

Bachelor of Technology (CIVIL Engineering), KUK
Credit-Based (2018-19 Onwards)
SCHEME OF STUDIES/EXAMINATIONS (Semester -V)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)			Total	Duration of exam (Hours)
						Major Test	Minor Test	Practical		
1	HM-255A	Professional Practice, Law & Ethics	2:0:0	2	2	75	25	0	100	3
2	CE-301A	Structural Analysis-II	2:1:0	3	3	75	25	0	100	3
3	CE-303A	Design of Concrete Structure-I	3:0:0	3	3	75	25	0	100	4
4	CE-305A	Hydrology	2:0:0	2	2	75	25	0	100	3
5	CE-307A	Geotechnical Engineering	3:0:0	3	3	75	25	0	100	3
6	CE-309A	Concrete Technology	2:0:0	2	2	75	25	0	100	3
7	CE-311LA	Structural Analysis-II Lab	0:0:2	2	1	-	40	60	100	3
8	CE-313LA	Concrete Technology Lab	0:0:2	2	1	--	40	60	100	3
9	CE-315LA	Geotechnical Engineering Lab	0:0:2	2	1	--	40	60	100	3
10	CE-317A	Survey Camp	0:0:0	0	0	--	100	50	150	
		Total	14:1:6	21	18	450	370	230	1050	

Note: All students have to undertake the Survey Camp for 2 weeks after 4th semester which will be evaluated in 5th semester.

**Bachelor of Technology (CIVIL Engineering), KUK
Credit-Based**

SCHEME OF STUDIES/EXAMINATIONS (Semester -VI)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						Major Test	Minor Test	Practical	Total	
1	CE-302A	Design of Steel Structure-II	3:0:0	3	3	75	25	0	100	3
2	CE-304A	Transportation Engineering	3:0:0	3	3	75	25	0	100	3
3	CE-306A	Irrigation Engineering	2:0:0	2	2	75	25	0	100	3
4	OE-I	Open Elective-I	3:0:0	3	3	75	25	0	100	3
5	EL-I	Elective-I	2:0:0	2	2	75	25	0	100	3
6	EL-II	Elective-II	2:0:0	2	2	75	25	0	100	3
7	CE-310LA	Transportation Engineering Lab	0:0:2	2	1	-	40	60	100	3
8	CE-312LA	ENVIRONMENTAL ENGINEERING-I (P)	0:0:2	2	1	-	40	60	100	3
9	CE-314LA	Irrigation Engineering Design & Drawing	0:0:3	3	1.5	--	40	60	100	3
10	*MC-902	Constitution of India*	3:0:0	3	0	75	25	0	100	3
		Total	18:0:7	25	18.5	525	295	180	1000	

Note: (1) ***MC-902** is a mandatory credit-less course in which the students will be required to get passing marks in the major test

SIM-903 is a credit course in which the students will be evaluated for the Summer Internship (training) undergone after 6th semester and whose credit will be evaluated in 7th semester.

OPEN ELECTIVE-I

S. No	Code No.	Subject	Semester	Credits
1.	OE-308A	Soft Skills and Interpersonal Communication	VI	3
2.	OE-310A	Introduction to Art and Aesthetics	VI	3
3.	OE-312A	Human Resource Development and Organizational Behavior	VI	3

ELECTIVE-I

Sl. No	Code No.	Subject	Semester	Credits
1.	EL-322A	Structure Dynamics	VI	3
2.	EL-324A	Solid and Hazardous waste Management	VI	3
3.	EL-326A	Engineering Geology	VI	3
4.	EL-328A	Ground Water	VI	3

ELECTIVE-II

S.No	Code No.	Subject	Semester	Credits
1.	EL-330A	Repair & Rehabilitation of Structures	VI	3
2.	EL-332A	Construction Engineering & Management	VI	3
3.	EL-334A	Structure Analysis by Matrix Method	VI	3
4.	EL-336A	Disaster Preparedness & Planning	VI	3

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
HM-255A	Professional Practice, Law & Ethics	2	-	25	75	100	4 Hr
Course Objective	To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.						
Unit	Course Outcome						
I	To familiarise the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession						
II	To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour						
III	To give an understanding of Intellectual Property Rights, Patents.						
IV	To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession						

UNIT-I

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

UNIT-II

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

UNIT-III

General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /" Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms; UNIT-IV

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

Text/Reference Books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. RERA Act, 2017
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press
9. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
11. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House

Code	Nomenclature of Subject	L	T	In t.	Ext.	Total	Time
CE-301A	STRUCTURAL ANALYSIS-II	2	1	2 5	75	100	3 Hr
Course Objective	Students will acquire the knowledge about the methods of analysis of different structures.						
Unit	Course Outcome						
I	Students will be able to study behavior in the form of S.F and B.M for continuous beams by influence line method						
II	Students will be able to analyze the behavior of rolling load on structures and fixed arches						
III	Students will be able to analyze the frames structures						
IV	Students will be able to study about methods for stiffness and flexibility.						

UNIT-I

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. Influence Line for statically indeterminate Beams: Muller-Breslau Principle, I.L. for B.M. & S.F. for continuous Beams

UNIT-II

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. Fixed Arches: Expression for Horizontal Thrust and Bending Moment at a section, Elastic centre

UNIT-III

Kani's Method: Analysis of continuous beams and simple frames, analysis of frames with different column lengths and end conditions of the bottom story.

