Government College of Engineering Jalgaon

Civil Engineering Department

BTech Syllabus

2017-18

GOVERNMENT COLLEGE OF ENGINEERING JALGAON

Department of Civil Engineering.

Scheme for B.Tech (Civil Engineering)

SEM VII

Course Code	Name of the Course	Group	Teaching Scheme Hrs /week				Evaluation Scheme							Credits
			TH	TU	PR	Total	Theory				Practical			
							ISA	ISE1	ISE2	ESE	ICA	ESE	Total	
CE401	Estimating and Costing	D	3	---	---	3	10	15	15	60	---	---	100	3
CE402	Water Resources Engineering-I	D	3	---	---	3	10	15	15	60	---	---	100	3
CE403	Construction Safety and Disaster Management	C	2	---	---	2	4	8	8	30	---	---	50	2
CE404	(Elective-I)	E	3	---	---	3	10	15	15	60	---	---	100	3
CE405	(Inter disciplinary elective)	E	3	---	---	3	10	15	15	60	---	---	100	3
CE406	Estimating and Costing-LAB	D	---	---	2	2	---	---	---	---	25	25	50	1
CE407	Water Resources Engineering-I-LAB	D	---	---	2	2	---	---	---	---	25	25	50	1
CE408	(Elective) -LAB	E	---	---	2	2	---	---	---	---	25	25	50	1
CE409	Project phase I	D	---	---	2	2	---	---	---	---	50	50	100	2
CE410	Seminar	D	---	---	2	2	---	---	---	---	25	25	50	2
CE411	Self Study-3(CE401/CE402/CE403/CE404/CE405)	D	---	---	---		---	---	---	---	--		50**	2
	Total		14	---	10	24	44	68	68	270	150	150	800	23

TH: Theory Lecture **TUT: Tutorial** **PR: Practical**

ISA: Internal Sessional Assessment **ISE : In Semester Examination** **ESE: End Semester Examination, ICA : Internal Continuous Assessment**

Interdisciplinary Elective

A Town and Country Planning
B Industrial Pollution and Control
C Operation Research
D Safety and Disaster Management

Elective I

A Advanced Structural Design
B Matrix Analysis of Structures
C Advanced Soil Mechanics
D Hydraulic Structures

- ****Marks and hence grade of course Self Study shall be based on one test each conducted on 20% syllabus of five subjects– CE401,CE402,CE403,CE404,CE405.**

One faculty member should be appointed as course coordinator for the course 'self study' to compile the marks of all tests and enter in to MIS.

- **The 20% syllabus for self - study shall be declared by subject teacher at the beginning of semester and he/she shall conduct the test examination for that**

course, assess answer papers of test examination and submit the marks to course coordinator.

GOVERNMENT COLLEGE OF ENGINEERING JALGAON
Department of Civil Engineering.
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SEM VIII

Course Code	Name of the Course	Group	Teaching Scheme Hrs /week				Evaluation Scheme							Credits
			TH	TU	PR	Total	Theory				Practical			
							ISA	ISE1	ISE2	ESE	ICA	ESE	Total	
CE451	Water Resources Engineering-II	D	3	---	---	3	10	15	15	60	---	---	100	3
CE452	Transportation Engineering	D	3	---	---	3	10	15	15	60	---	---	100	3
CE453	(Elective-II)	E	3	---	---	3	10	15	15	60	---	---	100	3
CE454	(Elective-III)	E	3	---	---	3	10	15	15	60	---	---	100	3
CE455	Water Resources Engineering-II-LAB	D	---	---	2	2	---	---	---	---	25	25	50	1
CE456	Transportation Engineering-LAB	D	---	---	2	2	---	---	---	---	25	25	50	1
CE457	(Elective-II) -LAB	E	---	---	2	2	---	---	---	---	25	25	50	1
CE458	Project Phase II	D	---	---	4	4	---	---	---	---	50	100	150	4
CE459	Industrial Visit	D	---	---	---		---	---	---	---	25	---	25	1
CE460	Industrial Lecture	D	1	---	---	1	---	---	---	---	25	---	25	1
CE461	Self Study- 4 (CE451/CE452/CE453/CE454)	D	---	---	---		---	---	---	---	--	---	50**	2
	Total		13		10	23	40	60	60	240	175	175	800	23

TH: Theory Lecture **TUT: Tutorial** **PR: Practical**
ISA: Internal Sessional Assessment **ISE : In Semester Examination** **ESE: End Semester Examination, ICA : Internal Continuous Assessment**

Elective II

A Advanced Design of Steel Structures
B Pavement Design
C Advanced Wastewater Treatment
D Advanced Foundation Engineering

Elective III

A Earthquake Resistant Design
B Advanced Fluid Mechanics
C Remote Sensing & Geographical Information system
D Railway, Tunnel and Airport Engineering

- ****Marks and hence grade of course Self Study shall be based on one test each conducted on 20% syllabus of four subjects – CE451, CE452,CE453,CE454. One faculty member should be appointed as course coordinator for the course 'self study' to compile the marks of all tests and enter in to MIS.**
- **The 20% syllabus for self - study shall be declared by subject teacher at the beginning of semester and he/she shall conduct the test examination for that course, assess answer papers of test examination and submit the marks to course coordinator.**
- **In the course Industrial Lecture, at least 12 lectures from industrial expert should be arranged and continuously assessed (6 lectures in VIth and VIIIth semester each)**

CE401 ESTIMATING AND COSTING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Approximate Estimate: Definition and necessity, general principles, methods of preparing approximate estimates for buildings, roads, bridges, water supply scheme, drainage scheme, and retaining wall

Detailed Estimate: Types of detailed estimate, purpose, data required for preparing detailed estimate, factors to be considered during preparing detailed estimate, methods of taking out quantities, abstracting, units of measurement

Building Cost: Building cost, provisional sum, centage charges, work charged establishment, administrative approval, budget provision, technical sanction, different methods of execution of minor works in PWD, like piece work, check list, day work, daily labour. introduction to registration as contractor in the PWD

Building Estimate: PWD method and centre line method of taking out quantities, using is 1200 rules, estimate of load bearing residential building (1 BHK Only)

Specification: Definition & purpose, types of standard specification, red book, legal aspect, drafting detailed specification with reference to material, quality, workmanship, method of execution, mode of measurement and payment for major items like (excavation, stone/ brick masonry, plastering, ceramic tile flooring, r.c.c. work only)

Analysis of Rates: Purpose and principles, importance of schedule of rates in cost estimates, Rate analysis, factors affecting rate analysis, task work, market rate analysis, fixed, variable, prime and supplementary cost, overhead cost

Valuation: Purpose of valuation, value and cost, types of value, factors affecting value of property, net and gross return, free hold and lease hold property, sinking fund, depreciation, capitalized value, annualized value, methods of valuation, rent fixation, valuation of old building

Text Books

1. Estimating and Costing in Civil Engineering, Theory and Practice, Datta B.N., UBS Publisher, New Delhi, 28th edition, 2016.
2. Estimating, Costing Specifications & Valuation in Civil Engineering, Chakraborti M., UBS Publisher, New Delhi, 25th edition, 2014.
3. Estimating, Costing and Valuation, Rangwala S. C., Charotar Publishing House, Anand, 17th edition, 2015.

ReferenceBooks

1. Civil Engineering Contracts & Estimates, Patil B. S., Orient Longman Ltd, Mumbai, 3rd edition, 2013.
2. National Building Code of India 2005, Group I to V, Bureau of Indian Standards, New, Delhi.

CE402 WATER RESOURCES ENGINEERING-I

Teaching Scheme 03L Total: 03 **Credit** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 100
Duration of ESE: 03Hrs

Runoff: Runoff process, yield, factors affecting runoff, estimation of runoff volume.

Floods: Estimation of peak flow, rational method and introduction to other methods, introduction to design floods for various hydraulic structures.

Hydrographs: Definition, components, factors affecting the shape, base flow separation, flood hydrograph, Unit hydrograph – definition, assumptions, applications, derivations and limitations, S-hydrograph.

Ground Water Hydrology: Occurrences and distribution of ground water, specific yield of aquifers, movement of ground water, Darcy's law, permeability, safe yield of basins, hydraulics of wells under steady flow in confined and unconfined aquifers, well loss, specific capacity of well, well irrigation: introduction to tube wells and open wells.

Introduction to Irrigation: Necessity, benefits, Ill effect, irrigation systems and methods and their classifications.

Reservoir Planning: Storage and diversion works, single and multipurpose, reservoirs, introduction to various investigations for locating a reservoir, mass curve and estimation of required storage, economics of reservoir planning, Benefit –cost ratio.

Reservoir Sedimentation: Process of erosion, introduction to suspended and bed loads, critical tractive force, trap efficiency and life of reservoir, factors affecting silting and control of reservoir sedimentation

Soil-water-plant Relationships: Classification of soil water, saturation capacity, Field capacity, determination of field capacity, quality of irrigation water.

Water Requirement of Crops: Limiting soil moisture condition, depth of irrigation water and frequency, principal Indian crops and their seasons, base period, duty of water and delta, factors affecting & methods of improving the duty of water, intensity of irrigation, paleo irrigation, kor depth and kor period, outlet factor, capacity factor, time factor, crop ratio, overlap allowance, calculations of canal capacities, application of water, warabandi, National Water Policy.

Water Logging and Drainage: Causes, preventive and curative measures of water logging, design and spacing of the tile – drains.

Text Books:

1. Irrigation, Water Resources and Water Power Engineering, Modi P.N., Standard Book House, Delhi, 8th edition, 2012

2. Irrigation Engineering And Hydraulic Structures, Garg S.K.,Khanna Publishers, Delhi. 1998.

Reference Books:

1. Engineering Hydrology, Subramanya K, Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd edition, 2008.

2. Irrigation and Water Power Engineering, Punmia B.C., Pande B.B., .Lal, Ashok Kumar Jain,. Laxmi Publications Pvt. Ltd., New Delhi, 1999.
3. Fundamentals of Irrigation Engineering, Bharat Singh, Nem Chand &Bros.,India; 6th Revised edition,1979
4. Irrigation and Water Resources Engineering, by Asawa, G.L, New Age International publisher, 1st edition 2005

CE403 CONSTRUCTION SAFETY & DISASTER MANAGEMENT

Teaching Scheme:02L+ 00 T, Total: 02 **Credit**: 02
Evaluation Scheme:08 ISE1 +08 ISE2 + 04 ISA + 30 ESE **Total Marks**: 50
Duration of ESE: 02Hrs

Constructio n safety management role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

Safety in construction operations accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. first aid on site ,prevention of accidents, safety measures while using construction equipment e.g. vehicles, cranes, hoist and lifts etc., safety of scaffolding and working platforms. safety while using electrical appliances & explosives.

