

B.TECH. THIRD YEAR

(CIVIL ENGINEERING)

(Batch 2015)

(Session 2017-2018)

SCHEME OF PAPERS

FIFTH SEMESTER (Civil Engineering)

Sr.No.	Course No.	Title	L	T	P	Credits
1.	CVE-301	Transportation Engg.-I	3	1	0	3.5
2.	CVE-302	Concrete Structure Design - I	3	1	0	3.5
3.	CVE-303	Structure Analysis - II	3	1	0	3.5
4.	CVE-304	Estimation and Costing	3	1	0	3.5
5.	CVE-305	Irrigation Engg. - I	3	1	0	3.5
6.	CVE-306	Steel Structure Design - I	3	1	0	3.5
7.	CVE-351	Transportation Engg.-I (LAB)*	0	0	2	1.0
8.	CVE-352	Structure Analysis (LAB)*	0	0	2	1.0
9.	CVE-353	Concrete Lab (LAB)*	0	0	2	1.0
10	STE - 351	Survey camp	0	0	0	6.0
			18	6	6	30.0
Total Contact Hours: 30						

- ❖ CVE 351, CVE 352 and CVE 353 are practical papers only. There will not be any theory examination for these papers.
- ❖ STE - 351 is survey camp. Duration of the survey camp will be four to six week and will be held at the end of 4th semester

Department of Civil Engineering

PunjabiUniversity, Patiala.

General Instructions to the Paper Setters

(Common for B.Tech. in Computer Engineering, Electronics and communication Engineering, Mechanical Engineering, Civil Engineering and Integrated BTech/MBA Branches)

Applicable to 2015 Batch

The B. Tech paper structure will be as shown below:

Pattern of Question Paper	
TITLE OF SUBJECT (CODE----	
Bachelor of Technology (Branch) Section:	
End Semester Exam	
TIME ALLOWED: 3 Hour	Roll. No.....
Maximum Marks: 50	
Note:- Attempt any Six questions selecting three questions from each section A and B. Section C is compulsory.	
Section-A (From Section A of the syllabus)	
Q1.	
Q2.	
Q3.	
Q4.	3x5
Q5.	
Section-B (From Section B of the syllabus)	
Q6.	
Q7.	
Q8.	
Q9.....	
Q10.....	3x5
Section-C (Common from Whole of the Syllabus)	
Q11	
a).....	
b)	
c)	
d)	
e)	
f)	
g)	
h)	
i)	
j).....	10x2=20

Note for the paper setter:

1. Numbers of questions to be set are nine (11) as per the above format.
2. Section A and B contain 10 questions of (5) marks each.
3. Section C is compulsory and contains ten sub-parts of one mark each. The answers for each question should preferably be of 2 to 3 lines.
4. The maximum limit on numerical questions to be set in the paper is 35% while minimum limit is 20% except theoretical, analysis and design papers
5. The paper setter shall provide detailed marking instructions and solution to numerical problems for evaluation purpose in the separate white envelopes provided for solutions.
6. The paper setters should seal the internal & external envelope properly with signatures & cello tape at proper place.
7. Log tables, charts, graphs, Design data tables etc. should be specified, whenever needed.
8. Use of Scientific calculator should be clearly specified.
9. There are some MBA subjects (*like BAS 202 Operational Research, MBA 5011 Foundation of Financial Accounting, MBA 5012Foundation of Managerial Accounting, MBA 5022 Foundations of Marketing, MBA 5023 Foundations of Law, MBA 5031 Foundations of Macroeconomics, MBA 5032 Foundations of Microeconomics, MBA-5033 Foundations of International Business, MBA 5013 Foundations of Finance*) where syllabus is not divided among four sections namely A, B,C,D then Question paper must be set by without specifying section in it and giving proper weightage to the respective portions.

CVE301 TRANSPORTATION ENGINEERING-I

L	T	P	Credits
3	1	0	3.5

Section-A

Introduction: Transportation and its important. 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.

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

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.

Section-B

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 Devise: Traffic control devise: 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: Index properties of soil, soil classification, 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. Marshall method of mix design. Basic concept of use of polymers and rubber modified bitumen in bituminous mixes.