UNIT-IV

Approximate Analysis of frames: (i) For vertical loads, (ii) for lateral loads by Portal method & Cantilever method. 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.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Books Recommended:

1. Indeterminate structures, R.L. Jindal S.Chand & Co., N.Delhi.
2. Advanced Structural Analysis-A.K.Jain, NemChand & Bros., Roorkee.
3. Structural Analysis-A Unified Approach, D.S.Prakash Rao,, University Press, Hyderabad.
4. Structural Analysis-A unified classical & Matrix Approach, A.Ghali & A.M.Neville, Chapman & Hall London.
5. Theory of Structures-Vol. I&II-S.P.Gupta & G.S.Pandit, Tata McGraw Hill, N.Delhi.
6. Basic Structural Analysis –C.S. Reddy, Tata McGraw Hill, New Delhi.
7. Structural Analysis –III, Amit Raheja. Professional Publication, Ambala cantt

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
CE-303A	DESIGN OF CONCRETE STRUCTURES-I	3	-	25	75	100	3 Hr
Course Objective	To learn about the design of different types of structures by using reinforced cement concrete (RCC)						
Unit	Course Outcome						
I	Students will be able to study the design philosophies of different methods for RCC structures.						
II	Students will be able to design of RCC beams using working stress and limit state method.						
III	Students will be able to design of RCC columns and footing using working stress and limit state method.						
IV	Students will be able to design of RCC slab and retaining walls and detailing of steel using working stress and limit state method.						

UNIT-I

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,

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.

UNIT-II

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.

Limit State Method:

Basic assumptions, Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement, and design examples.

UNIT-III

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.

Columns and Footings:

Effective length, Minimum eccentricity, short columns under axial compression, Uniaxial and biaxial bending, slender columns, Isolated and wall footings,

Design examples.

Serviceability Limit State:

Control of deflection, cracking, slenderness and vibrations, deflection and moment relationship for limiting values of span to depth, limit state of crack width, Design examples.

UNIT-IV

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.

One way and Two Ways Slabs:

General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Nonrectangular slabs, openings in slabs, Design examples.

Retaining Walls:

Classification, Forces on retaining walls, design criteria, stability requirements, Proportioning of cantilever retaining walls, counterfort retaining walls, criteria for design of counterforts, design examples.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections. **Time Duration: 4 Hours.**

Books:

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 Concrete 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.
7. Reinforced Concrete Design – Pillai and Menon, TMH, New Delhi.

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
CE-305A	HYDROLOGY	2	-	25	75	100	3Hr
Course Objective	Hydrology is the scientific study of the movement, distribution, and quality of water on Earth and other planets, including the water cycle, water resources and environmental watershed sustainability.						
UNIT	Course Outcome						
I	Students will be able to get better knowledge about the total precipitation in the particular area using different rain gauges						
II	Students will be able to measure the evaporation, transpiration and infiltration and can analyze the measured data.						
III	Students will be able to calculate the total runoff and able to draw hydrographs for the different durations of rainfall and can predict the future runoff.						
IV	Students will be able to get the knowledge of ground water, its quality and efficiency of the ground storage.						

UNIT-I

Introduction:

Hydrologic cycle, scope and application of hydrology to engineering problems, drainage basins and its characteristics, stream geometry, hypsometric curves.

Precipitation:

Forms and types of precipitation, characteristics of precipitation in India, measurement of Precipitation, recording and non-recording rain gauges, rain gauge station, rain gauge 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.

UNIT-II

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.

Infiltration:

Infiltration process, initial loss, infiltration capacity and measurement of infiltration, infiltration indices.

UNIT-III

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.

Floods and Flood Routing:

Flood frequency studies, recurrence interval, Gumbel's Method, flood routing, reservoir flood routing, channel flood routing and flood plain mapping.

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.

UNIT-IV

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.

Ground Water Quality:

Indian and International standards, pollution of ground water and possible source, remedial and preventive measures.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Books:

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

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
CE-307A	Geotechnical Engineering	3	-	25	75	100	3 Hr
Course Objective	The subject gives a better idea about the soil and its properties & also design of types of foundation.						
UNIT	Course Outcome						
I	Students will be able to study the sub-surface soil and its properties and methods of sampling and testing.						
II	Students will be able to study the different types of shallow foundation and its design.						
III	Students will be able to study the different types of pile foundation and its design.						
IV	Students will be able to study the different types of. Drilled Piers and Caisson Foundations and their design.						

UNIT-I

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 & interpretation, geo-physical methods, pressure-meter test, exploration logs. **Drainage & Dewatering:** Introduction, ditches and sumps, well point systems, shallow well system, deep well drainage, vacuum method, Electro-osmosis, consolidation by sand piles, Eductor method.

UNIT-II

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, I.S Code recommendations, factors affecting bearing capacity, methods of improving bearing capacity.

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.

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.

UNIT-III

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.

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.

UNIT-IV

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.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Books Recommended:

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 Shamsheer Prakash, McGraw Hill
5. Foundation Design by Teng, Prentice Hall
6. Soil Mechanics & Foundation Engineering by Bharat Singh, Shamsheer Prakash, Nem Chand & Bros, Roorkee.
7. Soil Mechanics and Foundation Engineering by Alam Singh.

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
CE-309A	CONCRETE TECHNOLOGY	2	-	25	75	100	2 Hr
Course Objective	To have better understanding about the various properties of materials and ingredients of concrete.						
UNIT	Course Outcome						
I	Students will be able to study the construction materials like Cement & Aggregates and its properties						
II	Students will be able to design concrete and perform test on concrete on various strength parameters, modifying its properties using other substances.						
III	Students will be able to study various effects on concrete & its non-destructive tests for properties evaluation.						
IV	Students will be able to study about methods of repairing and design of special concrete.						

