples.

8. Curves:

Classification of curves, elements of simple circular curve, location of tangent points-chain and tape methods, instrumental methods, examples of simple curves. Transition Curves-Length and types of transition curves, length of combined curve, examples. Vertical Curves: Necessity and types of vertical curves.

References:

1. Surveying Vol.I by B.C.Punmia
2. Surveying Vol.I by T.P.Kanitkar
3. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.
4. Chandra A. M., Plane Surveying, New Age International Publ., 2007.
5. Charles D Ghilani, Paul R Wolf., Elementary Surveying, Prentice Hall, 2012.

CET-209	ENGINEERING GEOLOGY	CC	3	1	0	3.5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: None

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the interior structure of the earth and seismological evidences.
CO2	Identify various landforms which are created by geological agents like wind, river, glaciers, volcanoes and earthquake.
CO3	Recognize various types of minerals with physical properties, rocks with their textures, structures and origin. Also use of common building stones.
CO4	Understand geological structure like folds, faults, joints, unconformity etc. knowledge of which is very essential in the design and construction of dams, tunnels etc.
CO5	Understand surface and subsurface strata, the sources and zones of ground water.

Syllabus:

1. **Introduction:**
   Definition, object, scope and sub division of geology, geology around us. The interior of the earth. Importance of geology in Civil Engineering projects.
2. **Physical Geology:**
   The external and internal geological forces causing changes, weathering and erosion of the surface of the earth. Geological work of ice, water and winds. Soil profile and its importance. Earthquakes and volcanoes.
3. **Mineralogy and Petrology:**
   Definition and mineral and rocks. Classification of important rock forming minerals, simple description based on physical properties of minerals. Rocks of earth surface, classification of rocks. Mineral composition, Textures, structure and origin of Igneous, Sedimentary and Metamorphic rocks. Aims and principles of stratigraphy. Standard geological/stratigraphical time scale with its sub division and a short description based on engineering uses of formation of India.
4. **Structural Geology:**
   Forms and structures of rocks. Bedding plane and outcrops, Dip and Strike. Elementary ideas about fold, fault, joint and unconformity and recognition on outcrops. Importance of geological structures in Civil Engineering projects.
5. **Applied Geology:**
   Hydrogeology, water table, springs and Artesian well, aquifers, ground water in engineering projects. Artificial recharge of ground water, Elementary ideas of geological investigations. Remote sensing techniques for geological and hydrological survey and investigation. Uses of geological maps and interpretation of data, geological reports.
6. **Suitability and stability of foundation sites and abutments:**
   Geological condition and their influence on the selection, location, type and design of dams, reservoirs, tunnels, highways, bridges etc. Landslides and Hillslope stability.

7. Improvement of foundation rocks:

Precaution and treatment against faults, joints and ground water, retaining walls and other precautions.

8. Geology and environment of earth.

References:

1. A Text Book of Geology by P.K.Mukherjee
2. Physical and General Geology by S.K.Garg
3. Engineering and General Geology by Prabin Singh
4. Introduction of Physical Geology by A.Holmes.

MAT-201	ENGINEERING GEOLOGY	BSC	3	1	0	3.5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Mathematics-I and Mathematics-II

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Use the finite difference method, different interpolation methods for getting the solution for the engineering problems
CO2	Apply principles of vector differential and integral calculus to the analysis of engineering problems.
CO3	Use matrix algebra with its specific rules to solve the system of linear equations and getting the solution for the differential equations
CO4	Understand and apply the concept of probability distribution and sampling theory to engineering problems.
CO5	Identify, formulate and solve engineering problems.

Syllabus:

Part-A:

FINITE DIFFERENCES AND DIFFERENCE EQUATIONS

1. Finite Differences:

Finite differences, Difference operators, Newton's forward and backward interpolation formulae, Bessel's formula and Stirling's formula, Lagrange's interpolation formula for unequal intervals, Numerical differentiation. Numerical Integration: Newton-cote's quadrature formula (Trapezoidal rule, Simpason's 1/3 and 3/8 rule), Gaussian quadrature formula.

2. Difference Equations:

Formation of difference equations, solution of linear difference quations.

Part-B:

NUMERICAL METHODS WITH PROGRAMMING

1. Numerical Solution of algebraic and transcendental Equations:

Bisection method, Rcgula-FaIsi method, Newton Raphson method. Secant method.

2. Solution of Linear Simultaneous Equations:

Gauss elimination method, Gauss-Jordan method, Crouts triangularisation method, Jacobi's iteration method, Gauss-seidal iteration method.

3. Numerical solution of ordinary differential equations:

Picard's method, Ruler's method, Runge-Kutta method, Milne's predictor-corrector method, Adams-Bashforth method.

Part-C

1. Statistical Methods:

Method of Least Square and curve fitting, Correlation, Coefficient of Correlation, Rank correlation Regression and lines of Regression, Binomial distribution, Poisson distribution and Normal distribution with their properties and applications.

2. Operational Research:

Linear programming problems formulation. Solving linear programming problems using i) Graphical mejthods ii) Simplex method iii) Dual Simplex method.

Note to Paper Setter:

Set 9 questions in all, 3 from each part. Candidates have to attempt 5 questions selecting, atleast 1 question from each part.

References:

1. Numerical Methods for Engineers : Steven C. Chapra
2. Numerical Mathematical Analysis : James B. Scarborough
3. Mathematical Analysis in Engineering : Chang C. Mei
4. Statistical Theory with Engineering Application : A. Hald
5. Mathematical Statistics : C. E. Weatherburn
6. Operational Research : H. A. Taha
7. Higher Engineering Mathematics : B. S. Grewal

CET-211	STRUCTURAL MECHANICS-I (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Verification of reciprocal theorem and moment area theorem
CO2	Analysis of truss and curved members
CO3	Analysis of three hinge arches
CO4	Determine elastic properties of beam and analysis of struts
CO5	Tension test for steel and compression test for concrete

Syllabus:

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss- horizontal deflections & vertical deflections of various joints of a pin- jointed truss.
4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
6. Experimental and analytical study of behaviour of struts with various end conditions.
7. To determine elastic properties of a beam.
8. Uniaxial tension test for steel (plain & deformed bars)
9. Uniaxial compression test on concrete & bricks specimens.

CET-213	FLUID MECHANICS-I (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Fluid Mechanics-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Apply dimensional analysis for design of experimental procedures
CO2	Calibrate flow measuring devices used in pipes, channels and tanks
CO3	Determine fluid and flow properties
CO4	Characterize laminar and turbulent flows

Syllabus:

1. To determine metacentric height of the ship model.
2. To verify the Bernoulli's theorem.
3. To determine coefficient of discharge for an Orificemeter.
4. To determine coefficient of discharge of a venturimeter.
5. To determine the various hydraulic coefficients of an Orifice (C_d,C_c,C_v).
6. To determine coefficient of discharge for an Orifice under variable head.
7. To calibrate a given notch.
8. To determine coefficient of discharge for a mouth piece.
9. Drawing of a flownet by Viscous Analogy Model and Sand Box Model.
10. To study development of boundary layer over a flat plate.
11. To study velocity distribution in a rectangular open channel.
12. Velocity measurements by current meter, float, double float (demonstration only).
13. Experiment on Vortex formation (demonstration only).

CET-215	SURVEYING -I (P)	CC	0	0	3	1.5

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Surveying-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Conduct survey and collect field data
CO2	Prepare field notes from survey data
CO3	Interpret survey data and compute areas and volumes

Syllabus:

1. Chain surveying: Chaining and chain traversing.
2. Compass traversing.
3. Plane tabling: methods of plane table surveying, two point & three point problems.
4. Leveling: Profile leveling and plotting of longitudinal section and cross sections.y leveling. Permanent adjustment of level.
    a. Reciprocal leveling.
    b. Contouring and preparation contour map.
5. Use of tangent clinometer.

CET-202	STRUCTURAL ANALYSIS-II	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	To understand the concept of static and kinematic indeterminacy (degrees of freedom) of the structures such as beams & rigid pin jointed frames.
CO2	To understand the concepts/ broad methods, sub-methods involved in the analysis of indeterminate structures.
CO3	To apply these methods for analyzing the indeterminate structures to evaluate the response of such structures in the form of bending moment, shear force, axial force etc.
CO4	To study the analyses of two hinged arches.
CO5	Analyse the cable bridges, suspension bridges and two hinged stiffening Girder

Syllabus:

1 Statically Indeterminate Structures:
Introduction, Static and Kinematic Indeterminacies, Castigliano's theorems, Strain energy method, Analysis of frames with one or two redundant members using Castigliano's 2nd theorem.

2 Slope deflection and moment Distribution Methods:
Analysis of continuous beams & portal frames, Portal frames with inclined members.

3 Column Analogy Method:
Elastic centre, Properties of analogous column, Applications to beam & frames.

4. Analysis of Two hinged Arches:
Parabolic and circular Arches, Bending Moment Diagram for various lodings, Temperature effects, Rib shortening, Axial thrust and Radial Shear force diagrams.

5. Unsymmetrical Bending
Introduction Centroidal principal axes of sections, Bending stresses in beam subjected to unsymmetrical bending, shear centre, shear centre for channel, Angles and Z sections.

6. Cable and suspension Bridges:
Introduction, uniformly loaded cables, Temperature stresses, three hinged stiffening Girder and two hinged stiffening Girder.

References:

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

CET-204	DESIGN OF STEEL STRUCTURES-I	CC	4	0	2	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Design Tension Members, Lug Angles and Splices.
CO2	Design Compression Members, Built-Up Compression Members.
CO3	Design a Welded and Riveted connection.
CO4	Design Plate Girders and Gantry Girders.
CO5	Design Roof trusses, Purlin, joints and end bearings of Steel Structures.

Syllabus:

1. Introduction:
Properties of structural steel. I.S.Rolled sections and I.S. specification.

2. Connections:
Importance, various types of connections, simple and moment resistant, riveted, bolted and welded connections.

3. Design of Tension Members:
Introduction, types of tension members, net sectional areas, design of tension members, lug angles and splices.

4. **Design of Compression Members:**
Introduction, effective length and slenderness ratio, various types of sections used for columns, built up columns, necessity, design of built up columns, laced and battened columns including the design of lacing and battens, design of eccentrically loaded compression members.

5. Column Bases and Footings:
Introduction, types of column bases, design of slab base and gussested base, design of gussested base subjected to eccentrically loading, design of grillage foundations.

6. Design of Beams:
Introduction, types of sections, general design criteria for beams, design of laterally supported and unsupported beams, design of built up beams, web buckling, web crippling and diagonal buckling.

7. Gantry Girders:
Introduction, various loads, specifications, design of gantry girder.

8. Plate Girder:
Introduction, elements of plate girder, design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices (brief introduction), Curtailment of flange plates, design beam to column connections: Introduction, design of framed and seat connection.

DRAWINGS:

1. Structural drawings of various types of welded connections (simple and eccentric)
2. Beam to column connections (framed & seat connections)
3. Column bases- slab base, gussested base and grillage foundation.
4. Plate girder.
5. Roof truss.

References:

1. Design of steel structures, A.S.Arya & J.L.Ajmani, Nem chand & Bros., Roorkee.
2. Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
3. Design of steel structures, S.M.A.Kazmi & S.K.Jindal, Prentice Hall, New Delhi.
4. Design of steel structures, S.K.Duggal, TMH Pub., New Delhi.
5. Design of Steel Structures – Duggal.
6. Design of Steel structures – Bhavikatti S S.
7. IS-800-2007.

CET-206	FLUID MECHANICS-II	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Fluid Mechanics-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Concept of Types of flows, Type of channels, Velocity distribution, and Energy and momentum correction factors, Chezy's, Manning's and Bazin formulae for uniform flow.
CO2	The analysis of Specific energy, critical depth, computation of critical depth, critical sub-critical and super critical flows can be understood.
CO3	Non uniform flow-Dynamic equation for G.V.F., Mild, Critical, Steep, horizontal and adverse slopes, surface profiles, direct step method can be learnt.
CO4	Layout of a typical Hydropower installation, Heads and efficiencies can be solved and implemented real time problems.
CO5	Concept of classification of turbines- Pelton wheel, Francis turbine and Kaplan turbine working, working proportions can be studied.
CO6	The formulation of velocity triangles at inlet and outlet, expressions for work done and efficiency, Angular momentum principle, Applications to radial flow turbines.

Syllabus:

1 Laminar Flow:

Navier Stoke's equation, Laminar flow between parallel plates, Couette flow, laminar flow through pipes-Hagen Poiseuille law, laminar flow around a sphere-Stokes'law.

2 Flow through pipes:

Types of flows-Reynold's experiment, shear stress on turbulent flow, boundary layer in pipes-Establishment of flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Stanton and Moody's diagram. Darcy's weisbach equation, other energy losses in pipes, loss due to sudden expansion, hydraulic gradient and total energy lines, pipes in series and in parallel, equivalent pipe, branched pipe, pipe networks, Hardy Cross method, water hammer.

3 Drag and Lift:

Types of drag, drag on a sphere, flat plate, cylinder and airfoil, development of lift on immersed bodies like circular cylinder and airfoil.

4 Open Channel Flow:

Type of flow in open channels, geometric parameters of channel section, uniform flow, most economical section (rectangular and trapezoidal), specific energy and critical depth, momentum in open channel, specific force, critical flow in rectangular channel, applications of specific energy and discharge diagrams to channel transition, metering flumes, hydraulic jump in rectangular channel, surges in open channels, positive and negative surges, gradually varied flow equation and its integration, surface profiles.

5 Compressible flow:

Basic relationship of thermodynamics continuity, momentum and energy equations, propagation of elastic waves due to compression of fluid, Mach number and its significance, subsonic and supersonic flows, propagation of elastic wave due to disturbance in fluid mach cone, stagnation pressure.

6 **Pumps and Turbines:**

Reciprocating pumps, their types, work done by single and double acting pumps. Centrifugal pumps, components and parts and working, types, heads of a pump-statics and manometric heads,. Force executed by fluid jet on stationary and moving flat vanes., Turbines-classifications of turbines based on head and specific speed, component and working of Pelton wheel and Francis turbines, cavitation and setting of turbines.

References:

1. Hydraulics & Fluid Mechanics by P.N.Modi and S.M.Seth
2. Flow in Open Channels by S.Subraminayam
3. Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold
4. Chow V.T. Open Channel Hydraulics, Blackburn Press , 2009.
5. Franck M White, Fluid Mechanics, Tata McGraw Hill Publications 2011.
6. Robert W. Fox Ogukuo H. Orutcgardm Alan T. Mc Donald, Introduction to Fluid Mechanics, Student Edition 7th Wiley India Edition, 2011.