Recommended Books:

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

CVE 302 CONCRETE STRUCTURE DESIGN - I

L	T	P	Crédits
3	1	0	3.5

Section-A

Introduction: reinforced concrete, definition, properties of materials, grades of concrete and reinforcing steel, stress-strain curves, permissible stresses, concrete structural systems-slabs, beams, columns and foundations, design philosophies working stress design, ultimate strength and limit state design method.

Limit State Design Method: Introduction, Limit States, Characteristic values, characteristic strength, characteristic loads, design values for materials and loads, factored loads.

Limit State Of Collapse (Flexure). Type of failures, assumptions for analysis. Analysis of beams: Moment of Resistance of singly, doubly and flanged beams.

Limit State Of Collapse (Shear, bond and torsion) Introduction - Design for shear, design of rectangular beam section for torsion, development length.

Section-B

Limit State Of Serviceability. Deflection, effective span to effective depth ratio, modification factors. Crack formation and its control.

Design of Rectangular and Flanged beams (singly reinforced and doubly reinforced sections). Analysis and design of one and two way slabs, Design of continuous beam

Design of axially and eccentrically loaded Short columns. (Uniaxial and Biaxial)
Design of Stair case. (single flight and doglegged stair)

Recommended Books:

1. Jain, A. K., Limit State Design of Reinforced Concrete, Nem Chand Brothers.
2. Ram Chandra, Limit State Design, Standard Book House.
3. Shushil Kumar, Treasure of RCC, Standard Book House.
4. S. Ramamurtham, Design of Reinforced Concrete Structure, Dhanpat Rai Publishing Comp.

References Books:

1. Pillai & Menon, Reinforced Concrete Design, Tata McGraw Hill Publishers
2. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India.
3. Sinha, S. N. and Roy, Fundamentals of Reinforced Concrete, S Chand Publishers.

CVE 303 STRUCTURE ANALYSIS - II

L	T	P	Crédits
3	1	0	3.5

SECTION: A

ANALYSIS OF STATICALLY INDETERMINATE STRUCTURES: Degree of static and kinematic indeterminacies, analysis of indeterminate beams, rigid frames and trusses by method of consistent deformation method of least work.

FIXED AND CONTINUOUS BEAMS: Analysis of fixed beams, continuous beams and propped cantilevers, fixed end moments due to different types of loadings, sinking and rotation of supports, bending moment and shear force diagrams for fixed beams and propped cantilevers, slope and deflection of fixed beams, analysis of continuous beams by the Three moment equation (Clapeyron's theorem) due to different types of loadings, effect of sinking of supports.

Analysis the beams and frames by slope-deflection method: moment-distribution method and rotation contribution method (sway and non-sway type)

.

SECTION: B

ANALYSIS OF TWO HINGED ARCHES:

Parabolic and circular Arches, Bending Moment Diagram for various loadings, Temperature effects, Axial thrust and Radial Shear force diagrams.

INFLUENCE LINES FOR STATICALLY INDETERMINATE STRUCTURES: Muller-Breslau principle for indeterminate beams.

APPROXIMATE METHODS OF STRUCTURAL ANALYSIS: Vertical and lateral load analysis of multistory frames, portal and cantilever methods and their comparison.

Recommended Books:

1. Dayaratnam, P., Advanced Structural Analysis, Tata McGraw Hill Publishers
2. Punmia, B. C. and Jain, A. K., Theory of Structures, Luxmi Publications.
3. S. Ramamrutham. Theory of structure, Dhanpat Rai Publication
4. C.S. Reddy, Basic Structural Analysis, Tata McGraw Hill Publication.
5. R.L. Jindal ,Indeterminate Structures, S. Chand & Co., New Delhi.

CVE 304 ESTIMATION AND COSTING

L	T	P	Credits
3	1	0	3.5

Section A

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.

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.

Section B

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).

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.

Recommended Books:

1. P.L.Bhasin ,Estimating and Costing for Building & Civil Engg.Works , S.Chand & Co., N.Delhi.
2. B.N.Dutta ,Estimating & Costing in Civil Engg...: Theory & PractiCVE , S.Dutta & Co., Lucknow.
3. George H.Cooper ,Building Construction Estimating by, McGraw Hill Book Co., New York.

CVE 305 Irrigation Engineering - I

L	T	P	Crédits
3	1	0	3.5

Section-A

Methods Of Irrigation: Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta and crop relation, Duty of water, relation between delta, duty and base period, Soil crop relation-ship and soil fertility, sprinkler irrigation advantages & limitations. Planning and of sprinkler irrigation, drip irrigation advantages & limitations, suitability.