UNIT-I

Introduction: Introduction of Concrete, preparation of concrete, grades of concrete, advantages of concrete, concept of quality control.

Cement: Introduction of Cement, ingredient in cement. basic chemistry, 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, colored Portland cement, Field and laboratory tests on cement. Pozzolanic materials, Fly ash, metakaoline, GGBS, iron slag, rise husk ash - its types, properties, applications & limitations.

Aggregates: Aggregates, classification of aggregates based on petrography, size, shape and textures, deleterious substances in aggregates, bulking of fine aggregates, sieve analysis, grading of aggregates as per IS-383-1970, fineness modulus, Maximum size of aggregate, Quality of mixing water, curing water.

UNIT-II

.Production of Concrete: Introduction, Design of mix by IS & ACI methods including 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.

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.

UNIT-III

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.

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.

UNIT-IV

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.

Special Concrete: Light weight concrete, definition and its properties, applications, high strength concrete, definitions, its properties and applications, Mass Concrete, waste material based concrete, shotcrete, fiber reinforced concrete: Materials Fibres types and properties, ferrocement, polymer concrete composites, heavy weight concrete for radiation shielding.

Prestressed Concrete: Introduction, basic concepts, classifications and types of prestressing, prestressing systems, and properties of materials, pre tensioned and post tensioned concrete elements.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

TEXT BOOKS

1. Neville A M and Brookes J J "Concrete Technology" Pearson Publishers, New Delhi, 1994.
2. Neville A M "Properties of Concrete" Pearson Publishers, New Delhi, 2004.
3. Gambhir M L "Concrete Technology" Tata McGraw Hill, New Delhi, 1995.
4. Shetty M S "Concrete Technology" S. Chand & Company, New Delhi, 2002.
5. Mehta P K "Microstructure of Concrete" Indian Concrete Institute and ACC, Bombay.

Code	Nomenclature of Practical	P	External	Session	Total	Time
CE-311LA	STRUCTURAL ANALYSIS –II (P)	2	60	40	100	3H
Course Objective	To make students acquire the knowledge of methods of analysis of structure fitness for use, physical test and determining the effects of load in a structure					

LIST OF EXPERIMENTS

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 deformer- verification of Muller Breslau principle.
5. Experimental and analytical study of an elastically coupled beam.
6. Determine the Forces in members of redundant frames.
7. Sway in portal frames - demonstration.

References:

1. A Laboratory Manual on Structural Mechanics by Dr. Harwinder Singh; New Academic Publishing Comp. Ltd.
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Code	Nomenclature of Practical	P	External	Session	Total	Time
CE-313LA	CONCRETE TECHNOLOGY (P)	2	60	40	100	3H
Course Objective	To have better understanding about the various properties of materials used for preparation of concrete, Design of concrete by IS method and different tests to evaluate the strength of concrete.					

LIST OF EXPERIMENTS

1. To determine the standard consistency and initial and final setting time of cement using Vicat's apparatus.
2. To determine the Fineness of cement by Sieve analysis and Blaine's air permeability method.
3. To determine the (1) specific gravity of cement (2) Soundness of cement by Le Chatelier's apparatus.
4. To determine the Compressive strength of cement.
5. To Determine the Fineness Modulus, Bulk Density, Water Absorption and Specific gravity of Fine Aggregates.
6. To Determine the Fineness Modulus, Bulk Density, Water Absorption and Specific gravity of Coarse Aggregates.
7. Mix Design of Concrete by IS methods.
8. Workability of cement concrete by (1) Slump test, (2) Compaction factor test, (3) Flow table test.
9. To Determine the Compressive strength of concrete by (1) Cube test, (2) Cylinder test.

10. To Determine the Split Tensile and Flexural strength of Concrete.
11. To Determine the Bond strength between steel bar and concrete by pull-out test.
12. To evaluate the Non-destructive testing of concrete by (1) Rebound hammer, (2) ultrasonic pulse velocity test.
13. To Determine the Compressive strength of Brick and Tile as IS standard.

Books Recommended:

1. Concrete Manual-M.L.Gambhir, Dhanpat Rai & Sons, N.Delhi.
2. Concrete Technology-M.L.Gambhir, Tata McGeraw Hill, N.Delhi.
3. Concrete Technology – Nevellie, Pearson Education.

Code	Nomenclature of Practical	P	External	Sessional	Total	Time
CE-315LA	Geotechnical Engineering Lab	2	60	40	100	3H
Course Objective	The subject gives better idea about the soil and its properties which are very useful in design of types of foundation.					

LIST OF EXPERIMENTS

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.

Books:

1. Soil Testing for Engineers by S.Prakash & P.K.Jain, Nem Chand & Bros.,Roorkee.
2. Engineering Soil Testing by Lambi, Wiley-Eastern.
3. Engineering Properties of Soils & Their Measurement by JE Bowles, McGraw -Hill.
4. Soil Engineering in Theory & Practice by Alam Singh, Vol. II, Geotechnical Testing & Instrumentation, CBS Pub.