Safety equipment and safety policies gear used on site, first aid on site, labour laws, legal requirements and cost aspects of accidents on site, study of safety policies, methods, equipment, training provided

Natural disasters and extent of disasters, natural calamities such as earthquake, floods, coasts hazards, landslides etc. manmade disasters such as chemical and industrial hazards, nuclear hazards, fire hazards etc.

Disaster management financing relief expenditure, legal aspects, rescues operations, casualty management, risk management. emergency management programme: administrative setup and organization. hazard analysis, training of personnel, information management, emergency facilities and equipment necessary.
Public awareness& management- creation, preparation and execution of the emergency management programme, role of safety officers,awareness committee,

Text Books

1.Project Management, K Nagarajan, New Age International Ltd, 8th edition,2004
2. Disaster management & rehabilitation, Rajdeep Dasgupta, Mittal Publication, 3rd edition, 2007

Reference Books:

1. Construction Engineering and Management, Seetharaman, Umesh Publications, 1st edition, 2010
2.Disaster management in India, Dr. Kadambaui Sharma, Dr. Avinash Chiranjeev, Jnanda prakashan(P&D) New Delhi, 2nd edition, 1998
3. Construction Safety Manual, National Safety Commission of India, 2005
4. Safety Management in Construction Industry, A manual for project manager (NICMAR Mumbai) 5. Bureau of Indian Standards, "IS for safety in Construction"

CE 404ADVANCED STRUCTURAL DESIGN

Teaching Scheme 03L Total: 03 **Credit** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 100
Duration of ESE: 04Hrs

R.C. Structures:
Introduction to earthquake resistant design , ductile detailing of rc members as per is 13920.Introduction to combined footing, design of combined footing. Design of of flat slabs.Analysis and design of cantilever retaining wall.

Design of circular water tanks resting on ground based on following conditions
i. Flexible joint between walls and the base.
ii. IS code method.

PrestressedConcrete Structures:

Introduction:- Basic concept, materials, prestressing systems, stages of loading,stresses in tendons.

Losses in pre-stresses :- Nature of losses, loss due to elastic shortening of concrete, shrinkage, creep, anchorage slip, successive pre-stressing of straight cables, relaxation ofstress in steel friction in a curved cable anchorage.Transfer of pre-stress in pre-tensioned members, transmission length, end zone reinforcements. Anchorage Zone stresses in post –tensioned members – Guyan's method.
Limit state design of pre-stressed concrete member's philosophy of design, various criteria for limit. states, design loads, strength and serviceability. Design of post tensioned flexural members – rectangular and flanged sections, cable profile, esign of shear reinforcement, bond partial pre-stressing limit state method.

Text Books:
1. Prestressed Concrete, N. Krishnaraju Tata McGraw-Hill Education, Dec-2006
2. Design of prestressed concrete structure,T. Y. Lin, John and Wiely publication, 3rd edition 1981
3. Limit State Analysis and Design of Reinforced Concrete,S.R. Karve& V. L. Shah, Structures Publicatins.
4.Earthquake Resistant Design of Structures, S. K. Duggal, Oxford University Press, 2007.

Reference books

1. Comprehensive R.C.C. Design, Punmia, Jain and Jain, Laxmi Publications.
2. Reinforced Concrete Design, S. UnnikrishnaPillai, DevdasMenon, Tata McGraw-HillPublication.
3. IS 456-2000 Plain and Reinforced Concrete - Code of Practice.
4. IS 1343 (1980): Code of Practice for Pre-stressed Concrete.
5. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismicforces.

CE404 (B) MATRIX ANALYSIS OF STRUCTURES

Teaching Scheme:03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Flexibility Method: Static redundancy, flexibility coefficients, basic determinate,released structure, geometric compatibility conditions, matrix formulation, application tocontinuous beams.Single bay single storey portals, pin jointed plane trusses.Settlement of supports and elastic supports.(up to three unknowns). Introduction to multibay multi-storey portal frame analysis.

Stiffness Method(structural approach): Stiffness coefficient, generalized stiffness coefficients, kinematic degree of indeterminacy, unknown joint displacements for various structures, joint equilibrium equations, hand solution for simple problems of beams, frames, trusses up to three unknowns.

Stiffness Method(member approach): General strategy, member and structure coordinate system, force-displacement relations in member coordinates, member stiffness matrix, transformation of displacements and forces from member to structure coordinates and vice-versa, stiffness matrix referred to structure coordinate system, joint equilibrium equations using assembly procedure, large structures, boundary conditions. Application to beams, plane and space trusses, plane and space frames and grids. Programming aspects, flow charts, solution of equations, member end forces, free body diagram of members

Memory Problems: In-core solution techniques, assembly of stiffness matrix in full form, half band form and sky line storage, half band width, column height, diagonal address.

Data File Preparation: Data preparation for solution of structures by stiffness method (member approach), alternatives for data preparation, displacement codes, joint-displacement and element displacement code relations.

Computer Programs: Computer programs for solution of simultaneous algebric equations, Gausselimination method. (FORTRAN / C language)

Text Books:

1. Matrix Methods of Structural Analysis, MeghreA.S. and DeshmukhS. K., Charotar Publishing House, Anand, India, 2nd Edition : 2016 Reprint.
2. Structural Analysis- A Matrix Approach,PanditG. S. and GuptaS. P., Tata McGrow Hill Publishing Company Limited, New Delhi, 26th reprint 2007.

Reference Books:

1. Analysis of framed structures, James M. Gere and William Weaver Jr., D Van Nostrand Company Inc., Affiliated East West Press Pvt. Ltd., 3rd Edition 1990.
2. Matrix, Finite Element, Computer and Structural Analysis: MukhopadhyayM., , Oxford & IBH publishing Co. Pvt. Ltd. 3rd Edition Reprint 2011.

CE404 (C) ADVANCED SOIL MECHANICS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme : 15 ISE1 + 15 ISE 2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE : 3 hrs

Clay Mineralogy: Atomic bonds, clay minerals, clay -water relations, electrical effects, cation exchange, clay mineral identification

Soil Strength: Drainage conditions and field problems, UU, CU,& CD Triaxial test, Skempton`s equation for pore pressure, shear strength characteristic of cohesive and cohesionless soil, volume changes during shear and stress dilatancy, critical void ratio & its determination, factor affecting shear strength of cohesive and cohesionless soil, apparent cohesion,

Concept of Stress Paths, Kf & Ko lines , stress paths for cases of foundation loading, excavation, active & passive earth pressure conditions, stress–strain models and constitutive relations, Duncan-Chang model

Soil bodies Exhibiting non-homogeneous attributes, Influence of anisotropy in soil bodies

Seepage: Flow net for anisotropic soil media, construction of flow net for hydraulic structures on non-homogeneous soil, directional variation of permeability in anisotropic medium, Anisotropy governing differential equations for flow through porous media in Cartesian co-ordinate & polar co-ordinate system for Laplace Equations, numerical analysis of seepage in layered soil, computation of seepage force.

Three Dimensional Consolidation: Equation, solution of 3-D consolidation equation, consolidation by vertical sand drain and its design aspects, free strain consolidation with no smear, effect of smear zone on radial consolidation, calculation of degree of consolidation with radial drains and solution of problems based on it.

Expansive Soil: Black cotton soil, nature & characteristics of it, chemical composition, clay minerals, swelling potentials & its measurements, detrimental effects, measures to control its detrimental effects.

Collapsible Soils: causes, properties of collapsible soils, collapse potential, collapse settlement, single & double oedometer test, single plate load test for determination of collapse potential, treatment, foundations on collapsible soils.

Text Books:

1. Textbook of Soil Mechanics and Foundation Engineering, Murthy V. N. S., CBS Publishers & Distributors Pvt. Ltd. India, 2008 .
2. Principles of Foundation Engineering, B.M. Das, Thomson Asia Pvt. Ltd,7th Edition, 2010.

Reference Books:

1. Geotechnical Engineering Principles & Practices, D. P. Couduto, Pearson Prentice Hall Publication, 1st Edition, 2007.
2. Basic and Applied Soil mechanics, Gopal Ranjan & A. S. R. Rao, New Age Int. Publication Pvt, Ltd, 2nd Edition,2000.
3. Soil Mechanics and Foundations, MuniramBudhu, John Wiley & Sons Publishers,2nd Edition, 2007

CE404 (D) HYDRAULIC STRUCTURES

Teaching Scheme:03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Gravity Dams: Forces on gravity dams, elementary profile, design, stability requirements, foundation treatment, mass concrete for dams, structural joints and galleries.

Arch Dams: types and its suitability, equations of cylindrical shells, general concepts about trial load method and elastic shell method. Hollow gravity dam, structural features.

Buttress Dams: Types, economic spacing of buttresses, design of deck slab buttress dam, advantages and limitations.

Spillways - Determination of capacity, types, ogee, side channel, chute, shaft and siphon. Basic principles of hydraulic design, energy dissipation arrangements below spillway. Spillway Gates: Types such as Tainter, drum, vertical lift, automatic gates. Outlets through dams: types, hydraulics of outlet works, river intakes and trash rack.

Conveyance Structures for Canal Flows: Introduction to - Structures for crossing canals across roads and railway lines, Structures for crossing canals across natural streams (cross drainage works), Structures to carry canal water over a natural stream, Structures to carry canal water below a natural stream, Structures to carry canal water at the same level as a natural stream, Transitions at changes in canal cross-sections, Planning and design of Aqueduct.

Canal Irrigation Types of canal, canal alignment, losses in irrigation channels. Design of lined channels, various types of canal lining, economics of lining.