Canal Irrigation: Classifications of canals, canal alignment, Inundation canals. Advantages and disadvantages of bandhara irrigation. Silt theories-Kennedy's theory, Lacey's theory. Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, suspended and bed loads. Design of unlined canals based on Kennedy & Lacey's theories.

Lined Canals: Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining

Section-B

Losses In Canals, Water Logging And Drainage: Losses in canals-Evaporation and seepage, water logging, causes and ill effects of water logging-anti water logging measures. Drainage of land, classification of drains -surface and subsurface drains. Design considerations for surface drains, Advantages and maintenance of tile drains.

Tube -Well Irrigation: Types of tube -wells -strainer type, cavity type and slotted type. Type of strainer, aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of a tube well, Assumptions, Theim & Duputi's formulae. Rehabilitation of tubewell.

River Training Works: Objectives, classification of river-training works, Design of Guide Banks. Groynes or spurs - their design and classification. Approach embankments and afflux embankments

Investigation and Preparation Of Irrigation Projects: Classification of project, Project preparation-investigations, Design of works and drawings, concept of multi -purpose projects, Major, Medium and minor projects, planning of an irrigation project, Economics & financing of irrigation works. Documentation of project report.

Recommended Books:

1. S.K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi.
2. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand, Roorke.

CVE 306 STEEL STRUCTURE DESIGN - I

L	T	P	Crédits
3	1	0	3.5

Section-A

Introduction: Loads, structural steels and their specifications, structural elements, steel vs. concrete and timber, design specifications as per IS: 800, structural layout, strength and stiffness considerations, efficiency of cross-section, safety and serviceability considerations.

Riveted/Bolted Connection: Riveting and bolting, their types, failure of riveted joint, efficiency of a joint, design of riveted joint, concentric riveted joints, advantages and disadvantages of bolted connections, stresses in bolts

Welded Connection: Types of welded joints, design of welded joint subjected to axial loads.

Compression Members: Axially loaded columns, effective length, slenderness ratio, allowable stresses, general specifications, design of axially loaded members, laced and battened columns and their design, built up compression members, eccentrically loaded columns and their design, column splice and its design.

Tension Members: Types of tension members, net area, net effective area for angles, tees, design of tension members, tension splice, and lug angles.

Section-B

Flexural Members (Beams): Design criteria, permissible stresses, laterally supported beams and their design laterally unsupported beams and their design, web buckling, web crippling.

Column Bases: Introduction, slab base, gusseted base, column base subjected to moment, grillage foundation.

Design of Steel Roof Truss: design of members for the given loads, design of riveted and welded connections, detailed working drawings.

Plate Girders: Introduction, weight and economic depth, design of flanges, design of web, curtailment of flange plates, intermediate and bearing stiffeners, design of welded plate girders, web and flange splice.

Book Recommended

- 1 Vazirani & Ratwani , Design of Steel Structures Vol.-III.Khanna Publishers
- 2 Arya & Azmani, Design of Steel Structures, Nem chand & Bros., Roorkee
- 3 Ram Chandra, Design of Steel Structures Vol.-I, Standard Book House
- 4 N. Subramanian, Design of Steel Structures, , Oxford University Press
- 5 S.K.Duggal,Steel Structures, Tata Mc Graw Hill

CVE 351 TRANSPORTATION ENGINEERING-I LAB

L	T	P	Credits
0	0	2	1.0

LIST OF EXPERIMENTS

1. Aggregate Impact Test.
2. Los-Angeles Abrasion Test on Aggregates.
3. Crushing Strength Test on Aggregates.
4. Penetration Test on Bitumen.
5. Ductility Test on Bitumen.
6. Viscosity Test on Bituminous Material
7. Softening Point Test on Bitumen.
8. Flash and Fire Point Test on Bitumen.
9. Specific gravity of bitumen
10. Proportioning of aggregate

CVE 352 STRUCTURE ANALYSIS LAB

L	T	P	Credits
0	0	2	1.0

- 1 Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
- 2 To determine the Flexural Rigidity of a given beam.
- 3 To verify the Moment-area theorem for slope and deflection of a given beam.
- 4 Deflection of a fixed beam.
- 5 Study of behavior of columns and struts with different end conditions.
- 6 Experiment on three-hinged arch.
- 7 Experiment on two-hinged arch.
- 8 Deflection of a statically determinate pin jointed truss.
- 9 Experiment on curved beams.
- 10 Unsymmetrical bending of a cantilever beam.