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
CE-302A	DESIGN OF STEEL STRUCTURES-II	3	-	25	75	100	3 Hr
Course Objective	To Impart knowledge and ability to design various steel structures.						
UNIT	Course Outcome						
I	Students will be able to familiar with the Elementary Plastic Analysis and Design of steel structures.						
II	Students will be able to design steel water tank and steel stacks and their stability checks.						
III	Students will be able to design steel towers and Cold Formed Sections and their stability checks.						
IV	Students will be able to design steel industrial building and their stability checks.						

UNIT-I

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.

UNIT-II

Design of Water Tanks:

Introduction, permissible stresses, design of circular, rectangular and pressed steel tanks including staging.

Design of Steel Stacks:

Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation.

UNIT-III

Towers:

microwave towers, Design loads, classification, design procedure and specification.

Cold Formed Sections:

Introduction and brief description of various types of cold formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, design of compression and bending elements.

UNIT-IV

Industrial Buildings:

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

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Books:

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, MGH, New york/International Students Ed.
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.

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
CE-304A	TRANSPORTATION ENGINEERING	3	-	25	75	100	3 Hr
Course Objective	The study of safe & optimum geometric design of highways & fundamental parameters of highway materials.						
UNIT	Course Outcome						
I	Students will able to study the history review of roads and development of their concern authorities.						
II	Students will study about geometric design and their cross sectional elements of highways.						
III	Students will study about regulation and safe movements of the traffic.						
IV	Students will study about different fundamental parameters of highway materials.						

UNIT-I

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.

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.

UNIT-II

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), ri axial 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.

UNIT-III

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 super-elevation. Providing super- elevation 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.

UNIT-IV

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.

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 construction of bituminous roads: bitumen boiler, sprayer, pressure distributor, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MOST specifications.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Books:

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.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
CE-306A	IRRIGATION ENGINEERING	2	-	25	75	100	3 Hr
Course Objective	The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.						
UNIT	Course Outcome						
I	Students will be able to understand the methods and management of irrigation						
II	Students will be able to gain knowledge on types of Impounding structures						
III	Students will be able understand methods of irrigation including canal irrigation.						
IV	Students will be able understand water management on optimization of water use.						

UNIT I

CROP WATER REQUIREMENT

Need and classification of irrigation- historical development and merits and demerits of irrigation- types of crops-crop season-duty, delta and base period- consumptive use of crops- estimation of Evapotranspiration using experimental and theoretical methods

UNIT II

IRRIGATION METHODS

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation
– design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies.

UNIT III

DIVERSION AND IMPOUNDING STRUCTURES

Types of Impounding structures - Gravity dam – Forces on a dam -Design of Gravity dams; Earth dams, Arch dams- Diversion Head works - Weirs and Barrages-

CANAL IRRIGATION

Canal regulations – direct sluice - Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining - Kennedy's and Lacey's Regime theory-Design of unlined canal

UNIT IV

WATER MANAGEMENT IN IRRIGATION

Modernization techniques- Rehabilitation – Optimization of water use-Minimizing water losses- On farm development works-Participatory

irrigation management- Water resources associations- Changing paradigms in water management-Performance evaluation-Economic aspects of irrigation

TEXTBOOKS:

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCES:

1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw- Hill Inc., New Delhi, 1997

OE- 308A	Soft Skills & Interpersonal Communication						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic understanding of Communication						
CO2	Understand the process of communication and speaking						
CO3	Develop the Personality concepts and its implementation						
CO4	Develop the basic of Group Discussion and interviews						

UNIT-I

Communication: Introduction Verbal, Non-Verbal, kinesics, proxemics, chronemics, Types of communication, extrapersonal communication, intrapersonal communication, intrapersonal communication, mass communication, Creativity in communication, Role of communication, flow of Communication and its need, Persuasive communication and negotiation; Time management in Persuasive communication, Importance of Persuasive Communication

UNIT-II

Barriers in the way of communication, noise, intrapersonal barriers, interpersonal barriers, organizational barriers, Extrapersonal barriers, Basics of communication: importance of communication, process of communication, objectives and characteristics of communication, Communication skills: Accent, Intonation, Phonetics, Speaking skills, Confidence, clarity, Fluency, Quality, pronunciation

UNIT-III

Personality Development; what is personality? Role of personality, Heredity, Environment, situation, Basics of personality, Soft skills; Needs and training, Activity in soft skills, Organizational skill; Introduction and its need, basics principles for Organization skills, Stress management; Introduction, Stress at home and office, Stress prevention, analyze the model of stress.

UNIT-IV

Group discussion, form of Group discussion, strategy for Group discussion, discussing problems and solution, Oral presentation, introduction, planning, Occasion, Purpose, Modes of delivery, Resume making; Purpose of Resume, Resume design and structure, contents in Resume, types of resume, Job interview, introduction, objective of Interview, types of interview, stages of interview, Face to face interview and campus interview

Text Books:

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication

Reference Books:

1. Personality Development and soft skills by Barun K. Mitra, Oxford Publication

2. Communication Skills For Engineers by C.Muralikrishna and Sunita Mishra, PearsonPub.

Note: The paper setter will set the paper as per the question paper templates provided.

Code	Nomenclature of Subject	L	T	Int.	Ext	Tota l	Tim e
OE-310A	Introduction to art and aesthetics	3	-	25	7 5	100	3 Hr
Course objective	The course will examine the role and development of the visual arts in past and present cultures throughout the world.						
UNIT	Course Outcome						
I	To help students to develop art application, aesthetic judgment						
II	To increase visual perception and critical thinking skills						
III	To gain the knowledge of architecture.						
IV	To know the different styles in Interior design and furniture design						

Unit-1

Movement in Art in the 18th and 19th Century. Neoclassicism - Romanticism – Impressionism – Monet and contemporary artists - Post Impressionism - Van Gogh and contemporaries.