CET-208	SOIL MECHANICS	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Engineering Geology

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Able to understanding the formation and structure of soils.
CO2	Able to understanding the index properties of soil
CO3	Able to understanding the permeability of soils and factors affecting permeability
CO4	Able to understanding the concept of seepage
CO5	Able to understanding Mechanism of compaction, factors affecting, and effects of compaction on soil properties
CO6	Able to understanding the knowledge of consolidation of soils
CO7	Able to understanding stress distribution in soils for point loads and areas of different shapes
CO8	Able to understanding the shear strength of soils and shear strength of sands

Syllabus:

1. Soil Formation and Composition

Introduction, soil and rock, Soil Mechanics and Foundation Engineering, origin of soils, weathering, soil formation, major soil deposits of India, particle size, particle shape, interparticle forces, soil structure, principal clay minerals.

2. Basic Soil Properties

Introduction, three phase system, weight-volume relationships, soil grain properties, soil aggregate properties, grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves, consistency of soils, consistency limits and their determination, activity of clays, relative density of sands.

3. Classification of soils

Purpose of classification, classification on the basis of grain size, classification on the basis of plasticity, plasticity chart, Indian Standard Classification System.

4. Permeability of Soils

Introduction, Darcy's law and its validity, discharge velocity and seepage velocity, factors affecting permeability, laboratory determination of coefficient of permeability, determination of field permeability, permeability of stratified deposits.

5. Effective Stress Concept

Principle of effective stress, effective stress under hydrostatic conditions, capillary rise in soils, effective stress in the zone of capillary rise, effective stress under steady state hydro-dynamic conditions, seepage force, quick condition, critical hydraulic gradient, two dimensional flow, Laplace's equation, properties and utilities of flownet, graphical method of construction of flownets, piping, protective filter.

6. Compaction

Introduction, role of moisture and compactive effect in compaction, laboratory determination of optimum moisture content, moisture density relationship, compaction in field, compaction of cohesionless soils, moderately cohesive soils and clays, field control of compaction.

7. Vertical Stress Below Applied Loads

Introduction, Boussinesq's equation, vertical stress distribution diagrams, vertical stress beneath loaded areas, Newmark's influence chart, approximate stress distribution methods for loaded areas, Westergaard's analysis, contact pressure.

8. Compressibility and Consolidation

Introduction, components of total settlement, consolidation process, one-dimensional consolidation test, typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays, Casagrande's graphical method of estimating pre-consolidation pressure, Terzaghi's theory of one-dimensional primary consolidation, determination of coefficients of consolidation, consolidation settlement, Construction period settlement, secondary consolidation.

9. Shear Strength

Introduction, Mohr stress circle, Mohr-Coulomb failure-criterion, relationship between principal stresses at failure, shear tests, direct shear test, unconfined compression test, triaxial compression tests, drainage conditions and strength parameters, Vane shear test, shear strength characteristics of sands, normally consolidated clays, over-consolidated clays and partially saturated soils, sensitivity and thixotropy.

10. Earth Pressure

Introduction, earth pressure at rest, Rankine's active & passive states of plastic equilibrium, Rankine's earth pressure theory, Coulomb's earth pressure theory, Culmann's graphical construction, Rebhann's construction.

References:

1. Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New Age Intetrnational(P)Ltd.Pub.N.Delhi.
2. Soil Engg. in Theory and Practice, Vol .I, Fundamentals and General Principles by Alam Singh, CBS Pub.,N.Delhi.
3. Engg.Properties of Soils by S.K.Gulati, Tata-Mcgraw Hill,N.Delhi.
4. Geotechnical Engg. by P.Purshotam Raj,Tata Mcgraw Hill.
5. Principles of Geotechnical Engineering by B.M.Das,PWS KENT, Boston.

CET-210	SURVEYING –II	CC	3	1	0	3.5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Surveying-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the levelling operation in geodetic surveying.
CO2	Understand the use of plane and geodetic coordinate geometry programs.
CO3	Able to apply the fundamentals of the triangulation survey.
CO4	Understand vertical photogrammetric equations in estimation of accuracies.
CO5	Understand ground control requirements of different photogrammetric products.
CO6	Understand production and use of image based products.

Syllabus:

1. Trigonometrical Levelling:
Introduction, height and distances-base of the object accessible, base of object inaccessible, geodetical observation, refraction and curvature, axis signal correction, difference in elevation between two points.

2. Triangulation:
Triangulation systems, classification, strength of figure, selection of triangulation stations, grade of triangulation, field work of triangulation, triangulatio copmputations, introduction to E.D.M. instruments..

3. Survey Adjustment and Treatment of Observations:
Definite weight of an observation, most probable values, type of error, principle of least squares, adjustment of triangulation figures by method of least squares.

4. Astronomy:
Definitions of astronomical terms, star at elongation, star at prime vertical star at horizon, star at culmination, celestial coordinate systems, Napier's rule of circular parts, various time systems:sidereal, apparent, solar and mean solar time, equation of time-its cause, effect,determination of longitude,inter-conversion of time, determination of time, azimuth and latitude byastronomical observations.

5. **Elements of Photogrammetry:**
Introduction:types of photographs, Terrestrial and aerial photographs awerial camera and height displacements in vertical photographs, stereoscopic vision and stereoscopies, height determination from parallax measurement, flight planning, plotting by radiline method, principle of photo interpretation and photogrammetric monitoring in Civil Enginmeeriing.

6. Introduction of remote sensing and its systems:
Concept of G.I.S and G.P.S-Basic Components, data input, storage & output.

References:

1. Borden D. Dent, Jeffrey Troguson, Thomas W. Hodler, Cartography: Thematic Map Design, McGraw-Hill Higher Education, 2008.
2. Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, 2007.

3. Hoffman.B, H.Lichtenegga and J.Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001.
4. Punmia B. C, Ashok K. Jain, Arun K. Jain, Higher Surveying, Laxmi Publications, 2005.

CET-212	FLUID MECHANICS-II (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Fluid Mechanics-II

Course Outcomes: At the end of the course, the student will be able to:

CO1	Compute drag coefficients
CO2	Test the performance of pumps and turbines
CO3	Determine Manning's and Chezy's coefficients for smooth and rough channels
CO4	Determine Energy loss in Hydraulic jump and Calibrate standing wave flume

Syllabus:

1. To determine the coefficient of drag by Stoke's law for spherical bodies.
2. To study the phenomenon of cavitation in pipe flow.
3. To determine the critical Reynold's 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 the characteristics of a centrifugal pump.
9. To study the momentum characteristics of a given jet.
10. To determine head loss due to various pipe fittings.

CET-214	SOIL MECHANICS (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Soil Mechanics

Course Outcomes: At the end of the course, the student will be able to:

CO1	Determine index properties of soils
CO2	Classify soils
CO3	Determine engineering properties of soils

Syllabus:

1. Visual Soil Classification and water content determination.
2. Determination of specific gravity of soil solids.
3. Grain size analysis-sieve analysis.
4. Liquid limit and plastic limit determination.
5. Field density by:
6. Sand replacement method
7. Core cutter method
8. Proctor's compaction test.
9. Coefficient of permeability of soils.
10. Unconfined compressive strength test.
11. Direct shear test on granular soil sample.
12. Unconsolidated undrained (UU) triaxial shear test of fine grained soil sample.

CET-216	SURVEYING-II (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Surveying-II

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Use theodilitefor measurement of angles
CO2	Set the curves on the ground using different methods
CO3	Complete the large area surveying

Syllabus:

Theodilite:

Study of theodolite, measurement of horizontal angle, measurement of vertical angle, Permanent adjustment.

2 Tacheometry:

Tacheometric constants, calculating horizontal distance and elevations with the help of tacheometer.

3 Curves:

Setting of simple circular curves by off set method, off set from chord produced, off set from long chord and by deflection angle method.

4 Triangulation:

An exercise of triangulation including base line measurement.

CET-218	ENGINEERING GEOLOGY(P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Engineering Geology

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand weathering process and mass movement
CO2	Distinguish geological formations
CO3	Identify geological structures and processes for rock mass quality
CO4	Identify subsurface information and groundwater potential sites through geophysical investigations
CO5	Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels

Syllabus:

1. Study of Physical Properties of Minerals.
2. Identification of Rock forming silicate and ore minerals.
3. Recognition of rocks.
4. Use of Clinometer compass and Brunton compass for measurement dip and strike of formations.
5. Drawing of geological cross-selections and study of geological maps.

Study of models of geological structure and outcrops patterns of different types of rocks and land forms.

CET-301	STRUCTURAL ANALYSIS-III	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-i and Structural Analysis-II

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the responses of the structures under rolling loading
CO2	Understand influence lines and be able to apply influence lines to determine maximum values of internal forces and reactions for structures under moving load.
CO3	Understand the behaviour of fixed arches.
CO4	Analyze the non-sway and sway frames using Kanni's method
CO5	Analyze the framed structures using approximate methods of analysis.
CO6	Understand the concept of matrix methods and be able to apply it for analysis of statically determinate and indeterminate Structures.

Syllabus:

1. **Rolling Loads:**
   Introduction, Single concentrated load, uniformly distributed load longer than span, shorter than span , two point loads, several point loads, Max.B.M. and S.F.Absolute, Max.B.M.
2. **Influence lines:**
   Introduction, influence lines for three hinged and two hinged arches, load position for Max.S.F. and B.M. at a section in the span.
3. **Fixed Arches:**
   Expression for H and B.M. at a section, Elastic centre.
4. **Influence Line for statically indeterminate Beams:**
   Muller-Breslau Principle, I.L. for B.M. & S.F. for continuous Beams.
5. **Kani's Method:**
   Analysis of continuous beams and simple frames, analysis of frames with different column lengths and end conditions of the bottom storey.
6. **Approximate Analysis of frames:**
   (I) for vertical loads, (ii) for lateral loads by Portal method & Cantilever method.
7. **Matrix Methods**
   Introduction, Stiffness Coefficients, Flexibility Coefficients, Development of flexibility & stiffness matrices for plane frame, Global axis and local axis, analysis of plane frame, pin jointed and rigid jointed.

References:

1. Indeterminate structures, R.L.Jindal S.Chand & Co.,N.Delhi.Advanced Structural Analysis-A.K.Jain, NemChand & Bros.,Roorkee.
2. Structural Analysis-A Unified Approach, D.S.Prakash Rao,, University Press, Hyderabad.
3.Structural Analysis-A unified classical & Matrix Approach, A.Ghali & A.M.Neville,Chapman & Hall London.
4. Theory of Strucutres,- Vol. I&II,- S.P.Gupta & G.S.Pandit, Tata McGraw Hill, N.Delhi.

CET-303	DESIGN OF CONCRETE STRUCTURES-I	CC	4	2	0	5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis

Course Assessment: Continuous assessment (through assignments/Mid-semester Evaluation), End semester Examination.

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Know various design philosophies for Structural Design
CO2	Design a Beam structure
CO3	Design one way and two way slabs
CO4	Know various design considerations for design of column and footing
CO5	Design the retaining wall

Syllabus:

1. **Elementary treatment of concrete technology:**
   Physical requirements of cement, aggregate, admixture and reinforcement, Strength and durability, shrinkage and creep. Design of concrete mixes, Acceptability criterion, I.S.Specifications,
2. **Design Philosophies in Reinforced Concrete:**
   Working stress and limit state methods, Limit state v/s working stress method, Building code, Normal distribution curve, characteristic strength and characteristics loads, design values, Partial safety factors and factored loads, stress -strain relationship for concrete and steel.
3. **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.
4. **Limit State Method:**
   Basic assumptions, Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement, design examples.
5. **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.
6. **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.
7. **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.
8. **One way and Two Ways Slabs:**
   General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Non-rectangular slabs, openings in slabs, Design examples.

9. **Columns and Footings:**
   Effective length, Minimum eccentricity, short columns under axial compression, Uniaxial and biaxial bending, slender columns, Isolated and wall footings, Design examples.
10. **Retaining Walls:**
    Classification, Forces on retaining walls, design criteria, stability requirements, Proportioning of cantilever retaining walls, counterfort retaining walls, criteria for design of counteforts, design examples.

References:

1. Design of Reinforced Concrete Structures,P.Dayaratnam,Oxford & IBH Pub.,N.Delhi.
2. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
3. Reinforced Concrete, I.C.Syal & A,K,Goel, A.H,Wheeler & Co.Delhi.
4. Reinforced Concrfete Design, S.N.Sinha, TMH Pub.,N.Delhi.
5. SP-16(S&T)-1980, 'Design Aids for Reinforced Concrete to IS:456, BIS, N.Delhi.
6. SP-34(S&T)-1987 'Handbook on Concrete Reinforcement and Detailing', BIS, N.Delhi.

CET-305	HYDROLOGY	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Fluid Mechanics

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Analyse hydro-meteorological data
CO2	Estimate abstractions from precipitation
CO3	Compute yield from surface and subsurface basin
CO4	Develop rainfall-runoff models
CO5	Formulate and solve hydrologic flood routing models

Syllabus:

1. **Introduction:**
   Hydrologic cycle, scope and application of hydrology to engineering problems, drainage basins and its characteristics, stream geometry, hypsometric curves.
2. **Precipitation:**
   Forms and types of precipitation, characteristics of precipitation in India, measurement of preciptation, recording and non recording raingages, raingage station, raingage network, estimation of missing data, presentation of rainfall data, mean precipitation, depth -area -duration relationship, frequency of point rainfall, intensity -duration- frequency curves, probable max. precipitation.
3. **Evaporation & Transpiration:**
   Process, evaporimeters and empirical relationships, analytical method, reservoir evaporation and methods of its control, transpiration, evapotranspiration and its measurement, Penman's equation and potential evapotranspiration.
4. **Infiltration:**
   Infiltration process, initial loss, infiltration capacity and measurement of infiltration, infiltration indices.
5. **Runoff:**
   Factor affecting run-off, estimation of runoff, rainfall-run off relationships, measurement of stage-staff gauge, wire gauge, automatic stage recorder and stage hydrograph, measurement of velocity-current meters, floats, area velocity method, moving boat and slope area method, electromagnetic, ultra-sonic and dilution methods of stream flow measurement, stage discharge relationship.
6. **Hydrograph:**
   Discharge hydrograph, components and factors affecting shape of hydrograph, effective rainfall, unit hydrograph and its derivation, unit hydrograph of different durations, use and limitations of UH, triangular UH, Snyder's synthetic UH, floods, rational methods, empirical formulae, UH method, flood frequency methods, Gumbel's method, graphical method, design flood.
7. **Ground Water:**
   Occurrence, types of aquifers, compressibility of aquifers, water table and its effects on fluctuations , wells and springs, movement of ground water, Darcy's law, permeability and its determination, porosity, specific yield and specific retention, storage coefficient, transmissibility.