References Manual:

- 1. Sastry, V.V. and Kukereja, C.B., Experimental Methods in Structural Mechanics, Dhanpat Rai & Sons.

CVE 353 CONCRETE LAB

L	T	P	Credits
0	0	2	1.0

1. To Determine the Compressive Strength of Cement.
2. Design of a concrete mix in accordance with BIS and ACI guidelines.
3. To Determine the Slump, Compaction Factor and Vee-Bee Time of Concrete.
4. Determination of flexural strength of concrete.
5. Determination of split tensile strength of concrete.
6. Determine the modulus of elasticity.
7. Effect of partial replacement of Cement by fly ash on properties of concrete.
8. To determine the Compressive Strength of hardened Concrete by Non-Destructive Test.
(Rebound hammer and Ultrasonic pulse velocity)

Books/Manuals :

- 1 Concrete Manual, Dr. M.L. Gambhir, Dhanpat Rai & Sons Delhi.
- 2 Concrete Lab Manual, TTTI Chandigarh

STE 351 SURVEY CAMP

L	T	P	Credits
0	0	0	6.0

Duration of the survey camp will be a four to six week and will be held at the end of 4th semester.

B.TECH. THIRD YEAR
(CIVIL ENGINEERING)
 (Batch 2015)
 (Session 2017-2018)

SCHEME OF PAPERS

SIXTH SEMESTER (Civil Engineering)

Sr.No.	Course No.1.	Title	L	T	P	Credits
1	CVE-307	Transportation Engg.-II	3	1	0	3.5
2.	CVE-308	Geo technology - I	3	1	0	3.5
3.	CVE-309	Steel Structure Design - II	3	1	0	3.5
4.	CVE-310	Concrete Structure Design - II	3	1	0	3.5
5.		Elective - I	3	1	0	3.5
6.		Elective - II	3	1	0	3.5
7.	CVE-357	Transportation Engg.-II (LAB)*	0	0	2	1.0
8.	CVE-358	Geo Technology - I (LAB)*	0	0	2	1.0
9.	CVE-359	Water Supply (Lab)*	0	0	2	1.0
			18	6	6	24.0
Total Contact Hours: 30						

*CVE 357, CVE 358 and CVE 359 are practical papers only.
 There will not be any theory examination for these papers.

The students are required to study any one subject each from Elective - I and Elective - II

S.No.	Course No.	Elective I	L	T	P	Credits
1	CVE 311	Water Supply Engineering	3	1	0	3.5
2	CVE 312	Hydro Electric Power Development	3	1	0	3.5
3	CVE 313	River Mechanics and Flood Control	3	1	0	3.5
4	CVE 314	Design of Hydraulic Structures	3	1	0	3.5
5	CVE 315	Non-Conventional / Alternate Sources of Energy	3	1	0	3.5

S.No.	Course No.	Elective II	L	T	P	Credits
1	CVE 316	Irrigation Engg. – II	3	1	0	3.5
2	CVE 317	Introduction to Finite Element Method	3	1	0	3.5
3	CVE 318	Construction Technology	3	1	0	3.5
4	CVE 319	Rock Mechanics	3	1	0	3.5
5	CVE 320	Transport Planning	3	1	0	3.5

Punjabi University, Patiala.

(Common for B.Tech. in Computer Engineering, Electronics and communication Engineering, Mechanical Engineering, Civil Engineering and Integrated BTech/MBA Branches)

The B. Tech paper structure will be as shown below:

Note for the paper setter:

- Page 14 of 31

CVE 307 TRANSPORTATION ENGINEERING-II

L	T	P	Credits
3	1	0	3.5

Section A

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.

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.

Highway Construction: Non-Bituminous Pavements: Compacting equipments. Construction steps of Earth roads, Gravel roads, WBM roads, WMM, Construction of Cement concrete pavements. Construction of joints in Cement concrete pavements. Basic concepts of the following: use of geo-synthetics, reinforced cement concrete pavements, Modified bitumen.

Construction of Bituminous Pavements: Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of Surface dressing, BUSG, BM and BC. Mastic asphalt.