Text Books:

1. Irrigation and Water Resources Engineering, Asawa G.L., New Age International (P) Ltd. Publishers, 2006
2. Irrigation Engineering and Hydraulic Structures, Garg, S. K., Khanna Publishers Delhi, 2007.
3. Irrigation, Water Resource and Water Power Engineering, Modi, P.N., Standard Book House, Delhi, 2008.
4. Earth and Rockfill Dam, Sherard J. L., John Wiley, New York, 1991
5. Concrete Dam, Varshney R.S. , Oxford IBH, 1988

Reference Books:

1. Design of Small Dams, USBR, Oxford IBH, 1970.
2. Part 2-1983 Specific requirements (Reaffirmed 1992) Section1. Aqueducts
3. Design of Large Dams, USBR, Oxford IBH, 1970.
4. Design of Gravity Dams, USBR, Oxford IBH, 1970.
5. Concrete Dams, Sharma H.D., Metropolitan Book Co, New Delhi, 1998.

CE405(A) TOWN & COUNTRY PLANNING

Teaching Scheme: 02L+ 00 T, Total: 02 **Credit**: 02
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 50
Duration of ESE: 03Hrs

Necessity and scope of town planning, brief history- greek and roman towns, planning in ancient India - indus valley civilization, vedic period, buddhist period, medieval period. contribution of town planners in modern era such as sir patrick geddes, sir ebenezer howard, sir le corbusier. present status of town planning in india. layout of residential units, neighbourhood unit planning, radburn plan, grid iron pattern. cul de sacs shoe string development. growth pattern of towns, concentric satellite, ribbon, scattered.

Elements of town, types of zoning, urban roads- objective and classification of roads, various road networks. surveys- physical, social, economic civic etc., analysis of data, town aesthetics, treatment of traffic islands, open spaces, walks ways, public sit-outs. sky walk, continuous park system, green ways.

Planning process planning standards for different land use allocation for commerce, industries, public buildings, parks & playgrounds, density distribution, density zones, traffic network, standard of roads, master plan-preparation & execution, implementation of development plan, study of planned towns like new mumbai, gandhinagar, etc.

MRTP –land acquisition – rural development importance of mrtp in town planning, land acquisition act – necessity and procedure of acquisition. planning agencies for various levels of planning, CIDCO, HUDCO, MHADA, decentralization concepts. rural developments- planning methodology, growth centre approach, area development approach, integrated rural development approach, slums-causes and clearance schemes

Introduction to smart cities benefits of smart cities, characteristics and factors of smart cities, understanding livability, affordability and inequality, development standards, smart indicators, smart city rankings, emerging trends and technologies. process of building a smart cities roadmap
smart cities framework: built environment, e-governance & citizen services, waste management, water management, energy management, urban mobility & public safety smart city enablers: instrumentation and control, connectivity, interoperability, security and privacy, data management, computing resources andanalytics,

Text Books:

1. Design of Cities, Edmund Bacon,Viking Press, New York, 4th edition, 1994
2. Site Planning, Kevin Lynch,The M.I.T. Press, England, 2nd edition, 1984

Reference Books:

1.Town and Country Planning in India, N. K. Gandhi, Indian Town and Country Planning Association, Bombay 2nd edition, 1973
2. Town Planning, Rangawala, Charotar Publishing House, 4thedition, 1995
3. Basics of Town Planning, J. G. Keskar,All India Institute of Local Self-Government, 1998
4. Town Planning, G.R.Diwan, Law, Administration and Professional Practice, 2000.
5. M.R.T.P. Act of 1966.

CE405(B)-INDUSTRIAL POLLUTION AND CONTROL

Teaching Scheme: 03L+00T: Total 03 **Credit:** 03
Evolution Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ISE **Total Marks:** 100
Duration of ESE: 03Hrs

Classification of Industries: Major industries responsible for water pollution across globe and in India, water uses inmajor industries, industrial wastewater survey, sampling procedures, characteristics ofmajor industries like dairy, sugar, pulp and paper, dye, metal plating, textile, petroleum,refineries, slaughterhouse, tannery, distillery etc. as per IS codes. Benefits of water pollution control by doing treatment of industrial waste.

Rules and Regulation: Treatment prescribed by IS codes for major industries like dairy, sugar, pulp and paper,dye, metal plating, textile, petroleum, refineries, slaughter house, tannery, distillery etc., importance of flow equalization,segregation of waste streams- specific applications.Environmental legislations in India, salient features of water pollution prevention act andair pollution control act, and Environmental protection act. Constitution of pollutioncontrol boards and their functioning.

Water Minimization Techniques: Concept of reduce, recover, reuse and recycle in industries, housekeeping and itsimportance, optimization of industrial processes keeping in view the wastewatergeneration and treatment, integrated approach for industrial water and wastewatermanagement, concept of CETP, industrial ecology, water quality index and its application and industrial wastewater management, application of advance wastewater treatment technology- reverse osmosis(theory, application and design), adsorption-(theory, application and design includingkinetic modeling), low cost sorbents.

Air Pollution: Parameters influencing air pollution, measurement of parameter plume behavior, transport and diffusion, stack height design and problems, Gaussian diffusion model for finding ground level concentration. Device and method used for sampling. Ambient air quality standards and emission standards. Effect of air pollution, cost/benefit ratio, Optimization.

Odors: Sources, measurement and control.

Hazardous Waste Management: Classification and their sources, health hazards, handling of toxic and radioactive wastes. Industrial solid waste sampling plan, characterization, disposal of waste from thermal power plant, disposal of solid organic industrial waste, toxic and hazardous waste. Disposal of waste by land filling, site selection, leachate and gas collection, lining; composting of waste, methods, factors affecting, Incineration, types, energy recovery and products of incineration, Processing of waste for useful products-pyrolysis, RDF, TDF, Legislation and regulatory trends.

Text Book:

1. Industrial Waste Water Treatment, A. D. Patwardhan, Prentice Hall of India Private Limited, 2008.
2. Environmental Pollution Control Engineering, C. S. Rao, New Age International (P) Ltd., 2nd Edition 2006.
3. Waste Water Treatment,M. N.Rao and A. K. Datta, Oxford& IBH Publication, 3rdEdition, 2009.
4. Solid Waste Management, Collection, Processing and Disposal,A. D. Bhide B. B. Sundaresan Mundrashilp Offset Printers, Nagpur 2001.

Reference books:

1. Introduction to Environmental Engineering and Science, G. M. Manster, P. E. Wendell, , Pearson Education Limited,3rd edition2013.
2. Air pollution, M. N. Rao and H. V. N. Rao, Tata McGraw Hill Publishing Company Limited New Delhi, 26th reprint 2007.

3. CPHEEO Manual On Municipal Solid Waste Management CPHEEO, MoUD GoI, New Delhi, May 2000.
4. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw-Hill, 22nd reprint, 2008.
5. Solid Waste Engineering, A. P. Vesilind, W. A. Worrell, Reinhart, Thomson Book Cole., 2nd Edition, 2002.
6. Integrated Solid Waste Management Engineering Principle and Management Issue, G. Techobanaglous, H. Theisen, S. A. Vigil, Tata McGraw Hill, New York, International Editions Civil Engg. Series, 1993.
7. Industrial Wastewater Treatment: A Guide Book, Edwards Joseph D., CRC Press Publications, 1995.
8. Air Pollution Control Theory, Crawford, M., TMH, 1976.

Important Links:

1. www.cpcb.nic.in.
2. www.mpcb.gov.in.
3. www.moef.nic.in/legis/**water**/wat1.html.
4. www.moef.nic.in/legis/**air**/**air**1.html.
5. envfor.nic.in/legis/env/env1.html.

CE405 (C) OPERATION RESEARCH

Teaching Scheme:03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Systems Concepts: System parameters and objectives, system classification, system cycle, open and closed systems, identification of Civil Engineering Systems and their method of analysis. mathematical representation of a system. Use of operations research in civil engineering and managerial decision making process, introduction to optimization techniques and their application in engineering planning, design and construction, various models; objective function and constraints, convex and concave functions, regions and sets.

Linear Programming: Formulation of linear optimization models, Civil engineering applications. Simplex method, special cases in simplex method, method of Big M, two phase method, duality, sensitivity analysis.

Non-Linear Programming: Single variable unconstrained optimization –local &global optima, Uni-modal function- Sequential Search Techniques: Dichotomous, Fibonacci, golden Section methods.

Multivariable Optimization Without Constraints: The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method. Multivariable optimization with equality constraints-Lagrange Multiplier Technique.

Transportation Model and Its Variants: Assignment Model and its variants. Games Theory. Dynamic programming: Multi stage decision processes, Principle of optimality.

Text Books:

1. Operations Research, Taha H. A., Pearson Prentice Hall, 8th edition 2007.
2. Engineering Optimazation Theory & Practice, Rao S.S., Wiely4th edition 2009.
3. Engineering Optimization: Methods and Applications, Ravindran A., Ken M. Ragsdell, G. V. Reklaitis, Wiely, 2006.

Reference Book:

1. Operations Research, Sharma J.K. Macmillan Publishers India 2006.
2. Operation Research ,Hira and Gupta, S.Chand Publishing, 2008.

CE405 (D) SAFETY & DISASTER MANAGEMENT

Teaching Scheme :03L+ 00 T, Total: 03 **Credit:** 03

Evaluation Scheme:15 ISE1 +15 ISE2 + 10 ISA + 60ESE **Total Marks:** 100

Duration of ESE : 03Hrs

Hazards & disasters: Difference between hazard and disaster, concept of risk and vulnerability, risk reduction, preparedness and mitigation, disaster management cycle, personal and community awareness. Types of disasters, earthquake, tsunami, landslide, cyclone, flood, drought, forest fire, chemical and industrial accidents.

Earthquakes: Concept, intensity, Richter's scale, element of risk, hazard zones in india, typical effects, main mitigation strategies, safe engineering practice, indian standard code and enforcement bye-laws.

Tsunami: Concept, onset, type and cases, warming, elements at risk. typical effects, physical damage, environmental damage, casualties and public health. Specific preparedness: hazard mapping, early warning systems, community preparedness. Main mitigation strategies, site planning and land management, engineering structures, flood management.