8. **Well Hydraulics:**

Steady state flow to wells in unconfined and confined aquifers.

References:

1 Engineering Hydrology by K.Subramanya.
2 Hydrology by H.M.Raghunath.
3 Hydrology for Engineers by Linsely, Kohler, Paulhus.
4 Elementary Hydrology by V.P.Singh.

CET-307	GEOTECHNOLOGY-I	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Engineering Geology and Soil Mechanics
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Characterise and classify soils
CO2	Identify shear strength parameters for field conditions
CO3	Compute and analyze the consolidation settlements
CO4	Understand the principles of compaction and its control

Syllabus:

1 Sub-Surface Exploration

Purpose, stages in soil exploration, depth and lateral extent of exploration, guidelines for various types of structures, ground water observations, excavation and boring methods, soil sampling and disturbance, major types of samplers, sounding methods-SCPT, DCPT, SPT and interpretation, geophysical methods, pressure-meter test, exploration logs.

2 Drainage & Dewatering

Introduction, ditches and sumps, well point systems, shallow well system, deep well drainage, vacuum method, Electro-osmosis, consolidation by sand piles.

3 Shallow Foundations-I

Design criteria for structural safety of foundation(i) location of footing,(ii) shear failure criterion, (iii) settlement criterion, ultimate bearing capacity, modes of shear failure, Rankine's analysis Tergazi's theory, Skempton's formula, effect of fluctuation of G.W.T. , effect of eccentricity on bearing capacity, inclined load, I.S Code recommendations, factors affecting bearing capacity, methods of improving bearing capacity.

4 Shallow Foundations-II

Various causes of settlement of foundation, allowable bearing pressure based on settlement, settlement calculation, elastic and consolidation settlement, allowable settlement according to I.S.Code. Plate load test and its interpretation, bearing capacity from penetration tests, design bearing capacity.

5 Shallow Foundations-III

Situation suitable for the shallow foundations, types of shallow foundations and their relative merits, depth of foundation, footing on slopes, uplift of footings, conventional procedure of proportioning of footings, combined footings, raft foundations, bearing capacity of raft in sands and clays, various methods of designing rafts, floating foundations.

6 Pile Foundations-I

Introduction, necessity of pile foundations, classification of piles, 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.

7 **Pile Foundations-II**

Group action in piles, pile spacing, pile group capacity, stress on lower strata, settlement analysis, design of pile caps, negative skin friction of pile group, uplift resistance of pile group, lateral resistance, batter pile group.

8 Drilled Piers and Caisson Foundations

Drilled piers-types, uses, bearing capacity, settlement, construction procedure.

Caissons-Types, bearing capacity and settlement, construction procedure.

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 I.S.3955.

References:

1 Basic And Applied Soil Mechanics by Gopal Ranjan & ASR Rao. New Age Int.(P)Ltd..
2 Analysis and Design of Sub-Structures by Swamisaran, IBH & Oxford.
3 Principles of Foundation Enginering By B.M.das, PWS Kent, Boston.
4 Foundation Analysis & Design by J.E.Bowles, McGraw Hills.
5 Design Aids in Soil Mechanics & Foundation Engineering by S.R.Kaniraj, McGraw Hills.
6 Foundation Design by Teng, Prentice Hall, India.

CET-309	WATER SUPPLY AND TREATMENT	CC	3	1	0	3.5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Hydrology and Irrigation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Estimate water demand;
CO2	Determine the quality of water;
CO3	Select and design appropriate water treatment unit processes;
CO4	Calculate design specifications for unit processes to remediate water of a particular quality to a particular standard;
CO5	Design the water distribution system.

Syllabus:

1 Water Quantity:

Importance and necessity of water supply scheme. Water demands and its variations. Estimation of total quantity of water requirement. Population forecasting. Quality and quantity of surface and ground water sources. Selection of a source of water supply. Types of intakes.

2 Water Quality:

Impurities in water and their sanitary significance. Physical, chemical and bacteriological analysis of water. Water quality standards.

3 Water Treatment:

Objectives, treatment processes and their sequence in conventional treatment plant, sedimentation – plain and aided with coagulation. Types, features and design aspects. Mixing basins and Flocculation units. Filtration – mechanism involved, types of filters, slow and rapid sand filtration units (features and design aspects). Disinfection principles and aeration.

4 Water Distribution:

Distribution system – Gravity system, Pumping System, Dual system, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System, their merits and demerits. Distribution Reservoir-functions & determination of storage capacity.

References:

1. Water Supply and Sewerage: E.W. Steel.
2. Water Supply Engineering: S.R. Kshirsagar.
3. Water Supply Engineering: S.K. Garg.
4. Water Supply Engineering: B.C. Punmia.
5. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

CET-311	ENVIRONMENTAL ENGG.-I(P)	CC	0	0	2	1

6.

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Chemistry Laboratory, Environmental Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Determine physical, chemical and biological characteristics of water
CO2	Determine optimum dosage of coagulant
CO3	Determine break - point chlorination
CO4	Assess the quality of water

Syllabus:

1. To determine the acidity of a water sample.
2. To determine the alkalinity of a water sample.
3. To determine total, suspended, dissolved and settable solids in a water sample.
4. To determine volatile and fixed solids in a water sample.
5. To determine the chloride concentration in a water sample.
6. To determine the sulphate concentration in a water sample.
7. To determine the turbidity of a given water sample.
8. To determine the hardness of a given water sample.
9. To determine the dissolved oxygen in a given water sample.
10. To determine the B.O.D. of a given water sample.
11. To determine the chlorine dose of a given water sample.
12. To determine most probable number of coliform bacteria for a given water sample.

CET-313	CONCRETE LAB (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-II and Structural Analysis-III
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Conduct Quality Control tests on concrete making materials
CO2	Conduct Quality Control tests on fresh & hardened concrete
CO3	Design and test concrete mix
CO4	Conduct Non-destructive tests on concrete

Pre-requisites: Knowledge of Structural Analysis-I,BMC&D
Corse Outcome: Same as the respective course
Syllabus:
Tests on Cement
1 Standard consistency of cement using Vicat's apparatus.
2 Fineness of cement by Sieve analysis and Blaine's air permeability method.
3 Soundness of cement by Le-Chatelier's apparatus.
4 Setting time of cement, initial and final.
5 Compressive strength of cement.
6 Measurement of specific gravity of cement.
7 Measurement of Heat of Hydration of cement.
Tests on Aggregate
1 Moisture content and bulking of fine aggregate.
2 Fineness modulus of coarse and fine aggregates.
Tests on Concrete
1 Workability of cement concrete by (a) Slump test, (b) Compaction factor test, (c) Flow table test,.
2 Compressive strength of concrete by (a) Cube test, (b)Cylinder test
3 Indirect tensile strength of concrete-split cylinder test.
4 Modules of rupture of concrete by flexure test
5 Bond strength between steel bar and concrete by pull-out test
6 Non-destructive testing of concrete

References:
1. Properties of Concrete, AM Nevelli – 5th Ed, Prentice Hall Publishers, 2012.
2. Concrete Technology, M. S. Shetty – S Chand Co., Publishers, 2006.
3. Concrete Technology, M. L. Gambhir – Tata Mc Graw Hill Publishers, 2012.

CET-315	GEOTECHNOLOGY (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-II and Structural Analysis-III
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Determine index properties of soils
CO2	Perform tri-axial stress
CO3	Determine the consolidation of soil mass
CO4	perform penetration test

Pre-requisites: Knowledge of Geotechnology
Corse Outcome: Same as the respective course
Syllabus:

1. Grain Size Analysis-Hydrometer method.
2. Shrinkage Limit Determination.
3. Relative Density of Granular Soils.
4. Consolidated Drained (CD) Triaxial Test.
5. Consolidated Undrained (CU) Triaxial Test with Pore Water Pressure Measurement.
6. Consolidation Test.
7. Undisturbed Sampling.
8. Standard Penetration Test.
9. Dynamic Cone Penetration Test.
10. Model Plate Load Test.

CET-302	DESIGN OF STEEL STRUCTURES-II	CC	3	0	2	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-I and Design of steel Structures-I
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Perform plastic analysis and design the steel beams and portal frames
CO2	Analyze and design the structural components of industrial building for different loads
CO3	Design of water tanks, stacks and transmission line towers
CO4	Analyses the behavior of different elements of cold forms steels and design of compression and bending elements

Syllabus:

1. **Elementary Plastic Analysis and Design:**
   Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members and compression members, flexural members, shape factor, mechanisms, plastic collapse, analysis, plastic analysis applied to steel beams and simple portal frames and design.
2. **Industrial Buildings:**
   Loads, general arrangement and stability, design considerations, design of purlins, design of roof trusses, industrial building frames, bracings and stepped columns.
3. **Design of Water Tanks:**
   Introduction, permissible stresses, design of circular, rectangular and pressed steel tanks including staging.
4. **Design of Steel Stacks:**
   Introduction,various loads to be considered for the design of steel stacks, design of steel stacks including foundation.
5. **Towers:**
   Transmission line towers, microwave towers, Design loads, classification, design procedure and specification.
6. **Cold Formed Sections:**
   Introduction and brief description of various type of cold formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, design of compression and bending elements.

References:

1. Design of Steel Structures, A.S.Arya & J.L.Ajmani, Nem Chand & Bros., Roorkee.
2. Design of Steel Structures, P.Dayartnam, Wheeler Pub. Allahabad.
3. Design of Steel Structures, Gaylord & Gaylord, McGraw Hill, Newyork/International Students Edn., Toyo Kogakusha, Tokyo.
4. IS:800-1984, Indian Standard Code of Practice for General Construction in Steel.
5. IS-801-1975, Indian Standard Code of Practice for Use of Cold formed light gauge steel structural members in general building construction.

CET-304	IRRIGATION ENGINEERING-I	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Fluid Mechanics and Hydrology

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Deals with the limits and application of canals and ground water for the purpose of irrigation.
CO2	Design of the reservoir, canals and wells by the method of Kennedy's and Lacey's theory.
CO3	Understand the types of irrigation and its application which have designed in the all cases.
CO4	Understand and develop the modern techniques which used for irrigation. Thus, it develops the storage of water, which is required for drinking and irrigation by wells through tanks.
CO5	Demonstrate the knowledge about water which is used for certain sequence only and it gives a particular way to supply in particular time only.
CO6	Communicate both the design and planning of the reservoir which used for irrigation process.

Syllabus:

1 **Introduction:**

Irrigation-necessity, advantages, disadvantages, impact of irrigation on human environment , need and development of irrigation in India, crops and crop seasons, ideal cropping pattern and high yielding varieties of crops.

2 **Soil-water relationship and irrigation methods:**

Soil-water relationship, root zone soil water, infiltration, conmsumptive use, field capacity, wilting point, available moisture in soil, GCA, CCA, intensity of irrigation, delta, base period, Kor depth, core period, frequency of irrigation, duty of water, relation between delta, duty and base period, irrigation requirement, flooding methods, border strip method, check basin and furrow method, assessment of irrigation water, sprinkler irrigation, favourable conditions, sprinkler systems, hydraulics of sprinkler irrigation, planning, design and maintenance of sprinkler systems, drip irrigation-components parts, advantages and limitations, suitability of drip irrigation.

3 **Canal irrigation:**

Component of canal distribution system, alignment of channels, losses in irrigation channels, design discharge, silt theories and design of alluvial channels, comparison of Kennedy's and Lacey's theories, canal section and design procedure, Garrets and Lacey's diagrams.

4 **Water logging and land reclamation:**

Water logging-effects, causes and measures of prevention, lining of irrigation channels, types of lining, design of lined channel land drainage, open drains, design considerations, advantages of tile drains, depth of tiledrains, layout of closed drains, discharge and spacing of closed drains, diameter of tile drain, outlets for tile drains, maintenance of tile drains, purpose of land reclamation and methods of land reclamation.

5 **River Training:**
Classification of rivers, river training and its objectives, classification of river training works, methods of river training, marginal embankments, guidebanks, spurs, cutoffs, bank pitching and launching apron.

6 **Canal outlets:**
Classification, requirements of a good outlet, design of pipe, APM and open flume outlet, flexibility proportionality, setting and sensitivity of outlet.

References:

1 Irrigation, Water Resources and Water Power Engg. by P.N.Modi.
2 Fundamentals on Irrigation Engg. by Bharat Singh.
3 Irrigation Engg & Hydraulic Structures by S.K.Garg.
4 Irrigation Engg. by S.K.Sharma.
5 Irrigation-Theory & Practice by A.M. Michael.

CET-306	WATER RESOURCES & SYSTEMS ENGINEERING	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Fluid Mechanics and Hydrology

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Impart an understanding of various aspects related to supply of pure and safe drinking water to communities and the conservation of water
CO2	Know different optimization techniques in Water Resources Systems planning, design, operation and management.
CO3	Facilitate optimal decision making in the planning, design and operation of especially large scale water resources systems.
CO4	Design the optimal strategies for reservoir releases for water quality augmentation, or maximizing hydropower generation, irrigation water supply etc.

Syllabus:

1 Water Resources Planning:

Role of water in national development, assessment of water resources, planning process, environmental consideration in planning, system analysis in water planning, some common problems in project planning, functional requirements in multipurpose projects, multipurpose planning, basinwise planning, long term planning.

Reservoir planning-dependable yield, sedimentation in reservoir, reservoir capacity, empirical-area reduction method.

2. Economic and Financial Analysis:

Meaning and nature of economic theory, micro and macro economics, the concept of equilibrium, equivalence of kind, equivalence of time and value, cost benefit, discounting factors and techniques, conditions for project optimality, cost benefit analysis, cost allocation, separable and non-separable cost, alternate justifiable and remaining benefit methods, profitability analysis.

3. Water Resources Systems Engineering:

Concept of system's engineering, optimal policy analysis, simulation and simulation modeling, nature of water resources system, analog simulation, limitations of simulation, objective function, production function, optimality condition, linear, non-linear and dynamic programming, applications to real time operations of existing system, hydrologic modeling and applications of basic concepts.

4. Applications of System Approach in Water Resources:

Applications of system engineering in practical problems like hydrology, irrigation and drainage engineering, distribution network, mathematical models for forecasting and other water resources related problems.

References:

1 Water Resources Engineering by Linseley and Franzini
2 Economics of Water Resources Engineering by James and Lee.
3 Optimisation Theory and Applications by S.S.Roy
4 Water Resources Systems Planning & Economics by R.S.Varshney.
5 Operational Research-An Introduction by Hamdy A.Taha.