Movements in art in the 20th Century. Fauvism – Cubism – Picasso – Braque - Expressionism - Futurism – Dadaism - Duchamp - Surrealism - Dali - Abstract Expressionism – Pollock - Warhol - Constructivism - De Stijl - Bauhaus School and Gropius - Conceptual Art - Site Specific Art- Op Art – Neo-Expressionism.

Unit-2

Rajasthani Architecture - Islamic Architecture : Tajmahal, Charminar, Golgumbaz, Fatehpur Sikri -Colonial Architecture in India at Lucknow, Patna, Kolkota. – Painting schools in Medieval India – Malwa, Deccan and Jodhpur Schools – Mughal and Rajput Painting – Mysore and Tanjore Paintings – Kangra, Madhubani and Pattachitra Styles.

Art & Architecture in Kerala – Traditional Architecture – Traditional Wood Carvings and Mural Paintings.

Unit-3

Indian Art in 19th and 20th Centuries. European influence in Indian Art, Company School, Raja Ravi Varma - Realistic academic painting & sculpture. Revivalist movement - Bengal school - Abanidranath Tagore – Nandalal Bose – Ramkinker Baij – Jamini Roy – Amrutha Shergil - Post – Independent developments in Indian Art: Progressive art Movements – Kolkata, Mumbai, Chennai - Souza – Hussain – Ara - Raza – Madras School: KCS Panicker and followers.

Unit-4

Different styles in Interior Design and Furniture Design: Egyptian, Rococo, Art Deco, Bauhaus, Modernism and Post Modernism, Minimalism, Eclecticism, High tech & hard edge style – Eastern influences.

REFERENCE

- 1.The Story of Art : E. H. Gombrich
- 2.A People's History of the World : Chris Harman
- 3.Gardner's Art Through the Ages: The Western Perspective : Fred S. Kleiner
- 4.The Social History of Art Volume III & IV : Arnold Hauser
- 5.Indian Art : Parthe Mitter 6. Indian Art: A Concise History : Roy C Craven

OE- 312A	Human Resource Management and organizational behaviour						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic understanding Human Resource Management						
CO2	Understand the process of Human resource training and development						
CO3	Develop the Leadership quality						
CO4	Develop the concept of formal and informal organizational behaviour						

UNIT – 1

HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD, Human Development and HRD, HRD at Macro and Micro Climate.

HRD–Micro Perspective: Areas of HRD, HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards, Employee Welfare and Quality of Work Life and Human

Resource Information, Staffing for HRD, Roles of HR Developer, Physical and Financial Resources for HRD, HR Accounting, HRD Audit, Strategic HRD

UNIT – 2

Instructional Technology for HRD : Learning and HRD, Models and Curriculum, Principles of Learning, Group and Individual Learning, Transactional Analysis, Assessment Centre, Behaviour Modeling and Self Directed Learning, Evaluating the HRD

Human Resource Training and Development : Concept and Importance, Assessing Training Needs, Designing and Evaluating T&D Programmes, Role, Responsibilities and challenges to Training Managers.

Training Methods: Training with in Industry (TWI): On the Job & Off the Job Training, Management Development: Lecture Method, Role Play, Simulation, Globalization challenges and Strategies of Training Program, Review on T&D Programmes in India.

UNIT – 3

Motivation: Types of Motives, Theories of Maslow, Herzberg, McGregor, Alderfers, Porter and Lawler's Model; Job Enlargement, Job Enrichment, Behaviour Modification. Leadership : Concept, Leader Vs. Manager; Classical Studies on Leadership, Trait Theories, Behavioral Theories, Group and Exchange Theories; Contingency Theory of Leadership, Leadership Styles.

UNIT – 4

Formal and Informal Organisations: Origin of Formal and Informal Organisations, Problems Associated with Informal Organisations.

Organisational Effectiveness (OE) : Concept; Approaches to O E, Adoptive Coping Cycle for Effectiveness; Achieving OE, Organisational Climate: Concept, Determinants of Organisational Climate, Physical Environment; Values and Norms

Organization Theory: Classical Theory; Neo-Classical Theory, Modern Behavioural Theories, contingency theory, system theory, modern structural models, Organizational Culture, Creating and Sustaining Culture, Work Culture

Books recommended

1. Nadler, Leonard : Corporate Human Resource Development.
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd, New Delhi , 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi , 2004.
4. Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi .
5. Luthans, Fed : Organisational Behaviour, Tata McGraw-Hill Co. New Delhi , 2004.
6. Stephen, P. Robins : Organisational Behaviour, Prentice-Hall of India Pvt., Ltd., 2004.
7. John, W. NMewstrom & Davis, Ketih : Organisational Behavior (Human Behavior at Work), Tata McGraw-Hill, New Delhi , 2002.
8. Bhatia, Hans Raj : General Psychology, Oxford and IBH Publishers, New Delhi .