Landslides: Concept, onset time and warning, causes. elements at risk, hazard zones and indian landslides. Typical effects, physical damage, casualties, main mitigation strategies, hazard mapping, landslide practice, retaining walls, surface drainage control works, engineering structures, community based mitigation.

Cyclones: Concept, onset type, warning, elements at risk, typical effects, indian hazard zones, main mitigation strategies, hazard mapping, land use control, engineering structures, flood management, improving vegetation cover, community based mitigation.

Floods: Concept, onset type, warning, elements at risk, hazard zones and indian floods, typical effects: physical damage, casualties and public health ,crops and flood, main mitigation strategies, mapping of the flood prone areas, land use control, flood control and management, community based mitigation.

Droughts:Concept, onset type and warning, elements at risk, typical effects, main mitigation strategies: drought monitoring, water supply augmentation and conservation, drought planning.

Forest Fire: Concept, forest fire damages in india, operational fire management systems and organizations, community involvement, public policies concerning fire, the needs of fire management.

Other Type of Hazards and Disasters: Chemical and industrial disasters, brief description, effects, preparedness, epidemic, onset type, warning,causes and effects, risk reduction measures, heat waves, definition, dangers and effects, forecasts and warning, awareness.

Text Books

1.Natural hazards and Disasters by Donald and david Hyndman Cengage Learning 2010
2. Safety management by Girimaldi and Simonds, AITBS, New Delhi, 2002

Reference Books:

1. Disaster Management by Tej Singh, Akansha Publishing House, 2006
2. Towards Basics of Natural Disaster by D.K.Sinha Researchco Book Centre/Star Educational Books Distributor Pvt. Ltd 2000
3. Disaster Reference: A Hand Book for Emergencies by Babu Thomas BIS publication 2003
4. BIS Codes:- I.S 1893 ,I.S.4326,I.S.13920,NBC

CE406–ESTIMATING AND COSTING-LAB

Teaching Scheme:02P,Total:02 **Credit:** 01

Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum five assignments shall be performed to cover entire curriculum of course CE401

1) Units of measurements of various Items of Civil Engineering Works / study of DSR, study and use of check list of PWD for estimating of various building works

2) Approximate estimate of
i) residential building. ii) public building. iii) industrial shed
iii) elevated service reservoir iv) road and bridges

3) Prepare detailed estimate of a single storey (up to 2 bhk) load bearing structure by using current DSR

4) Prepare detailed estimate of a framed residential double storey structure by using current DSR and estimate of detailed quantities of steel reinforcement and prepare bar bending schedule

5) Detailed estimate of any two of following
i) compound wall. ii) septic tank. iii) earth work in road / canal

6) Rate analysis of any ten items

7) Site visit (attached estimate and photographs) / study standard estimate of PWD or any civil organization

Note: Any one of the above lab course content should be done using any estimating and costing software/ prepare excel spread sheet.

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE 407 WATER RESOURCES ENGINEERING-I LAB

Teaching Scheme:02P,Total:02 C**redit :** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

From each of the following groups minimum two assignments shall be performed to cover entire curriculum of course CE402

Group 1: - 1) Marking catchment area on a topo-sheet and working out average annual rainfall and determining yield. 2) Checking for inconsistency of precipitation record by double mass curve technique. 3) Frequency analysis of precipitation data (plotting on semi-log graph paper)

Group 2: - 1) Development of flood hydrograph from unit hydrograph and complex storm. 2) Development of unit hydrograph from isolated and composite flood hydrograph. 3) Development of unit hydrographs of different durations use s- curve method.

Group 3: - 1) Determination of canal and reservoir capacity for water requirement of crops. 2) Determination of reservoir capacity from mass inflow and mass demand curve. 3) Benefit cost analysis of water resources project. 4) Determination of yield of well by recuperating test data.

Group 4: - 1) Design of drainage system in water logged area. 2) Design of micro – irrigation system; either sprinkler of drip irrigation system. 3) Design of lift- irrigation system.

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE 408 ADVANCED STRUCTURAL DESIGN LAB

Teaching Scheme : 02P **Credit**: 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks**: 50

Following tests/assignments shall be performed to cover entire curriculum of course CE 404

1. Design and draw RCC structures such as retaining wall, combined footing, water tank, flat slab etc.(Any two)
2. Design and draw a post tension girder.(Rectangular or flanged type)
3. Ductile detailing as per IS-code provisions (13920) in the design of structure.
4. Excel sheet programs /Software based design and drawing of any one structure.
5. Site visit to at least one structure mentioned above.

- **ICA –** Internal Continuous Assessment shall support for regular performance of assignments and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student based on assignments completed by him/her. The performance shall be assessed experiment/assignment wise using internal continuous assessment format .
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE408 (B) MATRIX ANALYSIS OF STRUCTURES LAB

Teaching Scheme:02P **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum eight experiments should be performedto cover entire curriculum of course CE 404(B).

1. Write a program for Gauss elimination method of solving simultaneous equations.
2. Analyse a truss by flexibility method.
3. Analyse a continuous beam by flexibility method.
4. Analyse a continuous structure with elastic support by flexibility method.
5. Analyse a frame by stiffness method.
6. Develop a program for generating element stiffness matrix of a typical plane truss element.
7. Develop a program for generating element stiffness matrix of a typical plane frame element.
8. Develop flowchart for a computer program for analyzing a plane frame/plane truss by stiffness method.
9. Develop assembly subroutine of program for analysis of plane frame/plane truss by stiffness method.
10. Generate input data software for analyzing a plane frame/plane truss by stiffness method. Use both types of code numbering.
11. Develop subroutine of program for feeding data of plane frame/plane truss by stiffness method. 12. Develop subroutine of program for adding joint loads to stiffness formulation of a structure to be analysed by stiffness method.
13. Matrix operations using Excel, MATLAB or any computing tool.

A Report based on above shall be submitted by each student.

- **ICA** – Internal Continuous Assessment shall support for regular performance of assignments and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student based on assignments completed by him/her. The performance shall be assessed experiment/assignment wise using internal continuous assessment format (S 10).
- **ESE** – The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE408 (C) ADVANCED SOIL MECHANICS LAB

Teaching Scheme : 02P **Credits: 01**
Evaluation Scheme : 25 ISA + 25 ESE **Total Marks: 50**

Minimum eight experiments shall be performed to cover entire curriculum of course CE404.

1. UU/CU Triaxial test
2. Plotting of stress path
3. Flow net plotting for non-homogeneous soil
4. Flow net plotting for anisotropic soil media
5. Design of vertical sand drain
6. Determination of swelling pressure of soil
7. Determining characteristics of black cotton soil
8. Determination of collapse potential by plate load test
9. Determination of collapse potential of soil single oedometer test
10. Designing foundation on black cotton soil
11. Designing foundation on collapsible soil

- ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10.
- ESE – The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE408 (D) HYDRAULIC STRUCTURES LAB

Teaching Scheme:02P **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum four experiments should be performedto cover entire curriculum of course CE404.

1. Design and drawing of Gravity dam from given data.
2. Layout drawing of various types of Buttress dam (or Arch dam) and section at middle.
3. Design and drawing of spillway and stilling basin.
4. Design and drawing of surge tank (any two types)
5. Design and drawing of head regulator for earth dams

A Report based on above shall be submitted by each student.

- **ICA –** Internal Continuous Assessment shall support for regular performance of assignments and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student based on assignments completed by him/her. The performance shall be assessed experiment/assignment wise using internal continuous assessment format (S 10).
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE 409 PROJECT PHASE I

Teaching Scheme:02P,Total:02 C**redit :** 02

Evaluation Scheme: 50 ICA + 50 ESE **Total Marks:** 100

Course Description: The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

1.It is expected that the broad area of Project phase I shall be finalized by the student in the beginning of the VII semester. Extension of Minor project undertaken may be Project.

2. In general a group of Maximum 5 students shall be allotted for Project and same project group for Project phase II.

3. Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students. The Synopsis/Abstract on the selected topic, after detail literature survey should be submitted to the Project guide appointed by Head of the department.

4. Project phase I may involve literature survey, problem identification, work methodology preparing specification and material procurement, collection of data , conduction of experiments and analysis. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.

5. Within three week a sort of session, a reveiew of all Project work area will be taken by a committee comprise of guide, expert and HOD

6. Another presentation will made to finalize the title of project within a month from first presentation.

7. Approximately more than 50% work should be completed by the end of VII semester.

8. Each student group is required to maintain log book for documenting various activities of Project phase I and submit group project report in the form of thermal bound at the end of semester–VII. Submit the progress report.

9. Evaluation Committee comprising of the Guide, Expert and HOD appointed by the Head of the department will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Guide lines for ICA :The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Assessment of the project-I for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given inTable-A.

Assessment of Project-I

Name of the Project:_____ Name of the Guide:_____

Table- A

SN	Name of Student	Problem Identification and project objectives	Literature Survey	A Project Methodology/ Design/PCB/ hardware/ simulation/ programming	Progress Status	Present ation
		20	20	30	10	20

CE 410 SEMINAR

Teaching Scheme:02P,Total:02 C**redit :** 01
Evaluation Scheme: 25ICA + 25 ISE **Total Marks:** 50

Description:The course explores the knowledge of presentation and effective communication.The course develops ability to work on multidisciplinary teams, identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

1.Each Student shall select a topic related to Civil Engineering for seminar which is not covered in curriculum. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.

2. Topic of Seminar shall be registered within a three weeks from commencement of VII Semester and shall be approved by the committee.

3. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar. Seminar shall be related state of the art topic of his choice approved by the committee.

4. Each student should deliver a seminar in scheduled period (Specified in time table or time framed by department) and submit the seminar report (paper bound copy/Thermal bound**).**

Assessment of seminar:

Guide lines for ICA: ICA shall be based on topic selection , presentation and seminar report submitted by the student in the form of thermal bound.

