JSPM's
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule Pune University,Pune)

Department of Civil Engineering

T. Y. B. Tech (2019 Pattern)

w.e.f. Academic Year 2021-2022

T. Y. B. Tech (Civil Engineering)
Academic Year – 2021-2022
Semester -V

Course Code	Course	Teaching Scheme			Examination Schemes						Credits
					Theory			TW	Lab	Total	
		TH	Tut	Lab	ISE (15)	MSE (25)	ESE (60)				
CE3101	Fluid Mechanics II	4	-	2	15	25	60		50	150	5
CE3102	Analysis of structures II	3	0	-	15	25	60	-	-	100	3
CE3103	Geotechnical Engineering-II	4	0	-	15	25	60	-	-	100	4
CE3104	Design of Steel Structures	4	0	4	15	25	60	-	100	200	6
CE3105	Elective-I	3	0	-	15	25	60	-	-	100	3
CE3106	Seminar	0	0	2	-	-	-	-	50	50	1
**	Audit Course-III	Non -credit									
Total		**18**	**0**	**8**	**75**	**125**	**300**	**-**	**200**	**700**	**22**

Elective I	Course Title
CE3105 A	Hydropower Engineering
CE3105 B	Green and Sustainable building technology
CE3105 C	Automation in Civil Engineering
CE3105 D	Air Pollution and Control

**Audit Course Code	Audit Course Title
HS3106	Essence of Indian Knowledge Tradition -I
HS3108	Cultural Studies
CE 3113	Urbanization and Environment

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T. Y. B. Tech (Civil Engineering)
Academic Year – 2021-2022
Semester -VI

Course Code	Course	Teaching Scheme			Examination Schemes						Credit
					Theory			TW	Lab	Total	
		TH	Tut	Lab	ISE (15)	MSE (25)	ESE (60)				
CE3107	Infrastructural Engineering	3	0	-	15	25	60	-	-	100	3
CE3108	Hydrology and Water Resources Engineering	3	0	2	15	25	60	-	50	150	4
CE3109	Design of Reinforced Concrete structure	4	0	4	15	25	60	-	50	150	5
CE3110	Water supply & Waste water Treatment	3	0	2	15	25	60	-	50	150	4
CE3111	Elective –II	3	0	-	15	25	60	-	-	100	3
CE3112	Employability Skill Development	0	0	2	-	-	-	-	50	50	1
**	Audit Course IV	Non credit									
Total		**16**	**-**	**10**	**75**	**125**	**300**	**-**	**200**	**700**	**20**

Elective II	Course Title
CE3111A	Remote sensing and Geographic Information System
CE3111B	Finite element methods in civil Engineering
CE3111C	Total Quality Management & Management Information System
CE3111D	Advanced Concrete technology

**Audit Course Code	Audit Course Title
HS3107	Essence of Indian Knowledge Tradition -II
HSHS3109	Introduction to Human Factors and Ergonomics
HS3110	Mind Education

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2019 Pattern (SEM-V)
[CE3101] Fluid Mechanics II

Teaching Scheme:	Credit	Examination Scheme:
TH: - 4 Hours/Week	TH:03	In Sem. Evaluation :15 Marks
LAB: -2 Hours/Week	LAB: 02	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 50 Marks

Course Prerequisites: Fluid mechanics, Engineering Mechanics, Engineering Mathematics and Engineering Physics.

Course Objective:

To study the analysis and design considerations related to open channel flow systems and energy dissipation. To provide students the knowledge about recognizes and classify types of flow, flow around submerged body and hydraulic machinery.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Apply knowledge of flow around submerged body, boundary layer and unsteady flow.
CO2: Apply mathematical relationship for open channel flow and depth energy relation in open channel.
CO3: Design open channel to suite real field requirements.
CO4: Apply knowledge of RVF and GVF in open channel flow problems.
CO5: Analyze the characteristics and performance of turbine.
CO6: Analyze the characteristics and performance of centrifugal pump.

Course Contents

UNIT-I	Flow around submerged body, boundary layer and unsteady flow	06 Hours

Fluid Flow around Submerged Objects: Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Drag on sphere, cylinder, flat plate and Aero foil, Karman's vortex street, Effects of free surface and compressibility on drag, Development of lifts, Lift on cylinder and Aero foil, Magnus effect, Polar diagram.