CET-308	GEOTECHNOLOGY-II	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Engineering Geology and Geotechnology-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Apply knowledge for Stability of slopes of earth dams under different conditions.
CO2	Understand Earth pressure theories
CO3	Understand the theory of retaining wall
CO4	Learn the concept of soil stabilization
CO5	Learn the fundamental of machine foundation

Syllabus:

1 Earth Dams:

Introduction, types of sections, earth dam foundations, causes of failure and criteria for safe design, control of seepage through the embankment, control of seepage through the foundation, drainage of foundations, criterion for filter design. Introduction to rock fill dams.

2 Stability of slopes:

Causes of failure, factors of safety, stability analysis of slopes-total stress analysis, effective stress analysis, stability of infinite slopes types of failures of finite slopes, analysis of finite slopes-mass procedure, method of slices, effect of pore pressure, Fellinius method to locate center of most critical slip circle, friction circle method, Tayler's stability number, slope stability of earth dam during steady seepage, during sudden draw down and during and at the end of construction.

3 Braced Cuts:

Depth of unsupported vertical cut, sheeting and bracing for deep excavation, movements associated with sheeting and bracing, modes of failure of braced cuts, pressure distribution behind sheeting.

4 Cofferdams:

Introduction, types of cofferdams, design and lateral stability of braced cofferdams, design data for Cellular cofferdams, stability analysis of cellular cofferdams on soil and rock, inter-lock stresses.

5 Cantilever Sheet Piles:

Purpose of sheet piles, cantilever sheet piles, depth of embedment in granular soils-rigorous method, simplified procedure, cantilever sheet pile, penetrating clay, limiting height of wall.

6 Anchored Bulkheads:

Methods of design, free earth support method in cohesionless and cohesive soils, fixed earth support method in cohesionless soils-Blum's equivalent beam method.

7 Soil Stabilization:

Soil improvement, shallow compaction, mechanical treatment, use of admixtures, lime stabilization, cement stabilization, lime fly ash stabilization, dynamic compaction and consolidation, Bituminous stabilization, chemical

stabilization, pre-compression, lime pile and column, stone column, grouting, reinforced earth.

8 Basics of Machine Foundations:

Terminology, characteristics elements of a vibratory systems, analysis of vibratory motions of a single degree freedom system-undamped free vibrations, undamped forced vibrations, criteria for satisfactory action of a machine foundation, degrees of a freedom of a block foundation, Barken's soil spring constant, Barken's method of a determining natural frequency of a block foundation subjected to vertical oscillations.

References:

1 Analysis and Design of Foundation and Retaining Structures by S.Prakash, Gopal Ranjan & S.Saran, Sarita Prakashan.
2 Analysis and Design of Sub Structures by Swami Saran, IBH Oxford
3 Basic and Applied Soil Mechanics by Gopal Ranjan and ASR Rao, Newage Int.Pub.
4 Soil Dynamic by Shamsher Prakash, McGraw Hill
5 Foundation Design by Teng, Prentice Hall
6 Soil Mechanics & Foundation Engineering by Bharat Singh, Shamsher Prakash, Nem Chand & Bros, Roorkee.

CET-310	TRANSPORTATION ENGINEERING -I	CC	3	1	0	3.5

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: Knowledge of Engineering Geology and Geotechnology-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Classify roads based on functional classification,
CO2	Describe design element: sight distance, horizontal curvature, super elevation, grades, visibility on vertical curves, cross section elements
CO3	Use fundamental physics and mathematical knowledge in deriving geometric design equations
CO4	Design and simulate the traffic flow for signals.
CO5	Traffic flow theory, traffic analysis and queuing processes
CO6	Traffic Management and Intelligent Transport Systems
CO7	Select the appropriate materials for use in different road layers.

Syllabus:

1. Introduction:

Transportation and its importance. Different modes of transportation. Brief review of history of road development in India and abroad: Roman, Tresagne, Telford and Macadam constructions. Road patterns. Classification of roads, Objectives of highway planning, Planning surveys. Saturation system of planning.

2. Highway Plans, Highway Alignment And Surveys:

Main features of 20 years road development plans in India. Requirements of an ideal highway alignment. Factors affecting alignment. Surveys for highway alignment.

Cross Section Elements And Sight Distance Considerations:

Cross section elements: friction, carriageway, formation width, land width, camber, IRC recommended values. Types of terrain Design speed. Sight distance, stopping sight distance, overtaking sight distance, overtaking zones, intermediate sight distance, sight distance at intersections, head light sight distance, set back distance. Critical locations for sight distance.

Design Of Horizontal And Vertical Alignment:

Effects of centrifugal force. Design of superelevation. Providing superelevation in the field. Radius of circular curves. Extra-widening. Type and length of transition curves. Gradient, types, values. Summit curves and valley curves, their design criterion. Grade compensation on curves.

Traffic Characteristics And Traffic Surveys:

Road user and vehicular characteristics. Traffic studies such as volume, speed and O & D study. Parking and accident studies. Fundamental diagram of traffic flow. Level of service. PCU. Capacity for non-urban roads. Causes and preventive measures for road accidents.

Traffic Control Devices:

Traffic control devices: signs, signals, markings and islands. Types of signs. Types of signals. Design of an isolated fixed time signal by IRC method. Intersections at grade and grade separated intersections. Design of a rotary. Types of grade separated intersections.

Highway Materials:Soil And Aggregates:

Subgrade soil evaluation: CBR test, plate bearing test. Desirable properties of aggregates. Various tests, testing procedures and IRC/IS specification for suitability of aggregates. Proportioning of aggregates for road construction by trial and error and Routhfuch method.

Bituminous Materials And Bituminous Mixes:

Types of bituminous materials: bitumen, tar, cutback and emulsions. Various tests, testing procedures and IRS/IS specifications for suitability of bituminous materials in road construction. Bituminous mix, desirable properties. Marshall' method of mix design. Basic concept of use of polymers and rubber modified bitumen in bituminous mixes.

References:

1. Highway Engg. by S.K.Khanna & C.e.G.Justo, Nem Chand & Bros,Roorkee.
2. Principles of Transportation and Highway Engg. by G.V.Rao,Tata McGraw Hill Pub., N.Delhi.
3. Traffic Engg. And Transport Planning by L.R.Kadiyali,Khanna Pub.Delhi.
4. Traffic Engg. by Matson, T.M.,Smith,W.S. and Hurd,P.W.McGraw Hill Book Co., New York.

CET-312	PROJECT PLANNING & MANAGEMENT	CC	3	2	0	4

Internal:50 Marks	End Term: 50 Marks	Total:100 Marks

Pre-requisites: None

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the roles and responsibilities of a project manager
CO2	Prepare schedule of activities in a construction project
CO3	Prepare tender and contract document for a construction project
CO4	Understand safety practices in construction industry
CO5	Identify the equipment used in construction

Syllabus:

1 Construction Management

Significance, objectives and functions of construction management, types of constructions, resources for construction industry, stages for construction, construction team, engineering drawings.

2 Construction Contracts & Specifications

Introduction, types of contracts, contract document, specifications, important conditions of contract, arbitration.

3 Construction Planning

Introduction, work breakdown structure, stages in planning-pre-tender stages, contract stage, scheduling, scheduling by bar charts, preparation of material, equipment, labour and finance schedule, limitation of bar charts, milestone charts.

4 Construction Organization

Principles of Organization, communication, leadership and human relations, types of Organizations, Organization for construction firm, site organization, temporary services, job layout.

5 Network Techniques in Construction Management-I:CPM

Introduction, network techniques, work break down, classification of activities, rules for developing networks, network development-logic of network, allocation of time to various activities, Fulkerson's rule for numbering events, network analysis , determination of project schedules, critical path, ladder construction, float in activities, shared float, updating, resources allocation, resources smoothing and resources leveling.

6 Network Techniques in Construction Management-II-PERT

Probability concept in network, optimistic time, pessimistic time, most likely time, lapsed time, deviation, variance, standard deviation, slack critical path, probability of achieving completion time, central limit theorem.

7 Cost-Time Analysis

Cost versus time, direct cost, indirect cost, total project cost and optimum duration, contracting the network for cost optimisation, steps in time cost optimisation, illustrative examples.

8 Inspection & Quality Control

Introduction, principles of inspection, enforcement of specifications, stages in inspection and quality control, testing of structures, statistical analysis.

References:

1 Construction Planning & Management by P.S.Gehlot & B.M.Dhir, Wiley Eastern Ltd.

2 PERT & CPM -Principles & Applications by L.S.Srinath. Affiliated East-west Press(P)Ltd.

3 Project Planning & Control with PERT & CPM by B.C.Punmia & K.K.Khandelwal,Lakshmi Pub. Delhi

4 Construction Management & Planning by B.sengupta & H.Guha, Tata McGraw Hills.

CET-314	TRANSPORTATION ENGINEERING-I (P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Transportation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Characterize the pavement materials
CO2	Perform quality control tests on pavements and pavement materials
CO3	Estimate earth work from longitudinal and cross-section details

Syllabus:

1. Aggregate Impact Test.
2. Los-Angeles Abrasion Test on Aggregates.
3. Dorry's Abrasion Test on Aggregates.
4. Deval Attrition Test on Aggregates.
5. .Crushing Strength Test on Aggregates.
6. Penetration Test on Bitumen.
7. Ductility Test on Bitumen.
8. Viscosity Test on Bituminous Material
9. Softening Point Test on Bitumen.
10. .Flash and Fire Point Test on Bitumen.

CET-316	STRUCTURAL MECHANICS -II(P)	CC	0	0	2	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: Knowledge of Structural Analysis-II and Structural Analysis-III
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Analyse two hinge arches, pin joint trusses
CO2	Study the unsymmetrical bending
CO3	Study the elastically coupled beam
CO4	Analyse the portal frame
CO5	Study the cable structures

Syllabus:

1. Experiment on a two hinged arch for horizontal thrust & influence line for Horizontal thrust
2. Experimental and analytical study of a 3 bar pin jointed Truss.
3. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.
4. Begg's deformeter- verification of Muller Breslau principle.
5. Experimental and analytical study of an elastically coupled beam.
6. Sway in portal frames - demonstration.
7. To study the cable geometry and statics for different loading conditions.
8. To plot stress-strain curve for concrete.

CET-318	COMPUTER APPLICATION (P)	CC	0	0	3	1

Internal:60 Marks	End Term: 40 Marks	Total:100 Marks

Pre-requisites: None

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the need for software tools in analysis and design of Civil Engineering Systems
CO2	Identify the available open source software tools used for specific problems in Civil Engineering
CO3	Use the latest software tools for Modeling, Analysis and Design of Civil Engineering Systems

1. Computation of roots of a polynomial using
   a) Bisection method b) Newton-Raphson method
2. Solution of linear simultaneous equation using Gauss Elimination/Gauss-Jordan/Triangulation factorization method.
3. Solution of a system of non-linear equation using fixed point/Newton-Raphson method/modified Newton-Raphson method.
4. Analysis of multi-span beam and frames using stiffness matrix method.
5. Analysis of plane frame and space frame using automated software.
6. Analysis of a three-storeyed and ten-storeyed building using automated software.
7. Introduction to Auto CAD.

CET-320	**SEMINAR**	**CC**	0	1	0	0.5

Internal:60 Marks	**End Term: 40 Marks**	**Total:100 Marks**

Pre-requisites:

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Select a topic relevant to civil engineering
CO2	Undertake a critical review of the literature on the chosen topic
CO3	Prepare and present a technical report

CET-401	DESIGN OF CONCRETE STRUCTUTRES-II	CC	4	0	0	4

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Structural Analysis and Concrete Structures-I
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Continuous beams, beams curved in plan.
CO2	Flat slabs and staircase
CO3	Combined footing, raft foundation and pile foundation.
CO4	Water tank, silos and bunkers
CO5	Prestressed members
CO6	Slab using yield line method

Syllabus:

1. **Continuous Beams:**

Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear, beams curved in plan-analysis for torsion, redistribution of moments for single and multi-span beams, design examples.

2. **Flat slabs and staircases:**

Advantages of flat slabs, general design considerations, approximate direct design method, design of flat slabs, openings in flat slab, design of various types of staircases, design examples.

3. **Foundations:**

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

4. **Water Tanks, Silos and Bunkers:**

Estimation of Wind and earthquake forces, design requirements, rectangular and cylindrical underground and overhead tanks, Intze tanks, design considerations, design examples.

Silos and Bunkers-Various theories, Bunkers with sloping bottoms and with high side walls, battery of bunkers, design examples.

5. Prestressed Concrete:

Basic principles, classification of prestressed members, various prestressing systgems, losses in prestress, initial and final stress conditions, analysis and design of sections for flexure and shear, load balancing concept, I:S:Specifications .

End blocks-Analysis of stresses, Magnel's method, Guyon's method, Bursting and spalling stresses, design examples.

6. **Building Frames:**

Introduction, Member stiffnesses, Loads, Analysis for vertical and lateral loads, Torsion in buildings, Ductibility of beams, design and detailing for ductibility, design examples.

7. **Yield Line Theory:**

Basic assumptions, Methods of analysis, yield line patterns and failure mechanisms, analysis of one way and two way rectangular and non-rectangular slabs, effect of top corner steel in square slabs, design examples.

References:

1. Plain and Reinforced Concrete, Vol.2, Jai Krishna & O.P.Jain, Nem Chand & Bros.,Roorkee.

2. Pre-Stressed Concrete, N.Krishna Raju, TMH Pub.,N,.Delhi.
3. Design of Prestressed Concrete Structures, T.Y.Lin, John Wiley & Sons., N.Delhi.
4. Reinforced Concrete-Limit StaTge Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
5. IS 1343-1980,IS Code of Practice for Prestressed Concrete.
6. IS 3370-1976(Part I to IV), Indian Standard Code of Practice for Liquid Retaining Structures.
7. IS 456-2000, Indian Standard of Practice for Plain and Reinforced Concrete.

IS 1893, 4326 & 13920 Indian Standard Code of Practice for Earthquake Resistant Design of Structures.

CET-403	INDUSTRIAL WASTE WATER TREATMENT	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Water Supply and Treatment and Sewerage & Sewage Treatment

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify the characteristics of industrial wastewaters
CO2	Describe pollution effects of disposal of industrial effluent
CO3	Identify and design treatment options for industrial wastewater
CO4	Formulate environmental management plan

Syllabus:

Effects of industrial wastes on streams, sewerage systems and wastewater treatment plants. Various steps to minimize effects of industrial effluents on waste water treatment plants and receiving streams-conservation of water, process change, reuse of waste water, volume reduction, strength reduction, neutralization, equalization and proportioning. Population equivalent. Industrial effluent standards for disposal into inland surface water sources and on land for irrigation.