Assessment of the Seminar for award of ICA marks shall be done jointly by the guide and a departmental committee, as per the guidelines given inTable-B

Name of Guide:_____

Table-B

SN	Name of Student	Seminar Topic	Topic Selection	Literature survey	Report writing	Depth of understanding	Presentation	Total
			10	10	10	10	10	50

CE451 WATER RESOURCES ENGINEERING-II

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 100
Duration of ESE: 03Hrs

Dams: Introduction and scope of the subject, types of dams, reservoir storage zones, selection of site for dam, choice of a dam.

Diversion Head Works : Introduction, selection of site, layout of diversion headwork and its components and functions, types of weirs and barrages, causes of failures of weirs on permeable foundations and remedies, hydraulic design of weir with respect to subsurface flow, safety against piping and uplift, Bligh`s, Lane' s and Khosla's theories.

Gravity Dams: Introduction, cross section, forces acting on dam, load combinations as specified by IS 6512-1984, stresses in dam (normal, principal and shear stresses), modes of failures, stability analysis and design of gravity dam, elementary and practical profile, low and high dam, materials of construction, control of cracking, galleries, Joints and keys.

Earth Dams : Introduction, types, elements of earth dam, basic design considerations, causes of failures, piping and its prevention, control of seepage, drainage in earth dams, phreatic line – its uses and characteristics, equation, procedure of construction phreatic line for various cases, stability of upstream and downstream slopes of earth dam under various situations, introduction to rock-fill dam.

Introduction to arch dams, types and their suitability

Spillways: - Introduction, spillway capacity, different types of spillways and their suitabilities, design principles of Ogee spillway, working of siphon spillway.Energy dissipation below spillway, types of hydraulic jump, jump height curves and tail water rating curves, various types of energy dissipators: Indian Standard stilling basins and buckets.

Gates: Uses, types of spillway crest gates.

Canal Irrigation: Types of irrigation canals, canal alignment. Design of cross section of stable unlined channels in alluvial soil by Kennedy's and Lacey's theories according to IS 7112 – 1973, merits and demerits of Kennedy's and Lacey's theories, Garret's diagram.Design procedure for L – section of an irrigation canal, balancing depth, losses in canals, schedule of area statistics and channel dimensions.

Text Books:

1. Irrigation, Water Resources and Water Power Engineering, Modi P.N., Standard Book House, Delhi, 8th edition, 2012
2. Irrigation Engineering And Hydraulic Structures, Garg S.K.,Khanna Publishers, Delhi. 1998.

Reference Books:

1. Engineering Hydrology, Subramanya K, Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2008.
2. Irrigation and Water Power Engineering, Punmia B.C., Pande B.B., .Lal, Ashok Kumar Jain,. Laxmi Publications Pvt. Ltd., New Delhi, 1999.
3. Fundamentals of Irrigation Engineering, Bharat Singh, Nem Chand &Bros.,India; 6th Revised edition,1979

4. Irrigation and Water Resources Engineering, by Asawa, G.L, New Age International publisher, First edition 2005

CE 452 TRANSPORTAION ENGINEERING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Highway Planning and Development: Highway planning in India, development, rural and urban roads, road, departments in India, road classification, road authorities i.e. IRC, CRRI, NHAI, PMGSY Program etc. Financing of road projects, road safety audit

Field Surveys: Reconnaissance, aerial surveys, location surveys, location of bridges

Highway Alignment and Geometric Design: highway alignment, cross section, formation width, land width, design of vertical and horizontal alignment including curves, super elevation, sight distance, gradients, alignment and geometrics of hill roads. Traffic characteristics, operations, design of intersections, design of parking facility, highway lighting, traffic planning and administration

Road Materials: Aggregates and their types, physical and engineering properties, fillers, bitumen, characteristics, emulsions and cutbacks, basic tests on all materials, soil investigation, test on soil; CBR, plate load test for modulus of subgrade reaction

Construction of Roads: Stabilized earth, gravel roads, W.B.M. roads, high cost roads, bituminous roads, cement concrete roads.

Pavement Analysis: Standard axle load and wheel assemblies for road vehicles under carriage system for aircraft, tire and contact pressure, contact area imprints, computations of ESWL, Stress Strain deformation analysis for single layer flexible pavement system, Stress deflection for rigid pavement due to load and temperature

Pavement Design: Design of flexible (G.I. method and CBR method using IRC 37-2001, IRC58-2002 recommendations) and rigid pavements (Westergaurd wheel road analysis), Maintenance & Strengthening of pavements

Traffic Engineering: Road user characteristics, vehicular characteristics, traffic flow characteristics, speed, traffic volume studies, parking studies-definition, purpose, types, survey methods. Accident studies-purpose, types, causes, collision diagram, condition diagram, preventive measures

Traffic Control Devices: Pavement marking, signs, signals, traffic management, various types of intersection and its design criteria, traffic simulation and its advantages

Advanced Urban Transport Technology: Classification, mass and rapid transit system, introduction to Intelligent Transportation system (ITS), electronic toll collection.

Bridges: Site investigation, waterway calculations, scours depth, afflux, and economic span.
Classification of superstructures with respect to structural behaviour and material used types of substructures, flooring joints, movable bridges, and temporary bridges. Methods of erection of various types of bridges, testing and strengthening of bridges

Bridge Bearings & Foundation: Suitability for each type of bridges
IRC 37-2001, IRC58-2002,

Text books:

1. Highway Engineering, Khanna S. K. & Justo, 10th edition, Nem Chand & Bros. Roorkee (UP), 2015.
2. Principles of Transportation Engineering, Chakroborty P. and Das A., 2nd edition, Prentice Hall of India, 2003.

3. Transportation Engineering: An Introduction, Khisty and Lall, 3rd Edition, Prentice Hall, 2003.
4. Transportation Engineering, Kadiyali L. R., Khanna Book Publishing co. Ptd. New Delhi, 2016.

Reference books:

1. Highway Engineering, Wright P. H. and Dixon C., 7th Edition, John Willey, 2015.
2. Pavement Design and Materials, Papagiannakis A. T. and Masad E. A., 1st Edition, John Willey, 2008.
3. Transportation Engineering and Planning, Costas P. and Prevedouros, 3rd Edition, Prentice Hall, 2001.
4. Principles of Highway Engineering & Traffic Analysis, Mannering F. L., Walter P. K. And Scott John, 3rd Edition, Willey, 2011.
5. Guidance of Design of Flexible pavement, Second Revision- IRC-37-2001.
6. Guidance of Design of Rigid pavement, - IRC-58-2002.

CE453 (A) ADVANCED DESIGN OF STEEL STRUCTURES

Teaching Scheme: 03L+ 00 T, Total: 03 **Credit**: 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 100
Duration of ESE: 03Hrs

Hoarding

Structures : Analysis and design of hoarding structures under dead, live and wind load conditions as per codal provisions by limit state method, introduction to fatigue failure. introduction to gantry girder.

Microwave Towers: Introduction, structural configuration, function, analysis and design.

Transmission Towers: Introduction, structural configuration, bracing systems, analysis and design as per codal provisions. Use working stress method.

Tubular Structures: Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per codal provisions, detailing of joints.

Design of Chimneys : Introduction, type, joints, lining, ladder, forces acting on chimneys, design of thickness of steel plates for self supporting chimney, design of base plate, anchor bolt and foundation, stability of steel chimneys.

Text Books:

1. Design of steel Structures, Volume II ,Ram Chandra, Standard Book House, Delhi.
2. Comprehensive Design of steel structure ,Punmia and Jain, Laxmi Publication, Delhi.
3. Design of steel structures, M Raghupathi, Tata McGraw Hill, New Delhi.
4. Limit state design of steel structures, S K Duggal, Tata McGraw Hill Education.
5. Design of steel structures, N Subramanian, Oxford University Press.

References Books:

1. Structural Design in Steel ,SarwarAlamRaz, New Age International Publishers
2. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.
3. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.
4. IS: 801 - 1975, Code of Practice for use of cold formed light gauge steel structural members in general building construction, BIS, New Delhi.

CE453(B) PAVEMENT DESIGN

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme : 15 ISA1 + 15 ISA2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE : 3 hrs.30 min

General: Structural action of flexible and rigid pavements. Characteristics of highway pavements.

Material Characteristics: AASHO sub grade soil classification. Group index, CBR, North Dakota cone bearing value, plate load test for "K", Marshal's method of bituminous mix design. Modulus of rupture and elasticity, poison's ratio and coefficient of thermal expansion of concrete, layer equivalency concepts.

Design Parameters: Standard Axle load and wheel assemblies for road vehicles, tire and contact pressure, contact area imprints, computations of ESWL for flexible and rigid pavements. Load repetitions and distributions of traffic for highway.

Analysis of Flexible and Rigid Pavements: Stress, strain deformation analysis for single, two three and multilayered flexible pavement systems. Stress and deflections for rigid pavements due to load and temperature, influence charts, ultimate load analysis, joints in C.C. pavements.

Flexible Pavement Design: North Dakota Cone, Group index, CBR, IRC-37, Brumister, Triaxial (Kansas), AASHO method of design.

Rigid Pavement Design: IRC-58, PA. C.A., AASHO method of design, design of joints and reinforcement.

Pavement Testing and Evaluation: Pavement evaluation techniques including bump integrators, Benkelman Beam, falling weight deflectometer methods. Straightening of pavement: Design of flexible, composite and rigid overlays for flexible and rigid pavements, repairs, maintenance and rehabilitation of pavements.

Text Books:

1 Traffic Engineering and Transportation Planning, Kadiyali L.R, 8th edition, Khanna Publication New Delhi, 2011.
2 Highway Engineering, Khanna S.K., and Justo C.E.G., Nem Chand Bros., Roorkee, 2004.

Reference Books:

1 Design and Performance of Road Pavement Croney & Croney; McGHraw Hill, 2002.
2. Principles of Pavement Design, Yoder & Witzace; Prentice Hall,2000
3. Pavement Analysis and Design, Y. H. Huang, 2nd edition, Pearson Prentice Hall, 2003.
4. Pavement Engineering - Principles and Practice, Mallick, R.B. and T. El-Korchi, CRC Press, Taylor and Francis Group, Florida, USA, 2009.
5. Pavement Design and Materials, Papagiannakis, A.T. and E.A. Masad, John Wiley and Sons, New Jersey, USA, 2008.