Boundary layer: Boundary layer Concept of boundary layer, development of boundary layer on a flat plate, nominal, displacement, momentum, energy thicknesses, laminar, transitional and turbulent boundary layer, laminar sub layer, Local and mean drag coefficients, hydro dynamically smooth and rough boundaries. Boundary Layer separation and its control.

Unsteady Flow: Types of unsteady flow; Flow through openings under varying head for cylindrical tank, Fluid compressibility. Water hammer phenomenon; Rise of pressure due to water hammer, Surge Tanks and their functions

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UNIT-II	Introduction to open channel flow and depth energy relationship in open cannel	06 Hours
Introduction to Open channel flow: Classification of channels, and Channel flows. Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, one dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, Introduction to notches and weirs ((Rectangular, Triangular, Trapezoidal). **Depth-Energy Relationships in Open Channel Flow:** Specific energy, Specific force Specific energy diagram, Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent; Critical flow computations; channel transitions		
UNIT-III	**Uniform flow in open channel**	**06 Hours**
Uniform flow in open channels: Characteristics and establishment of uniform flow, uniform flow formulae: Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections (rectangular, triangular, trapezoidal and circular).		
UNIT-IV	**Gradually Varied Flow and Rapidly Varied Flow**	**06 Hours**
Hydraulic Jump-Phenomenon of hydraulic jump; Location and examples of occurrence of hydraulic jump; Assumptions in the theory of hydraulic jump; Application of momentum equation to hydraulic jump in rectangular channel: Conjugate depths and relations between conjugate depths. Energy dissipation in hydraulic jump; Graphical method of determination of energy dissipation, Classification of hydraulic jump; Practical uses of hydraulic jump, venture flume, standing wave flume **Gradually Varied Flow in Open Channels:** Definition and types of non-uniform flow; Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF; Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their occurrence; Control section **Gradually varied flow computations:** Methods of GVF computations. Direct Step method, Graphical Integration method, Standard Step method, VenTe Chow method.		
UNIT-V	**Impact of Jet and Hydraulic Turbine**	**06 Hours**
Impact of Jet: Force and work done due to impact of jet on stationary and moving, flat and curved surfaces using linear momentum principle. **Hydraulic Turbines:** Elements of hydropower plant; hydraulic turbines- Classification, heads and efficiencies, Design and governing of Pelton Wheel, Francis turbine-parts and working. Cavitation in hydraulic turbines. Prediction of performance in terms of unit quantities and specific quantities, Specific speed, Characteristic curves.		
UNIT-VI	**Centrifugal Pump**	**06 Hours**
Centrifugal Pumps: General classification of pumps, Centrifugal pumps- Classification, theory working, Selection of pumps, Centrifugal head, Work done by impeller, Heads and efficiencies, minimum starting speed, Cavitation in centrifugal pumps, multistage pumping, Introduction to submersible pumps and reciprocating pumps,		
Lab Contents		
Guidelines for Assessment		

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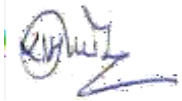

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Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab Experiment and assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness

- Both internal and external examiners should jointly frame suitable problem statements for practical examination based on the term work completed.
- 50 marks will be for oral examination.
- During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.
- Encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising boost to the student's academics.

List of Laboratory Assignments/Experiments

Experiments.	
1	Flow around a Circular Cylinder/Aerofoil
2	Study of Uniform Flow Formulae of Open channel.
3	Velocity Distribution in Open Channel Flow.
4	Calibration of Standing Wave Flume/Venturi flume
5	Study of Hydraulic Jump as Energy Dissipater.
6	Impact of Jet on flat plate / curved vane
7	Characteristics of a Pelton Wheel
8	Characteristics of a Centrifugal Pump
9	Calibration of Notch.
Assignments. (Any two of following)	
1	Graphical determination of energy loss in Hydraulic Jump.
2	Assignment on GVF computation using Direct Step and VenTe Chow methodor by using HEC-RAS software
3	Design of Lined Channel By Mannings Method.
Recommended Site visit to Hydropower generation plant/Research Institute.	

Text Books:

T1 Hydraulics & Fluid Mechanics by Dr. P. N. Modi and Dr. S. M. Seth, Standard Book House.
T2 Fluid Mechanics by Dr. A. K. Jain, Khanna Publishers.
T3 Fluid Mechanics and Fluid Machinery by R. K. Bansal, Laxmi Publications.