Study of the following Industries from waste generation, quality and its treatment including brief overview of manufacturing process:

Textile, tannery, sugar mill, distillery, dairy, pulp & paper, metal plating, oil refinery, nitrogenous fertilizers, thermal power plants and radio active wastes.

References:

a. Industrial and Hazardous Waste Treatment by N.L.Nemerow & A.Dasgupta.
b. Industrial Effluents by N.Manivasakam.
c. Waste Water Treatment by M.N.Rao & A.K.Dutta.

CET-405	Transportation Engineering-II	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Design the flexible pavement
CO2	Design the rigid pavement
CO3	Provide the suitable treatment for the soil for non-bituminous pavement
CO4	Provide the suitable treatment for maintaining the road pavement
CO5	Provide the suitable measures for the drainage and hill road construction
CO6	Analyses the financial aspect of the road construction
CO7	Select the site and respective method for tunneling

Syllabus:

1. Design Of Flexible Pavements:

Types of pavements. Flexible and rigid pavements. Components of a pavement and their functions. Factors affecting design of pavements. Design of thickness of a flexible pavement by Group Index method, CBR method (including latest IRC guidelines), Triaxial method and Burmister's method.

2. Design Of Rigid Pavements:

Westergaard's theory, critical locations of loading, load and temperature stresses. Critical combination of stresses. IRC guidelines for determination of thickness of a rigid pavement. Joints: requirements, types, patterns. Spacing of expansion and contraction joints. Functions of dowel and tie bars.

3. Highway Construction : Non-Bituminous Pavements:

Brief introduction to earthwork machinery: shovel, hoe, clamshell, dragline, bulldozers. Principles of field compaction of subgrade. Compacting equipments. Granular roads. Construction steps of WBM. WMM. Construction of cement concrete pavements. Slip-form pavers. Basic concepts of the following: soil stabilized roads, use of geo-synthetics, reinforced cement concrete pavements, prestress concrete pavements, roller compacted concrete pavements and fibre reinforced concrete pavements.

4. Construction Of Bituminous Pavements:

Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of BUSG, Premix carpet, BM, DBM and AC. Brief coverage of machinery for costruction of bituminous roads: bitumen boiler, sprayer, pressure distributer, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MOST specifications.

5. Highway Maintenance:

Pavement failures. Maintenance operations. Maintenance of WBM, bituminous surfaces and cement concrete pavements. Pavement evaluation. Benkleman beam. Introduction to various types of overlays.

6. Highway Drainage And Hill Roads:

Surface drainage: types, brief design. Types of sub-surface drainage. Special characteristics of hill roads: geometrics, hair pin bends, construction of hill roads, drainage of hill roads, maintenance problems of hill roads

7. Highway Economics And Finance

Need of economic evaluation. Highway user benefits and costs. Methods of economic evaluation: benefit cost ratio method, net present value method, internal rate of return method, comparison. Highway finance.

8. Tunnels

Sections of tunnels: advantages, limitations and suitability of each section. Shaft. Pilot tunnel. Driving tunnel in rocks: sequence of construction operations, full face method, heading and bench method, drift method. Driving tunnels in soft ground: sequence of construction operations, needle beam method, shield tunneling, compressed air tunneling.

References:

1. Highway Engg *by* S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
2. Principles and Practice of Highway Engg. *by* L.R.Kadiyali, Khanna Publishers, Delhi.
3. Principles of Pavement Design *by* Yoder,E.J & Witczak,M.W., John Wiley and Sons, USA.
4. Tunnel Engineering *by* S.C.Saxena, Dhanpat Rai Publications, N.Delhi.
5. A text book of Tunnel, Bridges and Railway Engg. *by* S.P.Bindra, Dhanpat Rai Delhi.

CET-407	SEWERAGE AND SEWAGE TREATMENT	CC	2 1 0	2.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify and explain components necessary for sewage systems and water reticulation systems
CO2	Design of sewage disposal plant units;
CO3	Apply decision-making methodologies to evaluate solutions for efficiency, effectiveness and sustainability

Syllabus:

1. Collection of sewage:

Importance of sanitation, Systems of sewerage – separate, combined and partially separate. Quantity of sanitary sewage and variations. Shapes of sewer – circular and egg shaped. Design of sewers, self-cleansing velocity and slopes, Construction and testing of sewer lines. Sewer materials. joints and appurtenances.

2. Sewage Characterisation:

Quality parameters- BOD, COD, Solids, D.O., Oil & Grease. Indian Standards for disposal of effluents into inland surface sources and on land.

3. Sewage Treatment:

Objectives, sequence and efficiencies of conventional treatment units. Preliminary treatment, screening and grit removal units. Theory and design aspects of primary treatment, secondary treatment- activated sludge process & its modifications, Tricking filter, sludge digestion and drying beds.

Stabilization pond, aerated lagoon, UASB process , septic tank and Imhoff tank. .

4. Disposal of Sewage:

Disposal of sewage by dilution – self-purification of streams. Sewage disposal by irrigation (sewage treatment).

References:

1. Waste Water Engineering: Metcalf and Eddy.
2. Sewage and Sewage Treatment: S.K. Garg.
3. Sewage and Sewage Treatment: S.R. Krishansagar.
4. Waste Water Engineering: B.C. Punmia.
5. Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

CET-409	CONCRETE STRUCTURES-II (DRG)	CC	0	0	3	1.5

Internal: 60 Marks	End Term: 40 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Concrete Structures-I and Concrete Structures-II
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Design of flat slab and water tank
CO2	Design of foundation
CO3	Design of Silo and Bunker

Syllabus:
Preparing drawing sheets showing reinforcement details in case of:

1. Flat slabs

2. Underground and Overhead Water Tanks.

3. Combined Footings, Pile Foundations, Raft foundation.

4. T-Beam Bridge.

5. Silo/Bunker.

CET-411	ENVIRONMENTAL ENGINEERING-II(P)	CC	-	-	3	1

Internal: 60 Marks	End Term: 40 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Determine physical, chemical and biological characteristics of wastewater
CO4	Assess the quality of wastewater

Syllabus:

1. To determine the acidity of a sewage sample.
2. To determine the alkalinity of a sewage sample.
3. To determine total, suspended, dissolved and settable solids in a sewage sample.
4. To determine volatile and fixed solids in a sewage sample.
5. To determine oil and grease in a sewage sample.
6. To determine the chloride concentration in a sewage sample.
7. To determine the sulphate concentration in a sewage sample.
8. To determine the B.O.D. of a given sewage sample.
9. To determine the C.O.D. of a given sewage sample.
10. To determine the T.O.C. of a given sewage sample.
11. To determine the fecal count of a given sewage sample.
12. Microscopic studies of a sewage.

CET-413	ELEMENTS OF EARTHQUAKE ENGINEERING	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Concrete Structures, Mathematics-II

Corse Outcome: On completion of the course, the students shall be able to:

CO1	To identify the effects of earthquake motions on civil engineering structures
CO2	Analysis and design of civil engineering structures located in various seismic zones
CO3	Perform seismic evaluation, repair and strengthening of the existing structures.

Syllabus:

1. **Seismology:**
   Introduction, plate tectonics, earthquake distribution and mechanism, seismicity, seismic waves, earthquake magnitude and intensity, seismic zoning and seismometry.
2. **Single Degree of Freedom Systems:**
   Various types of dynamic loads, vibration of single degree of freedom system, Free and forced vibrations, types of damping, critical damping. Transmissibility, vibration measuring instruments, response spectrum.
3. **Multi-degrees of Freedom(MDOF)Systems:**
   Equation of Motion, normal modes and natural frequencies, semi-definite systems, dynamic vibration absorbers, vibration dampers, principle of orthogonally, Stodolas method, Holzer's method, matrix method, modal analysis and its limitations. Mode super position method.
4. **Seismic Analysis and Design:**
   General principles, assumptions, seismic coefficient method, response spectrum method, strength and deflection, design criterion for structures, significance of ductility, design and detailing for ductility, codal provisions, design examples.
5. **Seismic Performance, Repair and Strengthening:**
   Methods for assessing seismic performance, influence of design ductility and masonry infills, criterion for repair and strengthening, repair and strengthening techniques and their applications, additions of new structural elements.
6. **Vibrational Control:**
   General features of structural control, base isolation, active and passive control system. Earthquake resistance design as per I.S.:1893, I.S.4326 and I.S.13920.

References:

1 Elements of Earthquake Engineering, Jai Krishna, A. R. Chandershekaran & Brajesh Chandra , South Asian Pub New Delhi.
2 Dynamics of Structures, Clough & Penzion, McGraw Hill
3 Earthquake Engineering, Y-X Hu,S-C.Liu and W.Dong, E and FN Sons., Madras.

4 Earthquake Resistant Concrete Structures, George G. Penelis and J. Kapoors, E & FN Sons, Madras.
5 Structural Dynamics, Mario Paz, CBB Pub. N. Delhi.

CET-415	ROCK MECHANICS	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Engineering Geology and Geotechnical Engineering - II. **Corse Outcome:** On completion of the course, the students shall be able to:

CO1	Identify the problems associated with underground excavations
CO2	Classify the rock mass using the reference data
CO3	Understand the failure criteria of rock
CO4	Determine in-situ stresses from field test data

Syllabus:

1 **Introduction:**
Importance of rock mechanics, composition of rocks, geological and lithological classification of rocks, classification of rocks for engineering purposes, R.Q.D. method of classification of rocks.
Theories of Brittle failure.

2 **Laboratory Testing of Rocks:**
Various methods of obtaining rock cores, methods of sample preparation, methods of removing end friction of the rock samples. Compression testing machine, uniaxial compression strength of rock samples, methods of finding tensile strength-direct and indirect methods, Brazilian test, shear box test, triaxial shear test, punch shear test.

3 **In-situ Testing of Rocks:**
Field direct shear test on rock blocks, field triaxial strength, use of flat jacks, chamber test, plate load test, cable jacking test.

4 **Stress Evaluation in Field:**
Stress-relief technique(over coring), use of strain gauges, bore hole, deformation cell, photo-elastic stress meter, stress measurement with flat jack. Hydraulics Fracturing Techniques.

5 **Stabilization of Rocks:**
Rock bolting, principle of rock bolting, various types of rock bolts, application of rock bolting. Field testing of rock bolts and cable anchors.

6 **Elastic and Dynamic Properties of Rocks:**
Stress-strain behaviour dynamic properties, resonance method and ultra-sonic pulse method.

7 **Pressure on Roof of Tunnels:**
Trap door experiment, Terzaghi's theory, Bieraumer, kommerel, Protodyakanov theory.

8 **Stress Around the Tunnels:**
Basic design and Principles of tunnels in rocks, design of pressure tunnels in rocks.

References :

1 Rock Mechanics , Vol.I,II,III,IV by Lama,et.al.
2 Fundamentals of Rock Mechanics by Jaeger and Cook
3 Rock Mechanics by Stagg & Zienkiewiez.
4 Rock Mechanics & Design of Structures in Rocks by Obert & Duvell
5 Rock Mechanics & Engineering by Jaeger
6 Art of Tunneling by Schzy.

CET-417	ADVANCED TRAFFIC ENGINEERING	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Engineering Geology and Geotechnical Engineering - II. **Corse Outcome:** On completion of the course, the students shall be able to:

CO1	Estimate basic characteristics of traffic stream
CO2	Conduct traffic studies and analyze traffic data
CO3	Design traffic signal systems
CO4	Determine the capacity of highways

Syllabus:

1. Introduction And Traffic Chracteristics

Objectives and scope of traffic engg. Organisational set up of traffic engg department in India. 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.

2. Traffic Surveys

Methods of conducting the study and presentation of the data for traffic volume study, speed study and origin and destination study. Speed and delay study. Parking surveys. On street parking, off street parking. Accident surveys. Causes of road accidents and preventive measures. Use of photographic techniques in traffic surveys.

3. Highway Capacity

Importance. Space and time headway. 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.

4. Traffic Control

Types of traffic control devices. Traffic signs, general principles of traffic signing, types of traffic signs. Road markings, types, general principles of pavement markings. Design of rotary. Grade separated intersections. Miscellaneous traffic control aids and street furniture.

5. Signal Design

Types of signals. Linked or coordinated signal systems. Design of signal timings by trial cycle method, approximate method, Webstor's method and IRC method

6. Traffic Regulation And Management

Need and scope of traffic regulations. Regulation of speed, vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management. Traffic management measures: restrictions on turning movements, one way streets, tidal flow operations, exclusive bus lanes, traffic restraint, road pricing.

7. Traffic And Environment

Detrimental effects of traffic. Vehicular air pollution. Situation in India. Vehicular emission norms in India and abroad. Alternate fuels. Factors affecting fuel consumption. Arboricultur.

8. Computer Application, Traffic Simulation

Computer application in traffic engg., transport planning and public transport. Traffic simulation, advantages. Steps in simulation. Scanning techniques. Introduction to Intelligent vehicle highway system. Various types of IVHS.

Books:

1. Traffic Engg. And Transport Planning *by* L.R.Kadiyali, Khanna Publishers, Delhi.
2. Highway Engg *by* S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
3. Traffic Engg. *by* Matson, T.M., Smith, W.S. and Hurd, F.W., McGraw- Hill Book Co., New York.
4. Traffic Flow Theory *by* Drew, D.R., McGraw- Hill Book Co., New York.