Section B

Highway Maintenance: Flexible and Cement concrete pavement failures. Maintenance operations. Maintenance of WBM, bituminous surfaces and Cement concrete pavements. Pavement evaluation. Benkleman beam. Introduction to various types of overlays.

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

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.

Tunnels: Purpose, advantages and disadvantages of tunnels, favorable conditions for tunnel construction, classification of tunnels, cross sections of tunnels. 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.

Recommended Books

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

CVE 308 GEO TECHNOLOGY-I

L	T	P	Credits
3	1	0	3.5

Section A

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.

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.

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.

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.

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.

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.

Section B

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.

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.

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.

Recommended Books

1. Gopal Ranjan & A.S.R. Rao ,Basic and Applied Soil mechanics, New Age Publisher, New Delhi
2. V.N.S. Murthy , A text book on Soil Mechanics and Foundation Engineering, U.B.S. Publisher, New Delhi
3. Parshotham Raj, Geotechnical Engg. , Tata McGraw Hill, New Delhi.
4. K.R. Arora, Soil Mechanics & Foundation Engineering, Standard Publishers, New Delhi.

CVE 309 STEEL STRUCTURE DESIGN - II

L	T	P	Crédits
3	1	0	3.5

Section – A

Design of riveted and welded joints, subjected to moment in the plane of joint and perpendicular to the plane of joint, framed connections.

Design of steel foot bridge with parallel booms, carrying wooden decking using welded joints.

Section – B

Complete design of industrial buildings

- i. Gantry girder
- ii. Column bracket
- iii. Mill bent with constant moment of inertia
- iv. Lateral and Longitudinal bracing for column bent

Design of single track Railway Bridge with lattice girders having parallel chords (for B.G.)

- i. Stringer
- ii. Cross girder
- iii. Main girders with welded joints
- iv. Portal sway bracings
- v. Bearing rocker and rollers

Recommended Books:

- 1 Vazirani&Ratwani Design of Steel Structures Vol.-III Khanna Publisher
- 2 Arya &Azmani Design of Steel Structures Nemchand Bros, Roorke
- 3 S.K.Duggal Steel Structures Tata Mcgraw Hill Publication Ltd.
- 4 Ram Chandra Design of Steel Structures Vol.-II Standard Book House Delhi

CVE 310 CONCRETE STRUCTURE DESIGN - II

L	T	P	Crédits
3	1	0	3.5

Section-A

Flats Slabs: Advantages and disadvantages of flat Slabs, Action of Flat Slab, Preliminary design of flat slabs, Basic action of two-way slab, Determination of minimum thickness of slab, Direct Design Method of flat slabs.

Beams curved in plan: Reinforced Concrete Design Circular beam loaded uniformly and supported on symmetrically placed columns,

Isolated footing: Design of Square, rectangular, circular sloped footing
Combined Footings: Different types, design of rectangular, trapezoidal, strap and raft footings, Pile Foundations.

Section-B

Retaining Walls: Types, behavior, stability requirements, design of cantilever and counterfort type retaining walls.

Domes: Analysis and design of spherical and conical domes

Water Tanks: Introduction, general design requirements on no crack basis, circular and rectangular tanks resting on ground.

Overhead tanks, intze type tanks and their design including staging and foundation.

Recommended Books:

5. Jain, A. K., Limit State Design of Reinforced Concrete, Nem Chand Brothers.
6. Ram Chandra, Limit State Design, Standard Book House.
7. Shushil Kumar, Treasure of RCC, Standard Book House.
8. S. Ramamurutham, Design of Reinforced Concrete Structure, Dhanpat Rai Publishing Comp.

ReferenCVE Books:

4. Pillai & Menon, Reinforced Concrete Design, Tata McGraw Hill Publishers.
5. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India.
6. Sinha, S. N. and Roy, Fundamentals of Reinforced Concrete, S Chand Publishers.

CVE 311 WATER SUPPLY ENGINEERING

L	T	P	Crédits
3	1	0	3.5

Section: A

PUBLIC WATER SUPPLY: Beneficial uses of water, water demand, per capita demand, variation in demand; causes, detection and prevention of wastage of water, population forecasting.

SOURCVES OF WATER SUPPLY: Surface and underground sources, relation and development of source in r/o quality and quantity of water, Development of wells, Storage reservoir-balancing and service storage, capacity determination by mass curve method. Intake and transmission system distribution systems: network design.