Reference Books:

R1. Flow in Open Channels, K. Subramanya, Tata McGraw Hill Publishing Co. Ltd.
R2. Open Channel Hydraulics, VenTe Chow, Tata McGraw Hill Publishing Co. Ltd.
R3. Fluid Mechanics by Yunus Cengel, Jhon Cimbala, Tata Macgraw Hill, New Delhi.
R4. Fluid Mechanics by R. J. Garde, A.J Mirajgaonkar, SCITECH Publication.
R5. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill.
R6. Fluid Mechanics by Frank White, McGraw Hill.

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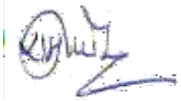

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3102] Analysis of Structures – II

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	TH: 03	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks Total :100Marks

Course Prerequisites : Engineering Mechanics ,Mechanics of Solids, Analysis of structure-I

Course Objective: The objective of this course is to enable the students to take an integral look at the theories of structural analysis with proper emphasis on structural elements of different geometry and boundary conditions.

Course Outcome:

After successful completion of the course, student would be able to–

CO1: Analyze indeterminate structures using slope deflection method.
CO2: Analyze indeterminate structures using moment distribution method.
CO3: Analyze indeterminate structures and truss using Flexibility method.
CO4: Analyze indeterminate structures using Stiffness method.
CO5: Analyze determinate beams using Finite difference method and frames using approximate methods.
CO6: Explain the concepts of Finite element method and shape functions.

Course Contents

UNIT-I	**Slope-deflection method of analysis**	**6 Hours**

Slope-deflection equations, equilibrium equation of Slope deflection method, application to beams with and without joint translation and rotation, yielding of support, application to sway and non-sway rigid jointed rectangular portal frames

UNIT-II	**Moment Distribution Method of Analysis**	**6 Hours**

Moment distribution method of analysis: Stiffness factor, carry over factor, distribution factor , application to beams with and without joint translation and yielding of support, application of moment distribution method to sway & non sway rigid jointed rectangular portal frames.

UNIT-III	**Flexibility Method of Analysis**	**6 Hours**

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Fundamental concepts of flexibility method of analysis, formulation of flexibility matrix, application of flexibility method to pin jointed plane trusses , beams and rigid jointed rectangular portal frames.

UNIT-IV	Stiffness Method of Analysis	6 Hours

Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix, application of stiffness method to beams and rigid jointed rectangular portal frames

UNIT-V	Finite Difference Method	6 Hours

Finite Difference Method – Introduction, application to deflection problems of determinate beams by central difference method and Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed fames by substitute frame method, cantilever method and portal method

UNIT-VI	Finite Element Method	6 Hours

finite element method: Introduction, discretization, types of elements-1D, 2D, 3D, isoperimetric and axisymmetric, convergence criteria, Pascal's triangle, direct stiffness method, principal of minimum potential energy, principal of virtual work and Shape functions of CST elements by using polynomials, 1D, 2D elements by using Lagrange's method

Reference Books:

1.Structural Analysis: DeodasMenon---Narosa Publishing House.

2. Structural Analysis: Thandavamoorthy---Oxford UniversityPress.

3. Structural Analysis: A Matrix Approach byPunditand Gupta, McGraw Hills.

4.Structural Analysis by Hibbler, Pearson Education

5.Structural Analysis: M. M. Das, B. M. Das PHI LearningPvtLtd.Delhi

6. Fundamentals ofStructural Analysis: 2nd ed---West---Wiley.

7. Theory of Structures: Vol.I& II by B. C. Punmia, Laxmi Publication

8. Theory of Structures: Vol.I & II by Perumul l& Vaidyanathan, Laxmi Publication. 9. Fundamentals of Structural Analysis: K. M. Leet, Vang, Gilbert—McGraw Hills

10. Matrix Methods for structural engineering. By Gere, Weaver.

11. Introduction to Finite element method, Dr. P.N. Godbole, New Age Publication, Delhi.

12. Finite element Analysis, S.S. Bhavikatti, New Age Publication, Delhi. Elementary Structural Analysis by Norris and Wilbur

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2019 Pattern (SEM-V)
[CE3103] Geotechnical Engineering II

Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: - 4 Hours/Week	TH:04	In Sem. Evaluation:15Marks Mid Sem. Exam: 25 Marks End Sem. Exam: 60 Marks

Course Prerequisites: Geotechnical Engineering I

Course Objective:

Course Objectives:

To understand various methods of exploring the subsoil and carry out detailed geotechnical investigation in the field.