ELECTIVE-1

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-322A	Structural Dynamics	2	-	25	75	100	3 Hr
Course Objective	To understand the behaviour of dynamic loading. Study the effect of earthquake loading on the behaviour of structures. Understand the codal provisions to design the structures as earthquake resistant.						
UNIT	Course Outcome						
I	Students will be trained to identify, formulate and solve complicated problem.						
II	Students will be able to understand the role of natural calamity in the damage of structures.						
III	Students will be able to develop the skill to analyse data and to apply the same in the practical problems.						
IV	Students will be able to apply the developed methodologies for the safe and stable design of structures						

UNIT-I

Introduction: Objective, difference between static and dynamic analysis, loading, essential characteristics of a dynamic problem, principles of dynamics, formulation of equation of motion.

UNIT-II

Single Degree Of Freedom System: analysis for free and forced vibration, Duhamels integral, Damping – types and evaluation, Response of SDOF system to harmonic excitation, Periodic excitation, Impulsive loading, arbitrary, step, pulse excitation, Response to General Dynamic loading, Numerical evaluation of dynamic response-superposition and step by step methods, generalized SDOF system.

UNIT-III

Multi degree of freedom: equation of motion, equation of structural property matrices, problem statement and solution methods, free vibration, forced harmonic vibration, damped motion for MDOF, Generalized co-ordinates, principle of orthogonality of modes,

UNIT-IV

Multi degree of freedom: Eigenvalue problem, modal response, approximate methods: Stodalla-Vanaello, Modified Reyleigh's method, Holzer's Method, Holzer Mykleston method, Matrix method, Energy method, Lagrange's equation, modal analysis, stochastic response of linier SDOF and MDOF system to Gaussian inputs.

Books recommended:

Clough and Penzien, 'Dynamics of Structures' McGraw Hill Book co.

Chopra, A.K., 'Dynamics of Structures', Theory and Application to Earthquake Engineering', Prentice Hall of India, New Delhi. 1995.

Glen V. Berg, 'Element of Structural Dynamic', Prentice Hall, Engewood Cliffs, NJ.

Grover L. Rogers, 'Dynamics of Framed Structures', John Wiley and Sons Inc., New York.

Engineering', Prentice Hall of

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-324A	Solid and hazardous waste management	2	-	25	75	100	3 Hr
UNIT	Course Outcome						
I	Examine physical and chemical composition of hazardous wastes.						
II	Analyze activities associated with the management of solid waste.						
III	Understand method to recover materials, conserve products, and to generate energy from solid and hazardous wastes						
IV	Design and locate waste containment systems as per regulatory standards.						

UNIT-1

Introduction, sources & types of solid waste; Municipal solid waste: composition & its quantity of generated Municipal solid waste; Industrial solid waste: classification & extent of generation of waste in India.

Physical, Chemical, and Biological characteristics of Municipal Solid waste; Impact of solid waste on environment

UNIT-2

Collection: Collection of Solid waste; collection policy, collection system, equipments, factors affecting collection, analysis of collection system, collection routes
Transfer and Transport: Need for transfer operation, transfer stations, types, transport means and methods, location of transport stations, Transfer stations: selection of location, types & design requirements, operation & maintenance.

UNIT-3

Physicochemical Treatment of Solid and Hazardous Waste: Combustion, stabilization and solidification of hazardous wastes, soil vapour extraction, air stripping

Biological Treatment of Solid and Hazardous Waste: Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; slurry phase bioreactor; in-situ remediation; Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

UNIT-4

Hazardous solid waste: Introduction; biomedical waste Management: Biomedical waste and their impacts on health and environment; legislative laws on management; labeling and storage of biomedical waste; transportation and disposal methods

Radioactive Waste Management: Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options

References:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D. Buckingham, P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.
4. Basics of Solid and Hazardous Waste Mgmt. Tech. by Kanti L. Shah 1999, Prentice Hall.
5. Solid And Hazardous Waste Management 2007 by S.C. Bhatia Atlantic Publishers & Dist.

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-326A	ENGINEERING GEOLOGY	2	-	25	75	100	3 Hr
Course Objective	At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.						
UNIT	Course Outcome						
I	Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.						
II	Will get basics knowledge on properties of minerals.						
III	Gain knowledge about types of rocks, their distribution and uses.						
IV	Will understand the methods of study on geological structure.						

UNIT-I

Introduction:

Definition, object, scope and sub division of geology, The interior of the earth, crust, mantle and core, Importance of geology in Civil Engineering projects. Different branches of geology.

Physical Geology:

Origin of earth, external and internal geological forces causing changes, erosion of the surface of the earth. Geological work of ice, water and wind, Soil profile and its importance, Earth movement, earthquakes and volcanoes.

UNIT-II

Mineralogy and Petrology:

Definition of mineral and rocks, Classification of minerals, physical and chemical properties of minerals. Classification of rocks. Mineral composition, Textures, structure and origin of Igneous, Sedimentary and Metamorphic rocks.

Structural Geology and general stratigraphy of India:

Elementary idea about outcrop, dip and strike, bedding plane, fold, fault, joint and unconformity. General principles of stratigraphy of India and their characteristics

UNIT-III

Geological Investigations:

Preliminary geological investigations- Use of geological maps and interpretation of data, geological reports, hydrogeology, water table, springs and artesian well, ground water in engineering projects, artificial recharge of ground water, Elementary ideas of geological investigation, Remote sensing techniques for geological and hydrological survey and investigation.

Geological conditions 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. Geological definitions and aspects of landslides and Hill-slope stability.

UNIT-IV

Improvement of foundation rocks:

Precaution and treatment against faults, joints and ground water (electrical and seismic methods). Retaining walls and other treatments.

Geology and environment of earth.

Engineering geology and its case study, water table, geology as a subject, flood plane deposits, deltas, waterfalls, lakes etc. Earth environment, global warming and effect.