CET-441	RIVER MECHANICS & FLOOD CONTROL	EC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Hydrology and Irrigation Engineering

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify the characteristics and objectives of water resources systems
CO2	Develop rainfall-runoff models
CO3	Formulate and solve hydrologic flood routing models
CO4	Perform basic economic analysis to evaluate the economic feasibility of water resources projects
CO5	Formulate and solve deterministic optimization models for design and operation of water resources systems

Syllabus:

1. **Introduction:**
   Indian rivers, flood, flood problems, river morphology, behaviour of river flow, role of sediments in rivers, changes in regimes, river gauging, causes of flood and losses, alleviation of flooding.
2. **Hydrologic Statistics:**
   Probabilistic treatment of hydrologic data, frequency & probability functions, statistical parameters, fitting a probability distribution, probability distribution fort hydraulic variables.
3. **Flood Mitigation by River Protection:**
   Basis of river engineering, flow types, resistance flow , energy slope, backwater effect, three dimensional flow, circular and helicoidal flow, river improvement works, river survey, protection by embankment, discharge capacity, design of dyke, stability analysis of dykes, bank protection, bank recession, types of bank proterction works, channel improvement, cutoffs diversion, bypass channel, cutoff channel, floord ways, flood plain zeroing, spreading grounds.
4. **Flood Mitigation by Reservoirs:**
   Design factors, storage capacity determinations, sequent peak algorithom method, live stoorage, ripple mass curve flood routing, flood storage, dead storage, reservoir classification, reservoir sedimentation, distribution of sediments in reservoirs, measurement of sediment yields, sediment load measurement, Mood's method, life of reservoir, reservoir operation based on annual storage and regulation, single and multi purpose reservoirs, gate operation schedule, maximum and minimum flow operation, multi purpose reservoir operation, reservoir econonmics-cost benefit ratios, optimisation of benefits.
5. **Flood Forecasting & Warning:**
   Basic data, communication network, forecasting techniques and procedures, forecast of rainfall, runoff from rainfall, forecasting stages, peak travel time, forecast reporting flood warning, engineering methods for flood fighting
6. **Engineering Economics of Flood Control:**
   Estimation of flood damages, estimation of benefits of flood control, cost benefit analysis of flood control project.

References:

1 Flood Control & Drainage Engg. by S.N.Ghosh.
2 Hydrology & Flood Control Engg. by S.K.Garg.
3 Hydrology & Water Resources Engg. by K.C.Patra.

CET-419	HYDRO ELECTRIC POWER DEVELOPMENT	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Engineering Geology and Geotechnical Engineering - II. **Corse Outcome:** On completion of the course, the students shall be able to:

CO1	Estimate hydropower potential
CO2	Identify types of hydropower plants
CO3	Design penstocks and surge shaft
CO4	Plan the layout of a hydropower plant

Syllabus:

1. Introduction:

Sources of power , estimation of water power, necessity and importance of harnessing small hydro power, flow duration and power duration curves, load curve, load factors, capacity factors, utilisation factors, firm and secondary power.

2. Types of Hydro Power Plants:

Elements of Hydro power, classification of hydro-power plants, run-of-river plants, storage plants diversion canal development, pumped storage plants, tidal power plants, base load and peak load plants in a power grid.

3. Intakes:

Intake structures, functions and their types, components of intakes-forebay, trash racks, gates and valves, force required to operate gates.

4. **Conveyance System:**

Penstocks, design criterion, economical diameter anchor blocks, cradles and footings, water hammer, instantaneous closure of power canal, surge tank, surges in canals.

5. Turbines:

Types of turbines, specific speed and classification of turbines, synchronous speed, scroll casing , flumes and draft tubes, dimensions of scroll casing and draft tubes, setting of turbines

6. Power House:

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

References:

1 Water Power Engineering, Dandekar, M.M., Sharma,K.N.
2 Hydro-Electric Engineering Practice Vol.I ,II & III Brown J.G.
3 Water Power Engineering, Borrows, H.K.
4 Water Power Development, Vol.I & II, Mosonyi,E.
5 Water Power Engineering, M.M.Deshmukh.

CET-421	CONCRETE TECHNOLOGY	OE	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Building Materials, Construction and Drawing

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify Quality Control tests on concrete making materials
CO2	Understand the behavior of fresh and hardened concrete
CO3	Design concrete mixes as per IS and ACI codes
CO4	Understand the durability requirements of concrete
CO5	Understand the need for special concretes

Syllabus:

1. **Concrete as Structural Material:**
   Introduction, preparation of concrete, grades of concrete, advantages of concrete, concept of quality control.
2. **Concrete Making Materials:**
   Cement, tests on cement (physical tests), types of Portland cement, various types of cement-ordinary Portland cement, rapid hardening cement, low heat cement, sulphate resistant cement, portland-pozzolona cement, high strength Portland cement, high alumina cement, waterproof cement, white Portland cement, hydrophobic cement, coloured Portland cement.

   Aggregates, classification of aggregates based on petrographic, size, shape & texures, deleterious substances in aggregates, bulking of fine aggregate, sieve analysis, grading of aggregates as per IS-383-1970. Fineness Modulus, Maximum size of aggregate. Quality of mixing water, curing water.
3. **Properties of Concrete:**
   Introduction, workability, factors influencing workability, measurement of workability, requirements of workability, properties of hardened concrete, stress and strain characteristics of concrete, Young's modulus of concrete, creep and shrinkage of concrete, permeability of concrete, durability of concrete sulphate attack, fire-resistance, thermal properties of concrete, construction joints, expansion and contraction joints.
4. **Production of Concrete:**
   Introduction, batching of materials, mixing of concrete materials, transportation of concrete, compaction of concrete, ready mixed concrete, vibrators, Internal vibrators, external vibrators, concrete curing and formwork removal.
5. **Non-Destructive Testing of Concrete:**
   Significance of Non-Destructive Testing, Rebound Hammer, Ultrasonic pulse velocity techniques, Penetration techniques, pullout tests, vibration methods, Radioactive techniques. Cover meter, core-tests.
6. **Deterioration of Concrete & its Prevention:**
   Causes of concrete deterioration, deterioration by water, surface weir, frost action, deterioration by chemical reactions, sulphate attack, alkali-aggregate reaction, corrosion of embedded steel in concrete. Prevention of deterioration of concrete.

7 **Repair Technology for Concrete Structures:**
Symptoms and diagnosis of distress, evaluation of cracks, repair of cracks, common types of repairs, distress in fire damaged structures, underwater repairs.

8 **Special Concrete:**
Light weight concrete, definition and its properties, applications, high strength concrete, definitions, its properties and applications, mass concrete, waste material based concrete, shortcrete, fiber reinforced concrete: Materials. Fibers-types and properties, ferrocement, polymer concrete composites, heavy-weight concrete for radiation shielding.

9 **Prestressed Concrete:**
Introduction, Basic concepts, classification and types of prestressing, prestressing systems, properties of materials, pretensioned and post-tensioned concrete elements.

Books:

1. Gambhir,M.L.,'Concrete Technology', TMH Pub.N.Delhi.
2. Shetty, M.S.'Concrete Techhnology', S.Chand & Co.N.Delhi.

CET-423	ENVIRONMENTAL ENGINEERING	OE	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Sewerage & Sewage Treatment, Water Supply and Treatment

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
CO2	Estimate the population - economic growth, energy requirement and demand.
CO3	Analyse material balance for different environmental systems.
CO4	Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO5	Identify the major pollutants and abatement devices for environmental management and sustainable development

Syllabus:

1. Introduction

Environment and its segment, biosphere, impact of humans upon environment, impact of environment upon humans, biodiversity and sustainable development.

2. Ecology

Meaning, scope and sub-division on ecology. Ecosystems and its types. Energy flow – radiation and heat budget, food chains, trophic levels, ecological pyramids, biogeochemical cycles (nitrogen, sulpher, phosphorus), consortism and its ranks. Ecological balance in nature, sources and effects of radioactive fall outs, disposal of radioactive wastes, chemical and biological agents and effects of chemical and biological warfare, population explosion - its effects and India scenario.

3. Energy And Environment

Energy, uses of energy, historical background, economics of energy, conventional and non-conventional sources of energy, renewable energy sources (such as solar, wind, tidal, wave, geothermal, hydro and bio mass energy) and their environmental impact with special reference on Indian scenario.

4. Air Pollution

Composition and structure of atmosphere, classification and sources of air pollutants, effects of air pollution on plants, animal and human health and economic effects of air pollution. Meteorological parameters influencing air pollution, plume behaviour. Effects of air pollution on meteorological conditions (such as green house effect, ozone depletion and acid rains). El-Nino and its effects. Automobile pollution - effects and control measures. Atmospheric self – cleansing processes, approaches and techniques of air pollution control. Air pollution control devices like settling chamber, cyclones, ESP, bag – filters, catalytic converters, etc.

5. Noise Pollution

General introduction to noise pollution, human acoustics, unit of measurement, loudness, measurements of noise and weighting networks,

sources and effects of noise pollution. Noise abatement/control and noise standards.

6. Solid Wastes

Definition, types, composition and sources of solid – wastes. Method of disposal - land filling, incineration, pulverization, and composting. Selection of method of disposal. Solid waste management and reuse of materials.

References:

1. 'Environmental Engineering' by H. S. Peavy. D. R. Rowe, et. Al., McGraw Hill Book Co. New Delhi.
2. Ecology' by E. P. Odum, Oxford and IBN Pub. New Delhi.
3. Air Pollution' by M. N. Rao.
4. Environmental Noise Pollution' by P. F. Cuniff, John Wiley & Sons.
5. Environmental Engineering' by S. S. Deswal & S. Deswal, Dhanpat Rai & Co.

CET-425	MACHINE FOUNDATIONS	OE	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Earthquake Engineering and Concrete Structures
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the dynamic behaviour of foundations.
CO2	Select foundation for dynamic loading
CO3	Design machine foundations
CO4	Identify vibration isolation techniques

Syllabus:

1. **Theory of Vibrations:**
   Definitions, harmonic motion, vibrations of a single degree freedom system, transmissibility, theory of vibration measuring instruments.
2. **General Principles of Machine Foundation Design:**
   Types of machines and machine foundations, criteria for satisfactory action of a machine foundation, permissible amplitude, allowable soil pressure, permissible stresses in concrete and steel, permissible stresses in timber.
3. **Evaluation of Parameters:**
   Modes of vibration of a rigid block foundation, Barken's soil spring constants, determination of coefficients of elastic uniform compression and Elastic uniform shear.
4. **Foundations for Reciprocating Machines:**
   Analysis of block foundation by Barken's theory of linear elastic weightless spring analogy, Indian Standard for design and construction of foundation for reciprocating machine, design procedure, design examples.
5. **Foundation for Impact Machines:**
   Dynamic analysis, Barken's recommendations for weight and base contact area, IS Code practice for design and construction of foundations for impact machines, design procedure, design examples.
6. **Foundations for Rotary Machines:**
   Special considerations, design criteria, methods of analysis and design.
7. **Vibration Isolation and Screening:**
   Active isolation, passive isolation, methods of isolation, wave screening, vibration absorbing materials, planning for vibration isolation.

References:

a. Dynamics of Bases and Foundations by D.D.Barken
b. Soil Dynamics by Shamsher Prakash
c. Soil Dynamics and Machine Foundations by Swami Saran
d. Principles of Soil Dynamics by B.M.Das
e. Vibration and Shock Isolation by Crede

CET-427 to CET-445	**PROJECT I**	**CC**	0	0	4	9

Internal: 50 Marks	**End Term: 50 Marks**	**Total: 100 Marks**

Pre-requisites:

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Work in a team to select a problem for project work
CO2	Review and evaluate the available literature on the chosen problem
CO3	Formulate the methodology to solve the identified problem
CO4	Apply the principles, tools and techniques to solve the problem
CO5	Prepare and present project report

CET-402	BRIDGE ENGINEERING	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering and Concrete Structures

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Design the slab culvert, Box culvert
CO2	Design the T beam bridge and substructures
CO3	Design the Bridge bearings
CO4	Design the steel bridge for railways

Syllabus:

1 **Introduction:**
Definition, components of bridge, classification of bridges, selection of site , economical span, aesthetics consideration, necessary investigations and essential design data.

2 **Standard Specifications For Roads And Railways Bridges:**
General, Indian Road Congress Bridge Code, width of carriage way, clearance, various loads to be considered for the design of roads and railway bridges, detailed explanation of IRC standard live loads.

3 **Design Consideration for R. C. C. Bridges:**
Various types of R.C.C. bridges(brief description of each type) , design of R.C.C. culvert and T-beam bridges.

4 **Design Consideration for Steel Bridges:**
Various types of steel bridges (brief description of each), design of truss and plate girder bridges.

5 **Hydraulic & Structural Design:**
Piers, abutments, wingwall and approaches.

6 **Brief Description:**
Bearings, joints, articulation and other details.

7 **Bridge Foundation:**

8 Various types, necessary investigations and design criteria of well foundation.

References:

1. Essentials of Bridge Engineering, D.J.Victor, Oxford & IBH Pub.N.Delhi.
2. Design of Bridges, N.Krishna Raju, Oxford & IBH, N.Delhi.
3. Bridge Deck Analysis, R.P.Pama & A.R.Cusens, John Wiley & Sons.
4. Design of Bridge Structures, T.R.Jagadish & M.A.Jairam, Prentice Hall of India, N.Delhi.

CET-404	RAILWAY AND AIRPORT ENGINEERING	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Understand the knowledge of various systems of railway, airport transportation.
CO2	Understand the design concept of railway track, runway, taxiways, etc.
CO3	Apply the concept of geometric design of railway track, runway, taxiway, etc.
CO4	Apply the knowledge of various signaling system for railway engineering, air traffic control navigational aids.

Syllabus:

Part-A Railway Engineering

1. Introduction, Permanent Way And Rails

Rail transportation and its importance in India. Permanent way: requirements and components. Gauges in India and abroad. Selection of gauge. Coning of wheels. Adzing of sleepers. Rails: functions, composition of rail steel, types of rail sections, requirements of an ideal rail section, length of rails. Defects in rails. Creep of rails. Long welded rails and continuously welded rails.

2. Sleepers, Fastenings And Ballast

Sleepers: functios, requirements of an ideal sleeper. Types of sleepers: wooden, cast iron, steel and concrete sleepers, advantages, disadvantages and suitability of each type. Sleeper density. Fastenings for various types of sleepers: fish plates, spikes, bolts, bearing plates, keys, chairs, jaws, tie bars. Elastic fastenings. Ballast: functions, requirements, types of ballast and their suitability.

3. Points And Crossings

Necessity. Turnout: various components, working principle. Switch: components, types. Crossing: components and types. Design elements of a turnout, design of a simple turnout. Layout plan of track junctions: crossovers, diamond crossing, single-double slips, throw switch, turn table, triangle.

4. Signalling, Interlocking And Train Control

Signals: objects, types and classification. Semaphore signal: components, working principle. Requirements / principles of a good interlocking system. Brief introduction to devices used in interlocking. Methods of control of train movements: absolute block system, automatic block system, centralised train control and automatic train control systems.

5. Geometric Design Of The Track

Gradients, grade compensation. Superelevation, cant deficiency, negative superelevation. Maximum permissible speed on curves. Tractive resistances, types. Hauling capacity of a locomotive.

6. Stations, Yards And Track Maintenance

Stations: functions and classification. Junction, non-junction and terminal stations. Yards: functions, types. Marshalling yard: functions, types. Maintenance of railway track: necessity, types of maintenance. Brief introduction to mechanised maintenance, M.S.P and D.T.M.