To apply basic concepts of geotechnical engineering for evaluating Consolidation characteristics, slope stability, bearing capacity of soils, stresses beneath loaded area, and lateral earth pressure on retaining walls.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Explain soil exploration techniques.
CO2: Estimate the stress below any type of loaded area.
CO3: Determine lateral Earth pressure for safe design of retaining structures
CO4: Analyze stability of existing slopes.
CO5: Calculate the bearing capacity of soil.

Course Contents

UNIT-I	**Soil Exploration**	**8 Hours**

Importance of exploration program, Types of samples- undisturbed, disturbed and representative samples, Types of samplers, sample disturbance, Design features of a good sampler: area ratio, Recovery ratio, RQD, inside and outside clearance, Stabilization of boreholes. Sounding tests – Standard penetration test and Cone penetration test, Geophysical methods-Electrical resistivity and Seismic refraction methods, Numerical problems. Typical soil exploration report. Modern Instruments and techniques (Ground Penetrating Radar)

UNIT-II	**STRESSES IN SOILS**	**8 Hours**

Stresses In Soils: Boussinesq's theory – Assumptions; Vertical stress under Concentrated, Line, Strip (no derivations). Derivation for vertical stress under Circular loaded area with UDL; Pressure Bulb; Newmark's chart and its applications. Westergaard's theory; Pressure distribution diagrams, Contact pressure below foundations

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UNIT-III	LATERAL EARTH PRESSURE	8 Hours
Lateral Earth Pressure: Active and passive earth pressures, Earth pressure at rest, Earth pressure coefficient and their range. Earth pressure theories- Rankine's and Coulomb's –assumptions and limitations, Graphical solutions for active earth pressure (cohesionless soil only) –Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, Earth pressure distribution.		
UNIT-IV	**STABILITY OF EARTH SLOPES**	**8 Hours**
Stability Of Earth Slopes: Types of slopes, causes and type of failure of slopes. Factor of safety, Method of slices. Fellenius method of locating centre of critical slip circle, Taylor's stability number.		
UNIT-V	**BEARING CAPACITY OF SHALLOW FOUNDATIONS**	**8 Hours**
Bearing Capacity of Shallow Foundations: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure; Terzaghi's bearing capacity equations assumptions and limitations, IS Code's bearing capacity equations, bearing capacity of footings subjected to eccentric loading. Effect of ground water table on the bearing capacity of soil. Standard penetration test - Bearing capacity based on corrected SPT value.		
UNIT-VI	**DEEP FOUNDATIONS**	**8 Hours**
Deep Foundations: Types of Deep Foundations; Load Transfer in Pile Foundations, Classification of pile foundations based on load transfer only; Ultimate bearing capacity of different types of piles in different soil conditions using IS code Method, Bearing capacity & settlement of Pile groups, negative skin friction on single pile and pile groups.		

Text Books:

T1. Braja M. Das (2018), "Principles of Geotechnical Engineering", 7th Edition, Cengage Learning.

T2. Punmia B.C., Jain A.K., and Jain A.K. (2019), 'Soil Mechanics and Foundation Engineering.", 17th Edition, Laxmi Publications Co., New Delhi.

T3. Gopal Ranjan and Rao A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.

T4. Dr. K R Arora "Soil Mechanics and Foundation Engg.",Standard Publishers.

Reference Books:

R1. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi

R2. C Venkatramaiaha, "Geotechnical Engineering", New Age International Publishers.

R3. Craig R.F. (2004), "Soil Mechanics", 7th edition, Spon press, New York.

R4. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.

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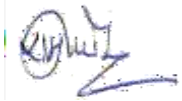

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3104] Design of Steel Structures

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 Hours/Week	TH:04	In Sem. Evaluation : 15 Marks
PR: 04 Hours/Week	PR:02	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Term work : 50 Marks
		Oral : 50 Marks
		Total : 200 Marks

Course Prerequisites: Stress- stain curve, mechanical properties of steel, plastic analysis of beams, load calculation, method of analysis of trusses, bending and shearing stresses.