QUALITIY AND EXAMINATION OF WATER: Necessity for examination of water impurities in water, sampling of water, physical, chemical and bacteriological quality for domestic water supply. Drinking water quality standards and criteria.

WATER SUPPLY AND DRAINAGE OF BUILDINGS: System of water supply houses connections, matering, internal distribution, and sanitary fittings pipe joints, Different types of pipes and pipes materials.

Section: B

WATER TREATMENT: Unit operations in water treatment screening, sedimentation, and its theory sedimentation aided with coagulation, flocculation, sand filtration-slow, rapid, gravity and pressure filters, Disinfecting, Necessary: requirements of disinfectant, methods, of disinfecting different practices of chlorinating.

MISCVELLANEOUS METHODS OF WATER TREATMENT: Aeration, taste and odour control iron and manganese removal water softening processes Base exchange process, Swimming pool water Treatment

Recommended Books:

- 1 B.C. Punmia, Ashok Jain, Arun Jain. Water Supply Engineering, Lakshmi Pub. Delhi
- 2 PEAVY, ROWE. Environmental Engineering and Technology, McGraw Hill.

CVE – 312 HYDRO ELECTRIC POWER DEVELOPMENT

L	T	P	Credits
3	1	0	3.5

Section A

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, utilization factors, firm and secondary power.

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.

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

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

Section B

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

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.

Recommended Books:

- 1 Dandekar, M.M., Sharma,K.N.,Water Power Engineering Vikas Publishing House, New Delh
- 2 Brown J.G Hydro-Electric Engineering Practice Vol.I ,II & IIIBlackie & Son publications
- 3 Borrows, H.K.Water Power Engineering Mc Graw hills

CVE- 313 RIVER MECHANICS & FLOOD CONTROL

L	T	P	Credits
3	1	0	3.5

Section A

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. Hydrologic Statistics: Probabilistic treatment of hydrologic data, frequency & probability functions, statistical parameters, fitting a probability distribution, probability distribution for hydraulic variables.

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 protection works, channel improvement, cutoffs diversion, bypass channel, cutoff channel, floored ways, flood plain zeroing, spreading grounds.

Section B

Flood Mitigation by Reservoirs: Design factors, storage capacity determinations, sequent peak algorithm method, live storage, 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 economics-cost benefit ratios, optimisation of benefits.

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

Engineering Economics of Flood Control: Estimation of flood damages, estimation of benefits of flood control, cost benefit analysis of flood control project.

Recommended Books:

1. S.N.Ghosh Flood Control & Drainage Engg. Taylor & Francis
2. S.K.Garg Hydrology & Flood Control Engg. New Age International,
3. K.C.Patra Hydrology & Water Resources Engg. CRC Press

CVE-314 DESIGN OF HYDRAULIC STRUCTURES

L	T	P	Credits
3	1	0	3.5

Section A

Gravity Dams: Dam parameters, Criteria for selection of dam sites, Joints & keys, Cooling arrangement, Water stops at joints, Closing gaps, forces acting on dams, Types of loads, Elementary profile of a gravity dam, Step by step method, Stability analysis methods, Safety criteria, Gravity analysis, Internal stress calculations, Graphical determination of shear stress, Effect of foundation elasticity on stresses, Galleries, Behaviour of concrete gravity dam subjected to earthquakes, Thermal stresses.

Arch Dams: Development of arch dam, Valleys suited for arch dams, Arch dams layout, Types of arch dams, Appurtenant works, Thin cylinder theory and most economical Central angle, Design of arch dam, Suitability at abutments, Effects of foundation elasticity on the behaviours of arch dam.

Buttress Dams: Types of buttress dam, Selection of type of buttress dam, Most economical profile having no tension, Design principles, Butterss design by Unit column theory, Basic shape of buttress, Design of multiple arch dam, Provision of spillways and outlet works.

Section B

Spillways and Energy Dissipaters: Factors affecting design, Components of spillways, Types of spillways, Design principles. Hydraulic design ogee spillway, Side channel spillway, Chute spillway, Syphon spillway, Shaft-spillway, Energy dissipation below spillways, Bucket type energy dissipaters, Design of various types of stilling basins.

Weirs and Barrages: Design of weirs & barrages on permeable foundation, Khosla theory of independent variable, Upstream and downstream protection , Flownets, design of sloping Glacis weir, calculation for hydraulic jump and uplift pressure.