Note: The physical study of rock samples and minerals may be performed in the tutorials.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Text Books

1. Engineering and General Geology by Prabin Singh
2. General & Engineering Geology by Dr. D.S.Arora

Reference Books

1. A Text Book of Geology by P.K. Mukherjee
2. Physical and General Geology by S.K.Garg
Introduction of Physical Geology by A.Holmes

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total
EL-328A	GROUND WATER	2	-	25	75	100
Course Objective	To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers, To understand the techniques of development and management of groundwater					
UNIT	Course Outcome					
I	Understand aquifer properties and its dynamics					
II	Get an exposure towards well design and practical problems					
III	Develop a model for groundwater management.					
IV	Students will be able to understand the importance of artificial recharge and groundwater quality concepts					

UNIT-I

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

UNIT-II

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).

UNIT-III

Tubewells, optimum capacity, silting of tubewell, design of Tubewells in different aquifers, tubewell types, parts, bore hole, strains, its types, well pipe, causing 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, in construction and corrosion and failure of tubewells, Pumping equipment and hydraulic testing of pumps.

UNIT-IV

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.

Books:

Groundwater Hydrology, D.K. Todd, John Wiley & Sons Inc. New York.
 Groundwater H.M. Raghunath, Wiley Eastern Ltd., N.Delhi.

ELECTIVE-II

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-330A	Repair and rehabilitation of structure	2	-	25	75	100	3 Hr
Course Objective	To acquire the knowledge on Quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.						
UNIT	Course Outcome						
I	The importance of maintenance and assessment method of distressed structures.						
II	The strength and durability properties ,their effects due to climate and temperature.						
III	Recent development in concrete.the techniques for repair and protection methods						

IV	Repair, rehabilitation and retrofitting of structures and demolition methods.
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UNIT-I

Maintenance and repair strategies: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of distress and deterioration of concrete- Evaluation of existing buildings through field investigations, Seismic evaluation of existing buildings

Serviceability and durability of concrete: Quality assurance for concrete construction concrete properties - strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion – design and construction errors - Effects of cover thickness and cracking.

UNIT-II

Materials and techniques for repair: Special concretes and mortar, , concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection.

UNIT-III

Repairs, rehabilitation and retrofitting of structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure - Special techniques for structural Retrofitting (Bracing, Shear walls, Base isolation etc).

UNIT-IV

Demolition techniques: Engineered demolition techniques for Dilapidated structures – case studies - Case Studies on Restoration of fire damaged buildings, Case study on repairs and strengthening corrosion damaged buildings; Case study on use of composite fibre wraps for strengthening of building components.

Books recommended:

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, (1991).
2. R.T. Allen and S.C. Edwards, Repair of Concrete structures, Blakie and Sons, UK, (1987)
3. M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand and Company, New Delhi, (1992).
4. Santhakumar, A.R., Training Course notes on Damage Assessment and repairs in Low Cost Housing, "RH DC – NB0" Anna University, July (1992).
5. Raikar, R., Learning from failures – Deficiencies in Design, Construction and Service – R & D centre (SDCPL), Raikar Bhavan, Bombay, (1987).
6. N. Palaniappan, Estate Management, Anna Institute of Management, Chennai, (1992).
7. Lakshmi pathy, M. et al. Lecture notes of Workshop on Repairs and Rehabilitation of Structures, 29 -30th October 1999, (1999).

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-332A	CONSTRUCTION ENGINEERING & MANAGEMENT	2	-	25	75	100	3 Hr
Course Objective	To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.						
UNIT	Course Outcome						
I	Understand basic concepts of construction planning. Schedule the construction activities.						
II	Forecast and control the cost in a construction.						
III	Understand the quality control and safety during construction.						
IV	Organize information in Centralized database Management systems.						

UNIT I

CONSTRUCTION PLANNING

Basic concepts in the development of construction plans-Choice of Technology and Construction method-Defining Work Tasks- Work breakdown structure- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

SCHEDULING PROCEDURES AND TECHNIQUES

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads,lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations- Crashing and time/cost tradeoffs -Improving the Scheduling

process – Introduction to application software.

UNIT II

COST CONTROL MONITORING AND ACCOUNTING

The cost control problem-The project budget-Forecasting for Activity cost control - financial accounting systems and cost accounts- Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

UNIT III

QUALITY CONTROL AND SAFETY DURING CONSTRUCTION

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control- Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

UNIT IV

ORGANIZATION AND USE OF PROJECT INFORMATION

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information - Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

TEXTBOOKS:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2009
2. Srinath,L.S., "Pert and CPM Principles and Applications", Affiliated East West Press, 2001

REFERENCES:

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition, 1985.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.
4. Halpin,D.W., "Financial and Cost Concepts for Construction Management", John Wiley and Sons, New York, 1985.

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-334A	Structure Analysis by matrix method	2	-	25	75	100	3 Hr
Course Objective : The analysis of structure by matrix method							
UNIT	Course Outcome						
I	Students will be able to familiar with Stiffness and flexibility method.						
II	Students will be able to familiar with Elementary approach of matrix.						
III	Students will be able to familiar with Stability analysis of structure.						
IV	Students will be able to familiar with Plastic analysis of beams and frames.						

UNIT-I

Stiffness Method (Systems Approach): Basis of stiffness method, Degrees of freedom, Force-displacement relationships, Nodal stiffness.