Course Objective:
To develop the ability to Understand the behavior and properties of structural steel members to resist bending, shear, tension and compression and apply the relevant codes of practice. Also to perform analysis and design of structural steel members and connection.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Explain the steel connections and fundamentals of steel structure.
CO2: Design of tension and compression members.
CO3: Design of column and column bases.
CO4: Design of laterally restrained and unrestrained steel beams.
CO5: Design of connections and welded plate girder.
CO6: Design of roof trusses and gantry girder.

Course Contents

UNIT-I	Introduction to steel structure and Simple connections	08 Hours

Types of steel structures, grades of structural steel, various rolled steel sections, relevant IS specifications such as IS:800-2007, IS:808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6), SP38. IS:4000-1992, codes for welded connections (mention code). Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, classification of cross section such as plastic, compact, semi-compact and slender.
Types of bolted and welded connections, Relative advantages and Limitations, Modes of failure, efficiency of joints- Axially loaded bolted and welded connections for Plates and Angle Members.

UNIT-II	Design of tension and compression member	08 Hours

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Tension member: various cross sections. Limit strength due to yielding, rupture and block shear.
Design of tension member: using single and double angle sections,
Buckling classification as per geometry of cross section, buckling curves, design of struts in trusses using single and double angle section.

UNIT-III	Design of column and column bases	08 Hours

Design of axially loaded column using rolled steel section. Design of built-up column, lacing and battening. Design of eccentrically loaded column providing uniaxial and biaxial bending (check for section strength only). Design of column bases: Design of slab base, gusseted base, and moment resistant base. (axial load and uni-axial bending)

UNIT-IV	Design of laterally restrained and unrestrained beam	08 Hours

Design of laterally restrained beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure, low and high shear, check for web buckling, web crippling and deflection. Design of laterally un restrained beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure and shear, check for deflection.

UNIT-V	Design of connections and welded plate girder	08 Hours

Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld.
Design of welded plate girder: design of cross section, curtailment of flange plates, stiffeners and connections.

UNIT-VI	Design of roof trusses and gantry girder	08 Hours

Design of gantry girder: Selection of gantry girder, design of cross section, check for moment capacity, buckling resistance, bi-axial bending, deflection at working load and fatigue strength.
Roof truss: assessment of dead load, live load and wind load, design of purlin, design of members of a truss, detailing of typical joints and supports

Lab Contents (Plan A)

Guidelines for Assessment

Continuous assessment of practical work is to be done based on overall performance and lab practical /assignments performance of students. Maximum number of students in a group, if any, should not be more than three to five for the term work design assignments. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

List of Laboratory Assignments/Experiments
(Draw any one sheet from (10) and (11) Using suitable software.)

1	Full imperial drawing sheet (Hand drawn) showing detailed sketch of rolled section & Bolted connections.
2	Full imperial drawing sheet (Hand drawn) showing detailed sketch of Detailed sketch of welded connections

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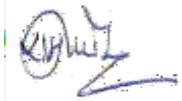

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3	Full imperial drawing sheet (Hand drawn) showing detailed sketch of Tension & Compression members
4	Full imperial drawing sheet (Hand drawn) showing detailed sketch of detailed sketch of Column section & Column bases.
5	Design of Industrial building including roof truss, purlin, bracing, gantry girder, column , column bases & connections
6	Full imperial drawing sheet (Hand drawn) showing detailed sketch of roof truss & analysis of roof truss
7	Full imperial drawing sheet (Hand drawn) showing detailed sketch roof truss connections
8	Full imperial drawing sheet (Hand drawn) showing detailed sketch gantry girder, column & column bases
9	Design of welded plate girder, design of cross section, curtailment of flange plate, stiffeners and connection
10	Full imperial drawing sheet (Using suitable software) showing detailed sketch of welded plate girder
	OR
11	Design of building including primary and secondary beams, column, column base and connections.One full imperial size drawing sheets. (Using suitablesoftware)
12	Two site visits: Report should contain structural details with sketches.