Part-B Airport Engineering

1. Introduction And Airport Planning

Air transportation, its importance and characteristics, status in India. Layout plan of an airport and its basic elements: terminal area, apron, taxiway, runway, hanger. Aircraft characteristics, their effect on elements of an airport. Site selection of an airport. Classification of airports.

8. Runway Layout And Pavement Design

Runway orientation, Wind Rose diagram. Basic runway length. Corrections to basic runway length. Runway patterns. Difference between highway and runway pavement. Types of runway pavements. Design factors for runway pavement. Brief introduction to design of thickness of a runway pavement.

Note: In total 8 questions will be set, 6 from part-A and 2 from part-B. Candidates will be required to attempt 5 questions selecting atleast 1 from part-B.

References:

1. A text book of Railway Engineering *by* S.C.Saxena and S.P.Arora, Dhanpat Rai Publicatios, N.Delhi.
2. Railway Track Engg. *by* J.S.Mundray, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.
3. Airport Planning and Design *by* S.K.Khanna, M.G.Arora, Nem Chand Bros., Roorkee.
4. The Planning and Design of Airports *by* Robort Hornjeff, McGraw Hill Book Co.
5. Air Transportation Planning and Design *by* Virender Kumar & Satish Chandra, Galgotia Publications, N.Delhi.

CET-406	IRRIGATION ENGINEERING-II	CC	3	1	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Hydrology and Irrigation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Plan an Irrigation System
CO2	Design irrigation canals and canal network
CO3	Plan and design diversion head works
CO4	Design irrigation canal structures
CO5	Analyze gravity and earth dams
CO6	Design spillways and energy dissipations works

Syllabus:

1 **Regulation works:**
Canal falls-necessity and location, development of falls, design of cistern element , roughening devices, design of Sarda type fall, design of straight Glacis fall. Off-take alignment, cross-regulator and distributory head regulators, devices to control silt entry into the off-taking channel and silt ejector, canal escapes, types of escapes.

2 **Cross drainage works:**
Classification and their selection, hydraulic design aspects of aqueducts, syphon aqueducts, super passage, canal syphon and level crossing, design of transitions.

3 **Diversion canal headworks:**
Various components and their functions, layout plan, selection of site for diversion headworks, Bligh's creep theory, Khosla's method of independent variables, use of Khosla's curves, various corrections, silt excluders.

4 **Storage Headworks:**
Types of dams, selection of a site, gravity dam-two dimensional design, forces acting, stability criterion, elementary profile of a dam, cutoffs and drainage galleries, arch dams-constant angle and constant radius arch dam, simple design and sketchs, most economical angle, Earth dam, design principles, seepage through earth dams, seepage line, control of seepage, design of filters.

5 **Spillways and Energy Dissipators:**
Essential requirements of spillway and spillway's capacity, types of spillways and their suitability, Ogee spillways, chute, side channel, shaft and syphon spillways, energy dissipation below spillways, stilling basins, USBR and I.S.Stilling Basins.

References:

1 Irrigation,Water Resources and Water Power Engineering by P.N.Modi.
2 Fundamentals on Irrigation Engineering by Bharat Singh.
3 Irrigation Engineering and Hydraulic Structures by S.K.Garg.
4 Theory and Design of Irrigation Structures Vol.I & II by R.S.Varshney, Gupta & Gupta.

CET-403	ESTIMATION AND ACCOUNTS	CC	0	0	2	1.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Building Materials, Construction and Design

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Prepare quantity estimates for buildings, roads, rails and canal works
CO2	Calculate the quantity of materials required for civil engineering works as per specifications
CO3	Evaluate contracts and tenders in construction practices
CO4	Prepare cost estimates

Syllabus:

1. Estimate:

Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two roomed building with different sections of walls, foundation, floors and roofs, R.B. and R.VC.C. works, Plastering, White-washing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, roads etc.

2. Specification of Works:

Necessity of specifications, types of specifications, general specifications, specification for bricks, cement, sand, water, lime, reinforcement; Detailed specifications for Earthwork, Cement, concrete, brick work,floorings, D.P.C., R.C.C., cement plastering, white and colour washing, distempering, painting.

3. Rate Analysis:

Purpose, importance and requirements of rate analysis, units of measurement, preparation of rate analysis, procedure of rate analysis for items:- Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing(white-washing, distempering).

4. Public Works Account:

Introduction, function of P.W. department, contract, guidelines, types of contracts, their advantages and disadvantages, Tender and acceptance of tender, Earnest money, security money, retention money, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction.

References:

a. Estimating and Costing for Building & Civil Engg.Works by P.L.Bhasin, S.Chand & Co., N.Delhi.
b. Estimating, Costing & Specification in Civil Engg. by M.Chakarborty, Calcutta.
c. Estimating & Costing in Civil Engg..: Theory & Practice by B.N.Dutta, S.Dutta & Co., Lucknow.
d. Building Construction Estimating by George H.Cooper, McGraw Hill Book Co., New York.

CET-410	GROUND WATER ENGINEERING	EC	3	2	0	4

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Hydrology and Irrigation Engineering

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Evaluate groundwater resources using geophysical methods
CO2	Estimate aquifer parameters
CO3	Model regional groundwater flow and design water wells
CO4	Design water wells

Syllabus:

Properties of Aquifers, Formation constants, compressibility of aqufers, Equation of motion for steady and unsteady ground water flow in isotropic homogeneous aquifers, Dupit's assumptions. Unconfined flow with a recharge, tile dtrain problem. Ground water exploration and methods of investigations.

Effect of boundaries, interference of water, leaky aquifers, Thiem's equilibrium formula for unconfined and confined aquifers and determination of hydraulic properties of aquifers. Partial penetration of an aquifer by a well, spherical flow in a well. Non equilibrium formula for aquifer(unsteady radial flows).

Tubewells, optimum capacity, silting of tubewell, design of tubewells in different aquifers, tubewell types, parts, bore hole, strains, its types, well pipe, casing pipe, blind pipe. Construction and working of tubewells, site selection, drilling operation, cable tool method, hydraulic method, rivers Rotary Method and drilling fluids, well screen assembly installation, verticality and alignment of tubewells, gravel packing, development of tubewells, sickness, inconstruction and corrosion and failure of tubewells, Pumping equipment and hydraulic testing of pumps.

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

References:

1. GroundwaterHydrology, D.K.Todd, John Wiley & Sons Inc.Newyork.
2. Groundwater, H.M.Raghunath, Wiley Eastern Ltd., N.Delhi

CET-412	ENVIRONMENTAL IMPACT ASSESSMENT	EC	3	2	0	4

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Environmental Engineering

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify the environmental attributes to be considered for the EIA study.
CO2	Formulate objectives of the EIA studies.
CO3	Identify the suitable methodology and prepare Rapid EIA.
CO4	Prepare EIA reports and environmental management plans.
CO5	Plan the methodology to monitor and review the relief and rehabilitation works.

Syllabus:

1. Environment and Human Activity:
Resources, pollution, reuse and environmental management.

2. Management of Aquatic Environment:
Water quality controls. Drainage basin activities and water pollution. The impact of human activity on aquatic resources. The control measures, regional planning.

3. Air Quality Management:
Atmosphere, effect of human activity on air quality, waste disposal alternative. Optimization, planning of waste disposal.

4. Waste Management:
Impact of waste disposal of human activity.

5. Land Use Management:
Impact of land use on human life. Control of hazards in land use, management of land use.

6. Environmental Assessment:
National environmental policy, implication of environment assessment in design process. Preparation of assessment, quantification. General requirements of environmental standards. Techniques of setting standards.

7. Case studies of EIA of river valley projects and thermal power projects.

References:

a. Environmental Impact Analysis by R.K.Jail and L.V.Urban
b. Environmental Impact Assessment by Canter
c. Environmental Impact Assessment by J.Glasson

CET-442	GEOSYNTHETICS ENGINEERING	EC	3	2	0	4

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Geo-Technology

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify the functions of geosynthetics
CO2	Select the geosynthetic products
CO3	Identify the testing methods for geosynthetics
CO4	Design geosynthetic products

Syllabus:

1. **Basic Description of Geosynthetics:**
   Historical Development, The Nomenclature, Function, Use Around The World, Applications, Development in India.
2. **Raw Materials – Their Durability And Ageing:**
   Raw Materials, Durability, Degrading Agencies, Polymers, Biological Resistance, Chemical Resistance, Weathering Resistance.
3. **Manufacturing Methods:**
   Fibres, Yarn, Nonwoven Geotextiles, Woven geotextiles, D.S.F. Fabrics.
4. **Geogrids – Testing And Evaluation:**
   Factors Influencing Testing, Sampling, Physical Properties, Mechanical Properties under Uniaxial loading, Creep Testing.
5. **Erosion Control With Geogrids:**
   Wind Erosion, Rain Water Erosion, Erosion Control Measures, Placement of Geogrid.
6. **Bearing Capacity Improvement With Geogrids:**
   Advantages, Mechanism. Modes of Failure, Friction Coefficient, Experimental Studies.
7. **Application of Geosynthetics in Water Resources Projects:**
   ***Case Studies*:** Dharoidam**,** Hiran II Dam, Meda Creek Irrigation Scheme**,** Lining of Kakarapar Canal.

References:

1. Designing with Geosynthetics, (Prentice-Hall) Robert M. Koerner
2. Engineering With Geosynthetics, (Tata McGraw-Hill) G.V. Rao & G.V.S. Raju

CET-444	TRANSPORTATION PLANNING	EC	3	2	0	4

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Design and conduct surveys to provide the data required for transportation planning.
CO2	Learn and understand zonal demand generation and attraction regression models.
CO3	Learn and understand demand distribution models (gravity models) and modal split models for mode choice analysis.
CO4	Develop and calibrate trip generation rates for specific types of land use developments.
CO5	Make final decisions among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization.

Syllabus:

1. TRANSPORT PLANNING PROCESS

Status of transportation in India. Objectives and scope of transport planning.Urban, regional and national transport planning. Transport planning process, various stages. Land use and traffic.

2. TRANSPORTATION SURVEY

Definition of study area. Zoning. Types of surveys. O-D surveys. Inventories of existing transport facilities, land use and economic activities.

3 . TRIP GENERATION

Trip purpose. Factors affecting trip generation. Trip generation estimation by multiple linear regression analysis, brief review of category analysis, advantages and limitations of these methods.

4. TRIP DISTRIBUTION

Methods of trip distribution. Basic concepts of uniform factor method, average factor method and opportunity model. Trip distribution by gravity model.

5. TRAFFIC ASSIGNMENT

Principles of assignment. Assignment techniques. All or nothing assignment. Brief review of multipath assignment, capacity restraint assignment and diversion curves.

6. MODAL SPLIT

General considerations for modal split. Factors affecting modal split. Brief introduction to various methods of modal split.

7. EVALUATION

Need for evaluation. Several plans to be formulated. Testing. Considerations in evaluation. Economic evaluation, basic principles, brief introduction to various methods of economic evaluation, comparison.

8. MASS RAPID TRANSIT SYSTEMS

Problems of Urban Transport. Introduction to MRTS. Requirements of MRTS. Types of MRTS. MRTS in India

References:

(i) Traffic Engg. And Transport Planning *by* L.R.Kadiyali, Khanna Publishers, Delhi.
(ii) Highway Engg *by* S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
(iii) Introduction to Transport Planning *by* Bruton, M.J., Hutchinson Technical Education, London.

CET-446	INTRODUCTION TO FINITE ELEMENT METHOD	EC	3	2	0	4

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Mathematical Methods, Structural Analysis

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Develop shape functions and stiffness matrices for spring and bar elements
CO2	Develop global stiffness matrices and global load vectors
CO3	Apply natural and arial coordinate systems to constant strain triangle and linear strain triangle elements
CO4	Analyze planar structural systems using finite element modelling

Syllabus:

1. **Introduction:**
   Field conditions, boundary conditions, functional approximation, finite differences method, development of finite element method.
2. **Element Properties:**
   Displacement models, relation between the nodal degrees of freedom and generalized coordinates, convergence requirements, natural co-ordinate systems, shape functions, element strains and stresses, development of element stiffness, matrix and equivalent nodal loads, static condensation.
3. **Isoparametric Elements:**
   Isoparametric, super-parametric and sub-paramatric elements, computation of stiffness matrix of isoparametric elements, convergence criteria for isoparametric elements, numerical integration technique using Gauss Quadrature.
4. **One Dimensional Element:**
   Truss element, analysis of plane truss problem, Hermitian beam element, beam on elastic foundation, solution of beam problem.
5. **Plane Stress and Plane Strain Analysis:**
   Triangular elements, rectangular elements, isoparametric elements, patch test, axisymmetric solid element.
6. **Plane Bending Analysis:**
   Displacement functions, plate bending elements, reduced integration, stress smoothing technique.
7. **Conduction Heat Transfer:**
   Formulation of finite element method for heat conduction, various weighted residual techniques, one dimensional heat conduction, two dimensional conduction heat transfer.
8. **Direct Stiffness Method of Analysis and Solution Technique:**
   Assemblage of elements, direct stiffness method, boundary conditions and reactions, Gauss elimination and matrix decompsition.

9. **Finite Element Analysis Software:**
Pre-and Post-processors finite element analysis software, error estimates and adaptive meshing.

References:

a. Krishnamurthy, C.S.,'Finite Element Analysis-Theory and Programming', TMH Pub.N.Delhi.
b. Cook, R.D.,Malkus,D.S. and Plesha,M.E.,'Concept and Applications of Finite Element Analysis', John Wiley & Sons, New York.
c. Desai, C.S. and Abel,J.F.,'Introduction to the Finite Element Method', Affiliated East-West Press Pvt.Ltd.N.Delhi.
d. Manicka Selvam,V.K.,'Finite Element Primer', Dhanpat Rai Pub.,N.Delhi.

CET-424	IRRIGATION ENGINEERING DESIGN & DRAWING (P)	CC	0 0 2	1.5

Internal: 60 Marks	End Term: 40 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Irrigation Engineering and Structural Analysis-I
Corse Outcome: On completion of the course, the students shall be able to:

CO1	Design irrigation canals and canal network
CO2	Plan and design diversion head works
CO3	Design irrigation canal structures
CO4	Analyze gravity and earth dams
CO5	Design spillways and energy dissipations works

Syllabus:
Complete design and drawing of the following:

1 Design of weirs and barrages on permeable foundation for surface and sub surface flow conditions.

2 Design of Guide Banks.

3 Flood Routing using step by step method.

4 Design of Syphon Aquaduct.

5 Design of Sarda type fall & sloping glacis fall.

6 Seepage line in a homogeneous earth dams on impermeable foundation with horizontal drainage.

7 Design of Ogee Spillway and stilling basin.

Note: Emphasis would be given to the computer aided designs of some of above structures.