CE453 (C) ADVANCED WASTE WATER TREATMENT

Teaching Scheme: 03L+00T: Total 03 **Credit:** 03
Evolution Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ISE **Total Marks:** 100
Duration of ESE: 03Hrs

Review of Conventional Water and Wastewater Treatment Operations and Processes:
Classification of wastewater treatment methods, transport phenomena, material balance principle, mass transfer at fluid boundaries, reaction kinetics, transport (flow) and transformation (reaction) models, aeration systems and their design. fundamentals of biological treatment processes, modeling of biological suspended growth complete-mix processes with and without recycle, evaluation of bio-kinetic coefficients, indian standards for discharge of treated wastewater on land, into public sewer and inland surface water.

Principles of Biological Treatment: Process design and operating parameters: activated sludge process conventional and sequential batch types, aerated lagoon, oxidation ditch, facultative waste stabilization pond, membrane bioreactor, Kinetic equations for filter performance, physical facilities and process design considerations of rotating biological contactors.

Anaerobic Process Fundamentals: Process design and operating parameters of anaerobic sludge blanket, lagoon, and filter systems, concepts of membrane usage and sequential batch operation in anaerobic systems. Sludge treatment and disposal, sludge mass-volume relationship, Process fundamentals of thickening, stabilization, conditioning, and dewatering. Design considerations of gravity thickener, flotation tank, digester, centrifuge, vacuum filter, belt filter press and drying bed.

Removal of Hazardous Waste: Biological removal of phosphorous, heavy metals, toxic and recalcitrant organic compounds. Biological treatment with membrane separation, combined aerobic treatment processes, activated sludge with fixed film packing, aerobic granular biomass wastewater treatment, submerged attached growth processes, denitrification with attached growth systems

Free Water Surface and Subsurface Flow Constructed Wetlands: Components, process, potential applications, hydraulics cesign elements, and operation and maintenance and applications of constructed wetland in wastewater and sludge treatment . Aquatic wastewater treatment systems using water hyacinth and duckweed. Stream and Effluent standards, design considerations for land treatment by slow rate, rapid infiltration and overland flow applications, evaluation of effluent quality for irrigation, wastewater reclamation and reuse.

Energy Efficiency in Wastewater Treatment: Limitations of conventional centralized wastewater systems, concept of sustainability inwastewater treatment,concept, significance, applications and elements of decentralized wastewater treatment,technologies for decentralized wastewater treatment, gray water treatment, upgrading wastewater treatment plant performance. Introduction to nano technology in water and wastewater treatment, drinking water decontamination using nano technology, application of nano TiO2 catalyst in waste water treatment, disinfection by nano particles.

Text Book:

1. Wastewater Engineering Treatment and Reuse, Metcalf and Eddy, Tata McGraw HillPublication, 6th Reprint. 2003.
2. Environmental Engineering H. S. Peavy, D. R. Rowe, and G. Tchobanoglous, McGraw Hill Education, 1st edition, 2013.
3. Water and Wastewater Technology, M. J. Hammer Sr., and M. J. Hammer Jr., Pearson New Internation, 7th Edition 2011.
4. Introduction to Environmental Engineering ,Davis, M, L, and Cornwell, D, A, Tata McGraw Hill Education, 5th Edition, 2012.

References Book:

1. Theory and Practice of Water and Wastewater Treatment, Droste, Ronald L, John Wiley & Sons Publication, latest Edition, 2009.
2. Physico-Chemical Processes of Water quality control, Weber W, J, Wiley-Interscience, 1994.
3. Unit Operations And Processes In Environmental Engineering, Renolds T, D, and Richards, P. A, PWS Publishing Company, 2nd Edition, 1996.
4. Environmental Engineering A Design approach, A. P. Sincero, G. A. and Sincero, PHI learning private limited, 2004.
5. Environmental Engineering Science, W. W. Nazaroff and Alvarwz-Cohen, John Wiley & Sons Publication, 2011.
6. Water Works Engineering, S. R.Quasim, E. M. Motley and G. Zhu, PHI Learning private limited, 2000.
7. Wastewater Treatment Plants Planning, Design And Operation, S. R. Quasim, CRC Press, 2nd Edition, 2010.
8. "Manual On Water Supply And Treatment", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
9. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, GoI,New Delhi, 1993.
10. Hand Book Of Environmental Engineering Calculations, C. C. Lee, and S. D. Lin, McGraw Hill Publication, 2nd Edition 2007.
11. Nanotechnology For Environmental Decontamination,M. K. Ram, S. Andreescu, and H. Ding, McGraw Hill, 2011.

CE 453(D) ADVANCED FOUNDATION ENGINEERING

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme : 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE : 3hrs.

Bearing Capacity: Bearing capacity for footing on or adjacent to slopes, footing on non-homogeneous soil conditions, bearing capacity of rock.

Footings: Footings with eccentric loading& moments, combined footing

Pile Foundations: Uplift resistance of pile, vertical piles subjected to lateral loads, Solution with soil modulus assumed constant, short and long piles, Hansen's method, Broom's method, use of p-y curves, deflection of vertical piles, Batter pile groups under inclined load, Culman's method, analytical method, Hrehnikoffi's method, Brill's approach,

Raft Foundations: Types, Bearing capacity of rafts on sands and clay, analysis of rigid rafts, modulus of subgarde reaction and its determination, effect of depth on subgarde reaction, criteria for rigid / Flexible raft, raft analysis using modulus of subgarde reaction,

Well Foundations : Depth of well foundation, bearing capacity of well foundation, loading on well foundation, lateral stability of well foundation, different methods of analysis – Terzaghi's analysis, Banerjee and Gngopadhyay's method, IRC method, design of components of well foundation.

Foundations in Difficult Soils: Expansive soils, chemically aggressive environment, soft soils, fills, collapsible soils, Geru & Manjara rock

Anchored Bulk Heads - Free earth support and fixed earth support methods .Types of anchors, Design of anchors

Text Books:

1. Foundation Analysis and Design, J. E. Bowles, 5th Edition, McGraw Hill International, 1996.
2. Theory and Practice of Foundation Design, N. N. Som and S. C. Das, PHI Learning Pvt. Ltd., 2009.

Reference Books:

1. Soil Mechanics and Foundation Engineering, V.N.S. Murthy, CBS Publishers & Distributors, 1st edition, 2007.
2. Principal of Foundation Engineering, Das B. M., 5th Edition, Thomson Brooks/Cole, 2004
3. Design Aids in Soil Mechanics and Foundation Engineering, R. Kaniraj, 1st edition, Tata McGraw Hill, New Delhi, 2004.
4. Foundation Design & Construction, M. J Tomlinson, 7th Edition, Addison-Wesley Longman Ltd, 2001.
5. Design of foundation System: Principles and Practices, N. P. Kurian, 3rd edition, Narosa Publishing House, 2005.
6. Foundation Engineering Handbook, R. W. Day, McGraw Hill, 2005.
7. Pile Foundation Analysis and Design, H. G. Poulus and E. H. Davis, John Wiley & Sons, 1980.

CE454 (A) EARTHQUAKE RESISTANT DESIGN

Teaching Scheme03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 100
Duration of ESE: 03Hrs

Seismology: Seismic activities of a plate tectonic region-india, types of waves, local geology and soil condition, quantification, magnitude, energy andintensity of earthquake. analysis of earthquake data, seismic zoning, cause of earthquake damage, historyof past earthquakes.

Vibration Theory: Free and forced vibration of single degree, multi degree of freedom system, damping, response spectra etc.

Structural Form and Response to Earthquakes: Form of super structure, regular, irregular form of structures, Response of non engineering buildings and RC building with brick infill Lateral load resisting system, guidelines for efficient seismic designs.

Seismic Analysis and Concept of Seismic Design: Evaluation of seismic force using equivalent static analysis as per Indian code, modal analysis techniques, lateral load analysis of building,Torsion.

Codal Provisions for Ductile Detailing of RC Structures subjected to Seismic Forces: Design of flexural members, design of columns and beam subjected to bending and axial load, design of joints of frame.

New Techniques in Seismic Design: Introduction to Geotechnical earthquake Engineering, BaseIsolation technique, Seismic dampers , Retrofitting techniques etc.

Text Books:

1.Earthquake Resistant Design of Masonry and Timber Structures by Arya A.S. 6th edition 1987.
2.Earthquake Resistant Design of R. C. C. Structures by Gosh S. K.
3.Elements of Earthquake Engineering by Krishna Jai, South Asian Pubublication, New Delhi.
4. Earthquake Resistant Design of Structures by Pankaj Agarwal and Shrikhande Manish, Prentice Hall of India, New Delhi, 2006

References Books :

1. Dynamics of Structures by Chopra Anil. K., 4th edition Prentice Hall Pvt. Ltd. 2011.
2. Dynamics of Structures by Clough R. W. and Penzien Joseph, Tata McGraw Hill.
3. Earthquake Resistant Designs by Dowrick D. J., John Wiley and Sons 1987.
4. Structural Dynamics by Paz Mario, CBS Publishers and Distributers, 2004
5. Government of Maharashtra Earthquake resistant Design of house guiding lines and assessment of damages
6. Manual of Earthquake Resistant Non engineering Construction, University, Roorkee

IS CODE REFERENCES

• IS:1893 (2002), Indian Standard Criteria For Earthquake Resistance of Structures (Part I): General Provisions and Building (Fifth Revision), Bureau of Indian Standards, New Delhi
• IS: 4326 Criteria for Earthquake Resistant Design and Construction of Buildings – Code of Practice, Bureau of Indian Standards, New Delhi

• IS:13920(1993), Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force –Code of Practice, Bureau of Indian Standards, New Delhi
•IS 456 (2000), Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi

CE454(B) - ADVANCED FLUID MECHANICS

Teaching Scheme: 03L+00T: Total 03 **Credit:** 03
Evolution Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ISE **Total Marks:** 100
Duration of ESE: 03Hrs

Basic Concepts and Fundamentals: Definition and properties of fluids, fluid as continuum, review of concepts of kinematics of fluid motion, vorticity, circulation, velocity potential and stream function, irrotational flow Langragian and Eulerian description, velocity and stress field, fluid statics, fluid dynamics.