Text Books:

T1 N. Subramanian (2009), "Design of Steel Structures", Oxford University Press.
T2 V.L. Shah, V. A. Gore (2015) , "Limit State Design of Steel Structures", Structures Publications
T3 S.S. Bhavikatti (2012), "Design of Steel Structures by Limit State Method", I.K International Publishing House Pvt. Ltd., 3rd Edition

Reference Books:

R1. Structural Design in Steel—SarwarAlam ,Raz—New Age International Publishers
R2. Analysis and Design: Practice of Steel Structures—KarunaGhosh-- PHI Learning Pvt. Ltd .Delhi
R3. Limit state design of steel structures by S K Duggal, Tata McGraw Hill Education, New Delhi.
R4. Design of Steel Structures by K. S. Sai Ram, Pearson, New Delhi.
R5. Fundamentals of structural steel design M L Gambhir, Tata McGraw Hill Education Private limited, New Delhi.
R6. Limit state design of Steel Structure by Ramchandra&Gehlot, Scientific Publishers, Pune.
R7. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S S, I.K. nternational Publishing House, New Delhi

IS Codes: IS:800-2007, IS: 808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6), SP38. IS:4000- 1992

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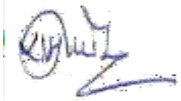

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3105 A] Hydropower Engineering

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	TH:3	In Sem. Evaluation: 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Total: 100 Marks

Course Prerequisites : Basic Civil & Environmental Engineering, fluid mechanics I, Engineering, Geotechnical Engineering

Course Objective: The objective of this course is to determine the energy resources and analyzes hydro power potential. Also study and design economically components of power plant is also another objective of this course.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Explain different energy potential
CO2: Analyze hydro power potential and choose the type of power plant.
CO3: Determine the various electric terms and estimate electrical energy.
CO4: Design components of power plant.
CO5: Design the turbine.
CO6: Evaluate economics of hydro power plants.

Course Contents

UNIT-I	Energy Resources – Planning and Potential	06 Hours

Power resources – Conventional and Nonconventional, Need & advantages, Overview of World Energy Scenario, energy and development linkage, Environmental Impacts of energy use - Air Pollution, Land and Water Pollution, Green House Effect, Trends in energy use patterns in India, Hydropower development in India, Hydropower potential.

UNIT-II	Hydropower Plants	06 Hours

Hydrological Analysis, Classification of hydropower plants - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Introduction to micro hydro, Base load and Peak load plants, advantages & disadvantages, Components of hydropower plants.,

UNIT-III	Load Assessment	06 Hours

Estimation of electrical load on turbines. Load factor, Plant factor, peak demand and utilization factor, load curve, load duration curve, Prediction of load, Tariffs, Hydro-Thermal Mix, Combined Efficiency of Hydro-Thermal-Nuclear Power Plants.

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UNIT-IV	Water Conductor System and Powerhouse	06 Hours
Water Conductor System – Alignment, Intake Structures- Location and Types, Trash Rack. Penstock and pressure shaft, Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipment's, Instrumentation and control		
UNIT-V	**Turbines**	**06 Hours**
Classification, Principles and design of impulse & reaction turbines, Selection of Turbine, Specific Speed, Governing of turbines, Water hammer, Hydraulic Transients and Surge tanks, Draft tubes, Cavitation.		
UNIT-VI	**Economics of Hydroelectric Power**	**06 Hours**
Hydropower - Economic Value and Cost and Total Annual Cost. Economic considerations – pricing of electricity, laws and regulatory aspects, Policies, Electricity act – 2003, Investment in the power sector, Carbon credits, Participation of private sector.		
Compulsory hydro power plant visit is must		

Reference Books:

R1. Water Power Engineering – M. M. Dandekar and K. N. Sharma
R2. Water Power Engineering – R. K. Sharma and T. K. Sharma, S. Chand and Co. Ltd.
R3. Handbook of Hydroelectric Engineering – P.S. Nigam
R4. Modern Power System Planning – Wang.
R5. Hydropower Resources in India – CBIP
R6. Hydro Power Structures – R. S. Varshney.
R7. Water Power Development – E. Mosonvi, Vol. I & II.
R8. Hydro-electric Engineering Practice – G. Brown, Vol. I, II & III.
R9. Water Power Engineering – P. K. Bhattacharya, Khanna Pub., Delhi.