Flexibility Method (Systems Approach): Flexibility coefficients, Basis of the method, Application to various types of structures.

UNIT-II

Introduction to Element Approach: Member stiffness matrix, Local or Member co-ordinate system, Global or Structural co-ordinate system, Rotation of axes etc, Structure stiffness matrix.

UNIT-III

Structural Stability Analysis: Elastic Instability, Introduction to stability problem, Energy methods, buckling of axially loaded members for different end conditions, Concept of effective length, approximate techniques, Stability analysis of beam-column and frames.

UNIT-IV

Plastic Analysis: Concept of Limit load analysis, Upper and lower bounds. Plastic analysis of beams and multi-storey frames using mechanism method.

Non Linear Analysis: Introduction to geometric and material non-linearity.

Books recommended:

1. Przemieniecki, J.S., 'Theory of Matrix Structure Analysis', Tata McGraw , Hill Book Co.
2. Martin, H.C. ' Introduction to Matrix Methods of Structural Analysis' McGraw Hill Book Co.
3. Meghre & Deshmukh, 'Matrix Methods of Structural Analysis' Charotar Publishing House, Anand.
4. Pandit & Gupta, Matrix Analysis of Structures, Tata McGraw Hill Publications (2003). Iyengar, N.G.R., Elastic Stability of Structural Elements, Macmillan India Ltd (1980).
5. Gere, G. M. and Weaver, Jr. W., Matrix Analysis of Framed Structures. CBS Publishers (1987).
6. McCormac, J. C. & Nelson, J. K., Structural Analysis: A Classical and Matrix Approach, John Wiley and Sons (1997).

Code	Nomenclature of Subject	L	T	Int.	Ext	Total	Time
EL-336A	Disaster preparedness & planning	2	-	25	75	100	3 Hr
Course	To Impart knowledge Disaster management and design & planning about to control						

Objective	the accidents.
UNIT	Course Outcome
I	Students will be able to study about Disaster and their types.
II	Students will be able to study about assessment of disaster and management of its control.
III	Students will be able to understand the building structures and their efficiency to control hazard.
IV	Students will be able to study the efficient structures and analysis of Hazard by case study.

UNIT-I

Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.

Disaster Mitigation and Preparedness: Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. Man-made hazards: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.

UNIT-II

Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.

Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.

UNIT-III

Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines..

Application of Geo-informatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.

UNIT-IV

Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two questions from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Books/References:

1. Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill. Pub
2. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester
3. Disaster Management, R.B. Singh (Ed), Rawat Publications
4. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction.
5. [www.http//ndma.gov.in](http://ndma.gov.in)
6. Disaster Management –Future Challenges & Opportunities by Jagbir Singh, I.K. International Publishing House.

Code	Nomenclature of Practical	P	External	Sessional	Total	Time
CE-310LA	TRANSPORTATION ENGINEERING (P)	2	60	40	100	3Hr
Course Objective	The aim of study is to determine the different properties of highway construction materials.					

Test on Aggregate/soil

1. To determine the toughness of the aggregate by Impact Test.
2. To determine the hardness of the aggregate by Los-Angeles Abrasion Test, Dorry's Abrasion test and Deval Attrition test on aggregates
3. To determine the Crushing Strength Test of Aggregates.
4. Flakiness and Elongation Index of aggregates.
5. Proportioning of aggregates.
6. Stripping test on aggregates.
7. Specific gravity and water absorption test on aggregates.
8. CBR lab test on soil.

Test on Bitumen

1. To determine the grade and hardness of the bitumen by Penetration Test.
2. To determine the elastic property of the bitumen by Ductility Test.

3. To determine the grade and hardness of the bitumen by Viscosity Test.
 4. To determine the Softening Point Test on Bitumen.
 5. To determine the Flash and Fire Point Test on Bitumen.
 6. Determination of bitumen content.
 7. Specific gravity and water absorption test of bitumen.
 8. Marshall's stability test.
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Code	Nomenclature of Practical	P	External	Session	Total	Time
CE-312LA	ENVIRONMENTAL ENGINEERING-I (P)	2	60	40	100	3H
Course Objective	To Impart knowledge of quality and mineral composition of drinking water supply.					

LIST OF EXPERIMENTS

1. To determine the pH value of a given sample of water waste water.

2. To determine the turbidity in given water waste water sample.
3. To determine the acidity of given sample of water waste water.
4. To determine the alkalinity of given sample of water waste water.
5. To determine temporary and permanent hardness in a given water sample.
6. To determine the chlorine does required for a given water sample.
7. To determine total suspended, suspended, dissolved settable solids in a sewage sample.
8. To determine the chloride concentration in a given sample of waste water.
9. To determine the sulphate concentration in given water sample.

Code	Nomenclature of Practical	P	External	Sessional	Total	Time
CE-314LA	Irrigation Engg. Design & Drawing	2	60	40	100	3H
Course Objective	To Impart knowledge of irrigation structures					

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 Aqueduct.
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.

MC-902A

Constitution of India

Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

UNIT-I

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.

Scheme of the fundamental rights

UNIT -II

The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.

Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT - III

Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.

Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT-IV

Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article19.Scope of the Right to Life and Personal Liberty under Article21.

Text Books

1. Constitution of India. Prof.Narender Kumar (2008) 8th edition. Allahabad LawAgency.

ReferenceBooks:

1. The constitution of India. P.M. Bakshi (2016) 15th Edition. Universal lawPublishing.

Note: The paper setter will set the paper as per the question paper templates provided.