Governing Equations of Fluid Motion: Reynolds transport theorem, integral and differential forms of governing equations: mass, momentum and energy conservation equations and solution to fluid flow with thermal effects, Navier-Stokes equations with exact solution, Euler's equation, Bernoulli's Equation, Couette flows, Poiseuille flows, fully developed flows in non-circular cross-sections, unsteady flows, creeping flows.

Potential Flows: Revisit of fluid kinematics, stream and velocity potential function, circulation, irrotational vortex, basic plane potential flows,uniform stream,source and sink, vortex flow, doublet, superposition of basic plane potential flows, flow past a circular cylinder. Magnus effect,KuttaJoukowski lift theorem,concept of lift and drag.

Laminar Boundary Layers: Prandtl'sBoundary layer equations, boundary layer thickness, boundary layer on a flat plate, similarity solutions, integral form of boundary layer equations, approximate methods, flow separation, entry flow into a duct.

Elements of Stability Theory: Concept of small-disturbance stability, OrrSommerfeld equation, Inviscid stability theory, boundary layer stability, thermal instability, transition to turbulence.

Turbulent Flow: Introduction, fluctuations and time-averaging, general equations of turbulent flow, turbulent boundary layer equation, flat plate turbulent boundary layer, turbulent pipe flow, Prandtl mixing hypothesis, turbulence modeling, free turbulent flows.

Compressible Flows: Speed of sound and Mach number, basic equations for one dimensional flows, isentropic relations, Normal-shock wave, Rankine-Hugoniot relations, Fanno and Rayleigh curve, Mach waves, oblique shock wave, Prandtl-Meyer expansion waves, Quasi-one dimensional flows, compressible viscous flows, compressible boundary layers.

Computational Fluid Dynamics (CFD): Introduction, motivation, boundary conditions andbasic discretization – finite difference method, finite volume method and finite element method.equations of motion solution procedure,additional equations of motion,grid generation and grid independenceboundary conditions practice, Makes Perfect Laminar CFD,calculations pipe flow, flow around a cylinder, turbulent CFD,calculations design of a Stator CFD with heat transfer, compressible flow CFD calculations, open-channel flow CFD calculations

Text Book:

1. Hydraulics and Fluid Mechanics Including Hydraulic Machines, P. N. Modi, S. M. Seth Standard Book House, 19th Edition 2009
2. Fox and McDonald's Introduction to Fluid Mechanics, P. J. Pritchard, J. W. Mitchell, J. C. Leylegian, 9thEdition, John Wiley & Sons, 2015.
3. Computational Fluid Dynamics: The Basics with Applications, Anderson Jr. John D., McGraw-Hill Series of Mechanical Engineering, 1995.

References Book:

1. An Introduction to Fluid Dynamics, G.K. Batchelor, Cambridge University Press, new edition, 2000.
2. Fluid Mechanics, White Frank M., Tata McGraw-Hill, Singapore, 6th Edition, 2008.

3. Viscous Fluid Flow, White Frank M., Third Edition, McGraw-Hill Series of Mechanical Engineering, 2006.
4. Modern Compressible Flow with Historical Perspective, Anderson Jr. John D., McGraw-Hill, 3rd Edition 2002.
5. Fundamentals of Aerodynamics, Anderson Jr. John D., Mc Graw Hill, 5th Edition 2010.
6. Advanced Engineering Fluid Mechanics, K. Muralidhar and G. Biswas, 3rd Edition, Narosa, 2016.
7. Incompressible Flow, Panton R.L., John Wiley and Sons, Kindle Edition, 4th Edition 2013.
8. Fluid Mechanics, KunduPijush K. and CohenIra M., Fourth Edition, Academic Press (ELSEVIER), 2008.
9. Boundary Layer Theory, Schlichting H., Springer Verlag, 9th edition, 2000.
10. Fluid Mechanics: Fundamentals and Applications (with Student Resources DVD) Tennekes H. and Lumley J.L., A First Course in Turbulence, The MIT press, Second Edition, 1999.

CE454(C) REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM

Teaching Scheme: 03L+ 00 T, Total: 03 **Credit: 03**
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks**: 100
Duration of ESE: 03Hrs

Principles of Remote Sensing : Definition, types and scope of remote sensing, stages in remote sensing data acquisition, electromagnetic radiation and electromagnetic spectrum, black body radiation and radiation laws, interaction of EMR with atmosphere and Earth's surface features.

Platforms, Sensors and Data Products: Remote sensing platforms, types & characteristics of sensors: IRS, LANDSAT, SPOT, IKONOS, Quick Bird, remote sensing data products.

Thermal & Microwave Remote Sensing : Thermal Remote Sensing, thermal properties of materials, emissivity of materials, thermal inertia of Earth surface features, thermal data sets: LANDSAT and ASTER, concept and principles of microwave remote sensing, microwave data sets SLAR. LIDAR and SAR, application of thermal and microwave data.

Image Interpretation: Factors affecting image interpretation image characteristics and preparation of image interpretation keys, elements of image interpretation, methods and techniques of image interpretation, multi concepts in image interpretation.

Introduction to GIS: Definition, concepts, information system, components of GIS, history, objectives of GIS, hardware and software requirements of GIS, geospatial data architecture, operations, geographic co-ordinate system, map projections, input data for GIS, display, types of output products, GIS categories, level and scale of measurement, importance of data quality.

Vector Data and Processing: GIS data types, data representation, data Sources, typical GIS data sets, data acquisition, vector data model, relationship between classes, data structure, data verification and editing spatial data models and errors- GIS databases, attributes data input and management.

Raster Data and Processing: Elements of data model, cell, value, data structure, cell by cell encoding, run length encoding, Quad tree, header files, format, types of raster data, data compression, linking and integration of vector data.

Data Conversion and Editing: Data format conversion, medium conversion, spatial interpolation, measurement and analysis methods, data accuracy and standards, attribute data input and management-relational mode- data manipulation- classification techniques, Digital Elevation Model: Need of DEM, various structures of DEM: line, TIN, grid.

Text Book

1. Textbook of Remote Sensing and Geographical Information systems, M. Anji Reddy, BS Publications, Hyderabad. 3rd edition, 2011.
2. Remote Sensing and GIS, A.M.Chandra and S.K. Gosh, Narosa Publishing Home, New Delhi, 2nd reprint,2016.

Reference books

1. Remote sensing and image interpretation, Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, John Wiley & Sons, 7th edition, 2015

2. Fundamentals of Remote Sensing , George Joseph , Universities Press, Hyderabad, 1st edition, 2005
3. Introduction to Geographical Information System, Kang tsung Chang ., Tata McGraw Hill, 7th edition, 2010
4. Geographical Information System Vol. I & II , Paul A. Longley, Micheal F. Goodchild, David J. Magaine David J. Magaine, David W Rhind.., John Wiley & Sons, 4th edition 2015.

CE454(D) RAILWAY TUNNEL AND AIRPORT ENGINEERING

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Railway: Characteristics of railway transport, classification of railway, track standard terminology, track sections in embankment and cutting, engineering survey.

Railway Track Gauge: Different gauges on indian railways, loading gauge, construction gauge, unigauge, problems caused by change of gauge.

Track and Track stresses: Requirements, forces acting on track, coning of wheels, tilting of rails, rails: functions, types of rails, rail joints, rail failure, function suitability and drainage, treatment, defects, standard rail sections.

Sleeper: Functions, requirements, types of sleepers; concrete sleepers, pre stressed, sleeper density, manufacturing and spacing of sleepers, ballast: function, specifications of track ballast, track fittings: fittings and fastening.

Alignment of Railway lines: Importance, basic requirements of an idealalignment, selection of a good alignment, geometric design of track: necessity for geometric design, gradients, grade compensation on curves, super elevation, equilibrium cant, cant deficiency, maximum permissible
Speed, negative super elevation.

Resistance to Traction: Resistance to-friction, wave action, causes of creep, effects of creep, measures to reduce creep. speed, track irregularity, wind, gradient, curvature. stress in rails, sleepers, ballast and formation.

Construction and Track maintenance: Plate laying method, operations involved Tools & common items of track maintenance.

Points and crossings: Important terms, types of track layouts and sketchesof turn out, diamond crossing, triangle, double junction, scissors cross over, single slip, double slip, gathering line, signalling and interlocking: objectives of signalling, classification of signals, CTC and ATC system, interlocking & it's principles.

Railway Stations and yards: Classification of railway stations, Purpose, facilities required at railway stations, requirements of station yard, types of yards,

Modernization in railways: Types of railways, high speeds, improvementsin track structure: components, automation, safety aspects, introduction to skybus, monorail & metro rails.

Tunnels: Necessity, types, advantages and disadvantages of tunnels compared to open cuts, tunnel alignment, size and shape of tunnels, tunnel lining,drainage, ventilation & lighting of tunnels, tunnelling methods for soft ground and hard ground, method of mucking, drilling, and blasting.

Airport: Agencies controlling national and international aviation, various surveys to be conducted, airport,classifications (ICAO), selection of site for airportAirport obstructions: Zoning laws, imaginary surfaces, approach and turning zone.

Runway and Taxiway Design: Orientation of runway, wind rose diagram, basic runway length and corrections, runway geometric design standards, drainage, introduction to pavement design airport layout, terminal area, unit terminal concept, apron, apron layout, aircraft parking, hangers, environmental guidelines

for airport projects, heliports, main characteristics of helicopters, nature of helicopters transport, site selection for helicopters

Text Books:

1. A Text Book of Railway Engineering, Saxena S. C. & Arora S. P.,7th edition, Dhanpat Rai Publications(P) Ltd., New Delhi, 2015.
2. Airport Planning & Design, Khanna S. K., Arora M. G. , Jain S. S. , 6thedition, Nemchand &Bros., Roorkee,2012.
3. A Text Book of Transportation Engineering, S. P. Chandola, S. Chand & Co.New Delhi, reprint 2008.
4. Tunnel Engineering, S. C. Saxena, Dhanpat Rai Publications(P) Ltd., New Delhi.