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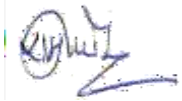

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3105B] Green and Sustainable Building Technology

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	TH:3	In Sem. Evaluation: 15 Marks
		Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Total: 100 Marks

Course Prerequisites : Basic Civil Engineering, National Building Code -2016, Development Control Rules (DCR), Building Bye Laws, Building Planning, Design and Constructions

Course Objective:

- To acquire knowledge on various aspects of green buildings
- To learn practices Indian Green Building Council
- To introduce to green building design
- To learn material conservation handling of non-process waste
- To study green building assessment systems national as well international

Course Outcome:

After successful completion of the course, students will able to:

CO1: Explain the concepts, principles, and benefits of green buildings and sustainable construction practices.

CO2: Analyse the practices of the Indian Green Building Council (IGBC) and GRIHA rating systems and their application in Indian context.

CO3: Apply techniques for efficient material usage and non-process waste handling during building construction.

CO4: Explain various national and international green building rating systems and their assessment criteria.

CO5: Interpret and apply key terminologies such as Embodied Energy, Life Cycle Assessment (LCA), Environmental Impact Assessment (EIA), Energy Audit, and Energy Management.

CO6: Design strategies for green building implementation including site planning, renewable energy integration, and indoor environmental quality improvements.

Course Contents

UNIT-I	Green Building Concepts:	06 Hours

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What is Green Building, why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment's in India, what are key Requisites for Constructing a Green Building? Principles of green building – Selection of site and Orientation of the building – usage of low energy materials – effective cooling and heating systems – effective electrical systems – effective water conservation systems.		
UNIT-II	**Green Building Practices in India:**	**06 Hours**
Practices Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings.		
UNIT-III	**Introduction to Green Building Design:**	**06 Hours**
Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximize System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Eco-friendly captive power generation for factory, Building requirement.		
UNIT-IV	**Material Conservation Handling of non-process waste:**	**06 Hours**
Material Conservation, Handling of non-process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indoor air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels.		
UNIT-V	**Green building Rating Systems:**	**06 Hours**
Green building assessments system studying e.g., LEED US (Leadership in Energy and Environmental Design); Living Building Challenge, Green Globes (Green Building Initiative) (US), Green Globes (ECD-Canada; LEED-Canada, Built Green CANADA BREEAM (Building Research Establishment Environmental Assessment Method) (UK), LEED India (Indian GBC); IGBC Green modules; TERI-GRIHA (Green Rating for Integrated Habitat Assessment) (India) Rating modules.		
Unit-VI	**Embodied Energy, Life Cycle Assessment, Environmental Impact Assessment, Energy Audit and Energy Management**	**06 Hours**
Introduction to the Concept: "Life Cycle assessment of materials". EIA: Introduction to EIA. Process of EIA and its application through a case study, EIA as a strategic tool for sustainable development. Embodied energy of various construction materials-Energy Management with respect to buildings, Clean Development Mechanism, Kyoto Protocol, Energy Conservation Building Code.		
REFERENCES		

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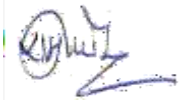

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Text Books

T1. Green Innovation, Sustainable development & its economy by Nitin Kumar Singh, Siddharth pandey, Himanshu Sharma, published by CRC press

T2. The idea of Green Building by A. K. Jain, Khanna Publications

Reference Books

R1. Manual of Tropical housing and climate change by Koenigsberger

R2. Climate responsive Architecture by Arvind Krishnan

R3. Manual of solar passive Architecture by Nayak J.K., R. HazzraJ.Prajapati

R4. Energy Efficient buildings in India by Mili Mujumdar

R5. Green Building Materials by Ross Spiegel and Dru Meadows

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3105C] Automation in Civil Engineering

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	03	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks Total: 100 Marks

Course Prerequisites:
Basics of Construction equipment and Machinery, Surveying, Building Construction.

Course Objective:
- To enlighten students about different new techniques available around the globe
- To study various terminologies used in construction machinery.
- To get knowledge about application of automation and use of robots in construction.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Analyse the application of Building Management Systems (BMS) and automation technologies in construction projects.
CO2: Describe the characteristics and operational features of various construction equipment.
CO3: Compare different automation techniques used in construction.
CO4: Explain the principles, components, and functioning of building automation systems.
CO5: Demonstrate the applications and benefits of robotics in various construction activities.
CO6: Apply the concepts and techniques of aerial and satellite-based survey.