CET-	ENVIRONMENTAL STUDIES	OEC	4	-	0	3.5

Internal: 50 Marks	End Term: 50 Marks	Total: 100 Marks

Pre-requisites: None

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
CO2	Estimate the population - economic growth, energy requirement and demand.
CO3	Analyse material balance for different environmental systems.
CO4	Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO5	Identify the major pollutants and abatement devices for environmental management and sustainable development

Unit 1 : Multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources :

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

• Role of an individual in conservation of natural resources.

• Equitable use of resoureces for sustainable lifestyles.

Unit 3 : Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem :-

1. Forest ecosystem
2. Grassland ecosystem
3. Desert ecosystem
4. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries

Unit 4 : Biodiversity and its conservation

Introduction – Definition : genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit 5 : Environmental Pollution

Definition, Cause, effects and control measures of -

1. Air pollution
2. Water pollution
3. Soil pollution
4. Marine pollution
5. Noise pollution
6. Thermal pollution
7. Nuclear hazards

Solid waste Management : Causes, effects and control measures of urban and industrial wastes.

• Role of an individual in prevention of pollution.

• Pollution case studies.

• Diaster management : floods, earthquake, cyclone and landslides.

Unit 6 : Social Issues and the Environment

From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rahabilitation of people; its problems and concerns, Case Studies, Environmental ethics : Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear

accidents and holocaust, Case Studies, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit 7 : Human Population and the Environment

Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Unit 8 : Field work

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain Visit to a local polluted site-Urban/Rural/Industrial/Agricultural

1. Study of common plants, insects, birds.
2. Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

CET-422	TRANSPORTATION ENGINEERING – II (P)	EC	-	-	2	1

Internal: 60 Marks	End Term: 40 Marks	Total: 100 Marks

Pre-requisites: Knowledge of Transportation Engineering-I

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Conduct traffic studies for estimating traffic flow characteristics
CO2	Characterize the pavement materials
CO3	Perform quality control tests on pavements and pavement materials
CO4	Estimate earth work from longitudinal and cross-section details

Syllabus:

1. Flakiness and Elongation Index of aggregates.
2. Specific gravity and water absorption test on aggregates.
3. Specific gravity of bitumen.
4. Proportioning of aggregates.
5. Marshall's stability test.
6. Stripping test on aggregates.
7. Determination of bitumen content.
8. CBR lab test on soil.
9. Traffic volume study using videography technique.
10. Traffic speed study using videography technique.

CET-426 to CET-450	**PROJECT I**	**CC**	0	0	4	3

Internal: 50 Marks	**End Term: 50 Marks**	**Total: 100 Marks**

Pre-requisites:

Corse Outcome: On completion of the course, the students shall be able to:

CO1	Work in a team to select a problem for project work
CO2	Review and evaluate the available literature on the chosen problem
CO3	Formulate the methodology to solve the identified problem
CO4	Apply the principles, tools and techniques to solve the problem
CO5	Prepare and present project report

LIST OF OPEN ELECTIVE-I FOR VII SEMESTER

Sr.	Course No.	Name of Subject	Remarks
1.	CET-419	Hydro Electric Power Development	
2.	CET-421	Concrete Technology	
3.	CET-423	Environmental Engg.	
4.	CET-425	Machine Foundations	
5.	COT-471	Fundamentals of Software Engg.	
6.	COT-473	Fundamentals of Database Systems	
7	COT-475	Fundamentals of Computer Hardware Technologies	
8.	COT-477	Artificial Intelligence	
9.	ET-461	Non-Conventional Energy Sources	
10.	ET-463	System Modeling and Control	Only for C and M
11.	ET-465	Fault Tolerance and Reliability Engg.	
12.	ET-467	Illumination Engg.	
13.	ET-469	Microprocessors and Applications	Only for C and M
14.	ET-431	Transducers and Applications	Only for C and M
15.	ECT-431	e-Business	
16.	ECT-433	Radio and TV Engineering	
17.	ECT-435	Acoustic Engineering	
18.	ECT-437	Measurement Systems	
19.	ECT-439	Basic Communications Engg.	
20.	MET-429	Industrial Robotics	
21.	MET-431	Cryogenic Engg.	
22.	MET-433	Industrial Noise and Control	
23.	MET-435	Computer graphics and product Design	
24.	MET-437	Piping Engg.	
25.	MET-439	Process Equipment Design	
26.	MET-441	Industrial Engg. And Organization	Not for M.
27.	CHT-463	Metals and Alloys	
28.	HuE-461	Modern Trends in Management	
29.	HuE-463	Industrial Social Responsibility	
30.	HuE-467	Development and Planning in Indian Economy	
31.	HuE-475	Advance Communication Skills in English	
32.	MaE-467	Advanced Mathematics-I	
33.	PhE-465	Lasers	
34.	PhE-467	Ultrasonics	

LIST OF OPEN ELECTIVE-II FOR VIII SEMESTER

Sr.	Course No.	Name of Subject	Remarks
1.	CET-414	River mechanics & Flood Control	
2.	CET-416	Geosynthetics Engg.	
3.	CET-418	Introduction to Finite Element Method	
4.	CET-420	Transport Planning	
5.	COT-472	Fundamentals of Operating Systems	
6.	COT-474	Fundamentals of Computer Networks	
7.	COT-476	Object Oriented Software Engg.	
8.	COT-478	Expert Systems	
9.	COT-480	Security and Cryptography	
10.	ET-462	Energy Management and Conservation	(All except E)
11.	ET-464	Robotic Dynamics and Control	
12.	ET-466	Reliability Centered Maintenance	
13.	ET-468	Process Instrumentation & Control	
14.	ET-470	ANNs and Fuzzy logic	
15.	ET-472	Control and Guidance	
16.	ET-474	Artificial Intelligence and Expert Systems	
17.	ECT-436	IC Fabrication Processes	
18.	ECT-438	Op-amp Applications	
19.	ECT-440	Theory and Application of DSP	
20.	ECT-442	Mobile Communication	
21	MET-428	Non-Conventional Energy Systems	
22.	MET-430	Value Engg.	
23.	MET-432	Pneumatics & Hydraulics Control	
24.	MET-434	Material Handling	
25.	MET-436	Computer Modeling & Software Engg.	
26.	MET-438	Air Pollution and its Control	
27.	ChT-464	Polymer Technology	
28.	HuE-462	Entrepreneurship	
29.	Hue-464	Human Resource Management	
30.	*	*Intellectual Property Rights	
31.	MaE-468	Advanced Mathematics-II	
32.	PhE-468	Non-Destructive Testing	
33.	PhE-470	Transducers & their Applications	

('*' Subject to the final approval of BOS AS & Hum.)

SCHEME OF EXAMINATION FOR B.TECH.(CIVIL) DEGREE COURSE

III SEMESTER EXAMINATION

Course No.	Subject	Teaching Schedule				Examination Schedule			
		L	T	P/D	Total	Theory	Sessional	Pract./ Viva-Voce	Total Marks	Duration of Exam. (Hrs.)
CET-201	Structural Analysis-I	3	2	-	5	100	50	-	150	3
CET-203	Building Construction Materials & Drawing		4	-	2	6	100	50	-	150	3
CET-205	Fluid Mechanics-I	3	2	-	5	100	50	-	150	3
CET-207	Surveying-I	3	1	-	4	75	50	-	125	3
CET-209	Engineering Geology		3	1	-	4	75	50	-	125	3
MAT-201	Mathematics III		3	1	-	4	75	50	-	125	3
CET-211	Structural Mechanics-I(P)		-	-	2	2	-	25	25	50	3
CET-213	Fluid Mechanics-I(P)		-	-	2	2	-	25	25	50	3
CET-215	Surveying-I(P)		-	-	3	3	-	50	25	75	3
		19	7	9	35	525	400	75	1000		

SCHEME OF EXAMINATION FOR B.TECH.(CIVIL) DEGREE COURSE
IV SEMESTER EXAMINATION

Course No.	Subject	Teaching Schedule				Examination Schedule			
		L	T	P/D	Total	Theory	Sessional	Pract./ Viva-Voce	Total Marks of Exam. (Hrs.)
CET-202	Structural Analysis-II	3	2	-	5	75	50	-	125 3
CET-204	Design of Steel Structures-I	3	-	2	5	75	50	-	125 3
CET-206	Fluid Mechanics-II	3	2	-	5	75	50	-	125 3
CET-208	Soil Mechanics	3	2	-	5	75	50	-	125 3
CET-210	Surveying-II	3	1	-	4	75	25	-	100 3
CET-212	Fluid Mechanics-II(P)	-	-	2	2	-	50	25	75 3
CET-214	Soil Mechanics(P)	-	-	2	2	-	50	25	75 3
CET-216	Surveying-II(P)	-	-	2	2	-	50	25	75 3
CET-218	Engineering Geology(P)	-	-	2	2	-	25	25	50 3
HUT-201	Industrial sociology	2	1	-	3	75	50	-	125 3
		17	8	10	35	450	450	100	1000

Note: Students shall devote 4 weeks to Survey Camp after 4th semester examination.

SCHEME OF EXAMINATION FOR B.TECH.(CIVIL) DEGREE COURSE
V SEMESTER EXAMINATION

Course No.	Subject	Teaching Schedule				Examination Schedule			
		L	T	P/D	Total	Theory	Sessional	Pract./ Viva-Voce	Marks of Exam. (Hrs.)
CET-301	Structural Analysis-III	3	2	-	5	75	50	-	125 3
CET-303	Design of Concrete Structures-I	4	2	-	6	100	50	-	150 4
CET-305	Hydrology	3	2	-	5	75	50	-	125 3
CET-307	Geotechnology-I	3	2		5	75	50	-	125 3
CET-309	Project Planning & Management	3	1	-	4	75	25	-	100 3
HUT-301	Principle of Management	3	1	-	4	75	50	-	125 3
CET-311	Structural Mechanics-II(P)	-	-	2	2	-	25	25	50 3
CET-313	Concrete Lab(P)	-	-	2	2	-	25	25	50 3
CET-315	Geotechnology (P)	-	-	2	2	-	25	25	50 3
CET-317	Survey Camp	-	-	-	-	-	100	-	100 -
		19	10		6	35	475	450	75 1000

SCHEME OF EXAMINATION FOR B.TECH(CIVIL)DEGREE COURSE
VI SEMESTER EXAMINATION

Course No.	Subject	Teaching Schedule				Examination			
		L	T	P/D	Total	Theory	Sessional	Pract./ Viva-Voce	Marks of Exam. (Hrs.)
CET-302	Design of Steel Structures-II	3	-`	2	5	100	50	-	150 3
CET-304	Irrigation Engineering-I	3	2	-	5	100	50	-	150 3
CET-306	Water Resources & Systems Engineering	3	2	-	5	100	50	-	150 3
CET-308	Geotechnology-II	3	2	-	5	100	50	-	150 3
CET-310	Transportation Engineering-I	3	1	-	4	75	25	-	100 3
CET-312	Water Supply & Treatment	3	1	-	4	75	25	-	100 3
CET-314	Transportation Engg.I(P)	-	-	2	2	-	25	25	50 3
CET-316	Environmental Engg.-I(P)	-	-	2	2	-	25	25	50 3
CET-318	Computer Applications	-	-	3	3	-	50	50	100 3
		18	8	9	35	550	350	100	1000

Note: Students shall devote 6 weeks to training after sixth semester examination outside the college campus at approved works.

SCHEME OF EXAMINATION FOR B.TECH.(CIVIL)DEGREE COURSE
VII SEMESTER EXAMINATION

Course No.	Subject	Teaching Schedule				Examination Schedule			
		L	T	P/D	Total	Theory Marks	Sessional of Pract./ Viva-Voce	Exam. (Hrs.)	
CET-401	Design of Concrete Structures-II	4	-	-	4	100	-	-	100 4
CET-403	Irrigation Engineering-II	3	1	-	4	75	25	-	100 3
CET-405	Transportation Engg.-II	3	1	-	4	75	25	-	100 3
CET-407	Sewerage & Sewage Treatment	2	1	-	3	75	25	-	100 3
CET-409	Concrete Structures-II(Drg,)	-	-	3	3	-	50	25	75 3
CET-411	Irrigation Engg.Design & Drawing	-	-	3	3	-	50	25	75 3
DEPARTMENTAL ELECTIVE-I		3	1	-	4	75	25	-	100 3
CET-413	Elements of Earthquake Engineering								
	OR								
CET-415	Rock Mechanics								
	OR								
CET-417	Advanced Traffic Engineering								
OPEN ELECTIVE-I									
CET-419 to CET-425		3	1	-	4	75	50	-	125 3
PROJECT-I		-	-	6	6	-	100	50	150 3
CET-427	Geotechnical Engineering OR								
CET-429	Transportation Engineering OR								
CET-431	Environmental Engineering								
CET-433	Practical Training Report	-	-	-	-	-	-	75	75 3
		18	5	12	35	475	350	175	1000

SCHEME OF EXAMINATION FOR B.TECH.(CIVIL)DEGREE COURSE
VIII SEMESTER EXAMINATION

Course No.	Subject	Teaching Schedule				Examination Schedule			
		L	T	P/D	Total	Theory	Sessional	Pract./ Viva-Voce	Total Marks of Exam.	Duration (Hrs.)
CET-402	Bridge Engineering	3	1	-	4	75	25	-	100	3
CET-404	Railway & Airport Engineering	3	1	-	4	75	25	-	100	3
CET-406	Industrial Waste Water Treatment	3	1	-	4	75	25	-	100	3
CET-408	Estimation & Accounts	-	-	3	3	-	25	25	50	3
DEPARTMENTAL ELECTIVE-II		3	2	-	5	75	25	-	100	3
CET-410	Ground Water Engineering OR									
CET-412	Environmental Impact Assesment									
OPEN ELECTIVE-II		3	1	-	4	75	50	-	125	3
CET-414 to CET-420										
CET-422	Transportation Engg.-II(P)	-	-	2	2	-	25	25	50	3
CET-424	Environmental Engg.II(P)	-	-	2	2	-	25	25	50	3
PROJECT-II										
CET-426	Structural Engineering OR	-	-	6	6	-	100	50	150	3
CET-428	Water Resources Engineering									
CET-430	Seminar	-	1	-	1	-	25	-	25	3
CET-432	Comprehensive Viva-Voce	-	-	-	-	-	-	75	75	3

CET-434	General Fitness & Professional Aptitude	75	3	-	--	-	-	-	75		
				15	7	13	35	375	350	275	1000