Recommended Books:

1. Creager, Justin & Hinds Engineering for Dams, Wiley Eastern Pvt. Ltd. Delhi.
2. R. S. Varshney Concrete dams, Oxford & IBH Pub. Co. Delhi.
3. K. B. Khushalani Dams Part-1 gravity Dams, Oxford & IBH, Delhi.

CVE-315 NON-CONVENTIONAL/ ALTERNATE SOURCES OF ENERGY

L	T	P	Credits
3	1	0	3.5

Section A

1. Introduction: Trends of energy consumption, sources of energy conventional and renewable, fossil fuel availability and limitations, need to develop new energy sources.
2. Solar energy: Solar radiation characteristics and estimation, Solar Collectors, Flat Plate and concentrating types. Their comparative study, design and material selection, efficiency, Selective paints and surfaces. Heating of air and water for building and other uses, Thermal storages, Solar Ponds, Solar pumps, solar Power, Solar Cookers etc. Direct Conversion of Solar energy to electricity and its various uses, materials, limitations and costs.
3. Bio-conversion: Generation of bio-gas, digesters and their design, selection of material, feed to digester, paralytic gasification, production of hydrogen, Algae production and their uses

Section B

4. Wind energy: Types of rotors, horizontal axis and vertical axis systems, system design and site selection.
5. Geo-thermal energy: Sites, potentiality and limitation, study of different conversion systems.
6. Tidal energy: Sites, potentiality and possibility of harnessing from site, limitations.
7. Ocean thermal energy: Principle of utilization and its limitations, description of various systems.
8. Other non-conventional energy sources: Fluidized bed combustions, heat from waste and other sources

Books -

1. Solar Energy Utilization : G.D. Rai
2. Solar Heating and Cooling : Duffie and Beckman
3. Power Plant Technology : M.M. EL. Wakil
4. Power Plant Engineering : P.C. Sharma

CVE 316 IRRIGATION ENGINEERING - II

L	T	P	Crédits
3	1	0	3.5

Section-A

Theories of Seepage: Seepage force and exit gradient, salient features of Bligh's Creep theory, Lane's weighted Creep theory and Khosla's theory, Determination of uplift. Pressures and floor thickness.

Design of Weirs: Weirs versus barrage, design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir energy

Dissipation Devices: Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipators and their hydraulic design.

Diversion Head Works: Functions and investigations: component parts of a diversion head work and their design considerations, silt control devices.

Section-B

Distributory Regulators: Offtake alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape.

Canal Falls: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.

Cross-Drainage works: Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types and design considerations, super passages, canal siphons and level crossing.

Canal Out-lets: Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality, sensitivity, sensitiveness, etc. Details and design of non-modular, semi-modular and modular outlets.

BOOK SUGGESTED

1. B.C. Punmia & Pande B.B. Lal. Irrigation and Water Power Engg.
2. S.R. Sahasrabudhe. Irrigation Engg. and Hydraulics Structures Katson Pub. House
3. Dr. Bharat Singh Fundamentals of Irrigation Engg Nem Chand and Bros

L	T	P	Credits
3	1	0	3.5

Section A

Introduction: Field conditions, boundary conditions, functional approximation, finite differences method, development of finite element method.

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.

Isoparametric Elements: Isoparametric, super-parametric and sub-parametric elements, computation of stiffness matrix of isoparametric elements, convergence criteria for isoparametric elements, numerical integration technique using Gauss Quadrature.

One Dimensional Element: Truss element, analysis of plane truss problem, Hermitian beam element, beam on elastic foundation, solution of beam problem.

Section B

Plane Stress and Plane Strain Analysis: Triangular elements, rectangular elements, isoparametric elements, patch test, axisymmetric solid element.

Plane Bending Analysis: Displacement functions, plate bending elements, reduced integration, stress smoothing technique.

Conduction Heat Transfer: Formulation of finite element method for heat conduction, various weighted residual techniques, one dimensional heat conduction, two dimensional conduction heat transfer.

Direct Stiffness Method of Analysis and Solution Technique: Assemblage of elements, direct stiffness method, boundary conditions and reactions, Gauss elimination and matrix decomposition.