Reference Books:

1. Principles of Transportation Engineering, Chakroborty P. and Das A., 1st edition, Prentice Hall of India, 2009.
2. Transportation Engineering Vol. I & II, V.N. Vazirani & S.P. Chandola, 7thedition , Khanna Publishers, New Delhi, 2003.
3. Railway Engineering, Satish Chandra & Agrawal M. M., 2nd edition, Oxford University press India, 2013.
4. Harbour, Dock & Tunnel Engineering, Shrinivasan R., 27th revised edition, Charotar publishing House Pvt. Ltd., 2009.

CE 455 WATER RESOURCES ENGINEERING-II LAB

Teaching Scheme:02P,Total:02 C**redit :** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum five assignments shall be performed to cover entire curriculum of course CE451

1. Development of flood hydrograph from unit hydrograph and complex storm.

2. Determination of reservoir capacity from mass inflow and mass demand curve.

3. Stability analysis of a gravity dam considering all major forces.

4. Stability analysis of slope of earth dam.

5. Design of Ogee spillway with energy dissipator.

6. Analysis of weir on permeable foundation by using Khosla's charts. 7. Design of unlined canal in alluvium by using Garret's diagram /Lacey's equations (at least three sections along the alignment including calculation of design discharge from command area and kor depth and kor period) and plotting L-section; also preparing schedule of area statistics and channel dimensions.

8. Detailed report along with drawings, based on visit to any dam; including proof of the visit.

9. Benefit - cost analysis of a water resources engineering project.

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE456–TRANSPORTAION ENGINEERING-LAB

Teaching Scheme:02P,Total:02 **Credit:** 01

Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum eight assignments shall be performed to cover entire curriculum of course CE452

1. Penetration test
2. Ductility of Bitumen
3. Softening point of Bitumen
4. Flash & fire point
5. Specific gravity of Bitumen
6. Viscosity of Bitumen
7. Stripping value of road aggregates.
8. Bitumen extraction test (on premix sample)
9. CBR test
10. Plate load test (for modulus of subgrade reaction)
11) Bituminous mix design Marshal Stability test
12) Numerical based on Flexible Pavement Design
13) Numerical based on Rigid Pavement Design
14) A report on at least one site visit.
    Visit to construction site of major road projects, hot mix plant etc (compulsory) .

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE 457 (A) ADVANCED DESIGN OF STEEL STRUCTURES - LAB

Teaching Scheme : 02P **Credit**: 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks**: 50

Following tests/assignments/designs shall be performed to cover entire curriculum of course CE454

1. Minimum 3 designs based on syllabus of CE 454.
2. Assignments /Problems based on the above syllabus. (At least five)
3. Exposure to computer aided analysis using available software be considered.
4. Site visit with report to any one structure mentioned in the syllabus.

Detailed drawing of any two designs should be completed with AutoCAD software

- **ICA –** Internal Continuous Assessment shall support for regular performance of assignments and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student based on assignments completed by him/her. The performance shall be assessed experiment/assignment wise using internal continuous assessment format .
- **ESE –** The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE457(B)PAVEMENT DESIGN LAB

Teaching Scheme : 02 P Total = 02 **Credits: 01**
Evaluation Scheme : 25 ISA + 25 ESE **Total Marks: 50**

Minimum six experiments shall be performed to cover entire curriculum of course CE453(B).

1. Determining CBR value for sub grade, sub-base and base material and designing the flexible pavement
2. Determining North Dakota cone bearing value and designing the flexible pavement
3. Determining modulus of sub grade by conducting plate load test
4. Bituminous mix design by Marshal method
5. Designing flexible pavement by IRC - 37.
6. Designing rigid pavement along with joints by IRC -58
7. Pavement evaluation by Bump integrators,
8. Pavement evaluation by Benkelman Beam,
9. Pavement evaluation by Falling weight deflectometer methods

- ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10.
- ESE – The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE457(C) - ADVANCED WASTE WATER TREATMENT-LAB

Teaching Scheme: 03P **Credit:** 01
Evolution Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum eight experiments shall be performed from list to cover entire curriculum of course **CE453(C)**

1. BOD rate constant determination.
2. Development of laboratory scale Activated Sludge Process (ASP) model
3. Determination of dissolved oxygen, MLSS, MLVSS, sludge volume index and sludge density Index.
4. Evaluation of bio-kinetic parameters.
5. Sequential batch operation and evaluation of ASP model.
6. Activated carbon treatment for organic matter removal.
7. Development and operation of anaerobic reactor system.
8. Evaluation of effluent quality for irrigation.
9. Use of software for the analysis and design of environmental systems such as EPANET, SEWERCAD, STORMCAD, WATERCAD, Qual2e, MODFLOW etc.
10. Design physical, chemical and biological treatment systems by spreadsheet computation.

ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE457(D)ADVANCED FOUNDATION ENGINEERING

Teaching Scheme : 02 P Total = 02 **Credits: 01**
Evaluation Scheme : 25 ISA + 25 ESE **Total Marks: 50**

Minimum six experiments shall be performed to cover entire curriculum of course CE453(D).

1. Determination of the bearing capacity of footing on sloped ground.
2. Determination of the bearing capacity of footing on multilayered soil
3. Design of piles subjected to lateral load.
4. Design of battered pile group under inclined load.
5. Design of raft foundation for a given site.
6. Design of Well foundation for a given site.
7. Design of foundation on expansive soil
8. Design of foundation on collapsible soil
9. Design of anchors
10. Field visit to foundation construction site.

- **ICA** – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge acquired and record submitted by student based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10.
- **ESE** – The End Semester Exam for this course shall be based on oral examination to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CE458- PROJECT PHASE II

Teaching Scheme: 04P **Credit: 04**
Evolution Scheme: 50 ICA + 100 ESE **Total Marks: 150**

1. Project phase I work decided in VII semester shall be continued as Project phase II

2. Students should complete implementation of ideas given in synopsis/Abstract, so that project work should be completed before end of semester.

3. Project phase II will be monitored twice in a semester by presentation of student in front of a committee constituted in phase I

4. Project phase II may involve fabrication, design , experimentation , data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability.The stage also includes testing , possible results and report writing.

5.Each students project group is required to maintain log book for documenting various activities of Project phase II and submit group project report at the end of Semester-VIII in the form of Hard bound.

Assessment of the project phase II for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given inTable-D. Guide lines for ESE:In ESE the student may be asked for demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.

Assessment ofProject-II

Name of the Project:_____ Name of the Guide:_____

Table-D

		Assessment by Guide				Assessment by Committee		Total
SN	Name of Student	Attendance , Participation and team work	Material procurement / assembling/ Designing/Programming	Case study/ Execution	Project Report	Dept of Understanding	Presentation	
Marks		05	10	10	10	10	05	50

CE459- INDUSTRIAL VISIT

Teaching Scheme: 00 **Credit: 01**
Evolution Scheme: 25 ICA **Total Marks: 25**

1. During summer vacation after VI semester or during winter vacation between seventh and eighth semester, every student, shall visit minimum six construction sites / industries/ research laboroteris separately or a long tour of 7 days at different sites.

2. Students should submit written report about the visits individually at the end of the semester

3. The report should contain information about the following points:

(a) The organization - activities of organization and administrative setup technical personnel and their main duties.

(b) The project/ industry brief description with sketches and salient technical information.

(c) The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.

(d) Suggestions (if any) for improvement in the working of those organizations.

4. The industrial visit report should be presented by using PPTs.

CE460- INDUSTRIAL LECTURE

Teaching Scheme : 00P **Credit**: 01
Evaluation Scheme: 25 ICA **Total Marks**: 25

In the course Industrial Lecture, at least 12 lectures from industrial expert should be arranged and continuously assessed. (6 lectures in 6^{th} and 8^{th} semester each)

S.No.	Name of Student	Attendance (01/2 Marks per Lecture)	Depth of Understanding (01 Marks per Lecture)	Report Writing	Total
		06	12	07	25

** Syllabus contents/guidelines are same as **CE362 - Industrial Lecture**

CE362- INDUSTRIAL LECTURE

Teaching Scheme : 00P **Credit**: 00
Evaluation Scheme:00 **Total Marks**: 00

Course Content:

There shall be minimum 6 lectures of 60 -90 minutes duration.

The lecture shall include presentation, informal discussions with students and faculty, and laboratory tours (if required).

Topics of Industrial Lectures shall be technical in nature and should not be the specific or extended part of the curriculum.

Typically speakers should talk about:

i. Their own career following (and sometimes including) university.

ii. Interesting jobs/projects they have had worked on.

iii. The areas of work they are currently involved in.

iv. The type of work engineering graduates can expect.

v. Current job opportunities that may be available for engineering graduates in general and electronics and telecommunication engineering graduates in particular.

vi. Any suggestions for students with regard to job hunting / CV writing / interviews etc.

vii. Latest technology used in the industry which is not the part of curriculum or routine training programmes.

viii. Any other suitable topic/information which provides industrial exposure and improves entrepreneurship quality/ employability of the students.

Course coordinator shall discuss with students on the content of lecture and may conduct oral or give written assignments to judge the depth of understanding of students.

Students shall submit the report based on minimum six lectures giving summary of the lecture delivered.

The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in the format provided by institute/department.

Industrial Lecture deliverables: An industrial lecture report as per the specified format (available on the department and institute's website) and assignments given by course coordinator (if any).

(**Note:** List of renowned experts/Officials/Entrepreneurs from Industries/Government Organizations/Private Sectors/Public Sectors / R&D Labs etc shall be prepared by the committee appointed by HoD and shall be approved by principal. After approval from the principal, minimum six Industrial Lectures shall be arranged, which shall be delivered by experts to cover the various aspects of course content)

Evaluation system:

It includes Internal Continuous Assessment (ICA). Guidelines for ICA are given bellow.

Internal Continuous Assessment (ICA)

The ICA shall be evaluated by course coordinator.

Course coordinator shall judge the students on the principle of continuous evaluation and contribution of individual student.

It shall be evaluated on the basis of deliverables of industrial lecture and depth of understanding (oral conducted by course coordinator).

Course coordinator shall maintain the record of continuous evaluation (oral) and handover to HoD as the marks and credit are to be allotted in the VIIIth semester.