Recommended Books:

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

CVE-318 CONSTRUCTION TECHNOLOGY

L	T	P	Credits
3	1	0	3.5

Section A

Setting out of works: Important Survey Methods; Concrete Technology; Structural Steel Fabrication and Erection Methods & Procedures, Temporary Structures – Staging & Storage Works; Conventional Formwork Systems; Plant layout & Material Handling; Prefab Construction.

Basic Methods in Foundation Engg.: Building Finishes; Different types of flooring & best practices, External and Internal wall finishes, coatings and claddings, False Ceilings, finishes in Entrance lobbies.

Section B

Construction Equipment: Sub systems, Ground Drive, Wire Ropes, Belts, Tires, Electrical motors, Bearings Static Plants – Compressors, Generators, Water pumps, Crushers. Brief details of Excavation and Earth moving and other equipments, Properties, maintenance and schedules.

Materials management: Importance, scope, objective and function. Integrated approach to materials management. Classification of construction materials, Estimating of materials requirement, planning, Procurement.

Recommended Books:

1. Mehta P.K and Monterio P.M Concrete Microstructure, Properties and Materials, 3rd edn. McGraw Hill New York 2006
2. Rangwals S.C Rangwala K.S & Rangwala KK, Construction of Structure & Management of works, 3rd edn. Charotar Publishing House, Anand, 2000.
3. Ahuja K.K., Material Management, 1st ed., CBS Publishers and Distributors reprint, 1999.
4. Gopalkrishnan p., Handbook of Materials Managements, Prentice Hall Of India, New Delhi 1998.
5. Varma, Mahesh., Construction Equipment and its Planning and application, Metropolitan Book Company (p) Ltd., 1994 (Reprint-Solution)

L	T	P	Credits
3	1	0	3.5

Section A

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.

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.

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.

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. Hydraulic fracturing Techniques.

Section B

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.

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

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

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

Recommended Books:

- 1 Jaeger and Cook Fundamentals of Rock Mechanics Wiley Publisher
- 2 Stagg & Zienkiewicz Rock Mechanics. Springer publisher
- 3 Obert & Duvell Rock Mechanics & Design of Structures in Rocks Wiley Publisher

L	T	P	Credits
3	1	0	3.5

Section A

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.

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

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.

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

Section B

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

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

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.

Mass Rapid Transit Systems: Problems of Urban Transport. Introduction to MRTS. Requirements of MRTS. Types of MRTS. MRTS in India

Recommended Books:

- 1. L.R.Kadiyali ,Traffic Engg. And Transport Planning , Khanna Publishers, Delhi.
- 2. S.K.Khanna & C.E.G. Justo ,Highway Engg , Nem Chand Bros., Roorkee.
- 3. Bruton, M.J, Introduction to Transport Planning, Hutchinson Technical Education, London.

CVE – 357 TRANSPORTATION ENGINEERING-II LAB

L	T	P	Credits
0	0	2	1.0

- Flakiness and Elongation Index of aggregates.
- Specific gravity and water absorption test on aggregates.
- Marshall’s stability test.
- Stripping test on aggregates.
- Determination of bitumen content.
- CBR lab test on soil.
- Soundness Test
- Demonstration of roughness measurement (by fifth wheel bump integrator)
- Demonstration of Benkelman Beam deflection test

CVE – 358 GEOTECHNOLOGY-I LAB

L	T	P	Credits
0	0	2	1.0

List of Experiments:

- 1. Determination of water content
- 2. Determination of Specific Gravity by Pycnometre bottle
- 3. Grain size Analysis by Mechanical Method
- 4. Determination of Atterberg’s limit.
- 5. Grain size Analysis by Hydrometer Method
- 6. Determination of field density by Core cutter method .
- 7. Determination of field density by Sand replacement method
- 8. Proctor’s Compaction Test

CVE 359 ENVIRONMENT ENGINEERING (LAB)

		L	T	P	Credits
		0	0	2	1.0
1	To measure the PH value of a sample				
2	To find the turbidity of a given sample				
3	To find B.O.D. of a given sample				
4	To measure D.O. of a given sample				
5	Determination of Hardness of a given sample				
6	Determination of total solids, dissolved solids, suspended solids of a given sample				
7	To determine the concentration of sulphates in water/wastewater sample.				
8	To find chlorides in a given sample				
9	To find acidity/alkalinity of a given sample				
10.	To determine the COD of a wastewater sample.				