Course Contents

UNIT-I	Introduction	06 Hours

Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS- Review and analysis of state- of –art in construction automation

UNIT-II	Introduction to Different equipment used in construction	06 Hours

Introduction to Conventional construction methods Vs Mechanized methods and advantages of latter. Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; plastering
machines; Pre-stressing jacks and grouting equipment. Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

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UNIT-III	Off and On site automation in construction	06 Hours
Off- site automation in construction Information processing (computer applications), materials processing, case study (concrete batch plant) - Existing and prototype equipment for construction – case study (concrete placement and finishing), final product design session		
UNIT-IV	**Building Automation**	**06 Hours**
Introduction to building automation systems – components– Heating, ventilation, and air conditioning (HVAC)– Lighting – Electrical systems water supply and sanitary systems– Fire safety – security - Communication and office automation system -Water pump monitoring & control - Control of Computerized HVAC Systems		
UNIT-V	**Robotics in Construction**	**06 Hours**
Automation and robotic technologies for customized component, module and building prefabrication- Elementary technologies and single – Task construction robots - Site automation robotic on site factories.		
UNIT-VI	**Aerial and Satellite Surveying**	**06 Hours**
GIS and GPS in Construction; use of Drones for spread out sites; Use of robots for repetitive activities.		

Reference Books:

R1. JavadMajrouhi Sardroud, (2011),"Automated Management of Construction Projects" LAP Lambert Academic Publishing.

R2. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi 2.

R3. Wang Shengwei, (2010), "Intelligent Buildings and Building Automation" Taylor & Francis Group.

R4. Majrouhi Sardroud Javad, (2014), "Automation in Construction Management" Scholars' Press.

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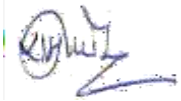

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3105D] Air Pollution and Control

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	TH: 3	In Sem. Evaluation : 15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Total Marks :100 Marks

Course Prerequisites: Basics of Environmental Science

Course Objective:
To comprehend various kinds of air pollution control equipment and its suitability with respect to meteorological parameters and stability conditions.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Explain the meteorological aspects and its effects with respect to Gaussian diffusion model.
CO2: Analyze ambient air quality according to standards laid by CPCB.
CO3: Describe the sources and controlling measures of indoor air and odour pollution.
CO4: Illustrate process operation of air pollution control devices.
CO5: Explain land use planning as a method of air pollution control.
CO6: Describe environmental impact assessment and its management.

Course Contents

UNIT-I	Meteorological aspects	6 Hours

Zones of atmosphere, Scales of meteorology, Meteorological parameters, Temperature lapse rate, Plume behaviour. Gaussion diffusion model for finding ground level concentration, Plume rise, Types & quality of fuels, Formulae for effective stack height and determination of minimum stack height as per CPCB norms.

UNIT-II	Ambient Air sampling and analysis	6 Hours

Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling of gases and particulates. Stack emission monitoring for particulate and gaseous matter, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Emission inventory and source apportionment studies. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009

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UNIT-III	Indoor air pollution	6 Hours
Causes of air pollution, sources and effects of indoor air pollutants, factors affecting exposure to indoor air pollution, sick building syndrome. Investigation of indoor air quality problems, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Use of various plants to control indoor air pollution. Radon and its decay products in indoor air. Odour pollution: Theory, sources, measurement and methods of control of odour pollution		
UNIT-IV	**Control of air pollution**	**6 Hours**
By process modification, change of raw materials, fuels, process equipment and process operation. Control of particulate matters. Working principle and design of control equipment as Settling chamber, Cyclone, Fabric filter and Electro Static Precipitator. Control of gaseous pollutants. Combustion chemistry & control of air pollution from automobiles.		
UNIT-V	**Land use planning**	**6 Hours**
As a method of control. Economics of air pollution control: Cost/benefit ratio and optimization. Legislation and regulation: Air (Prevention and Control) Pollution Act, 1981. The Environment (Protection) Act 1986. Emission standards for stationary and mobile sources.		
UNIT-VI	**Environmental impact assessment and management**	**6 Hours**
Methodology for preparing environmental impact assessment (Identifying the sources of air pollution, calculating the incremental values, prediction of impacts and mitigation measures). Role of regulatory agencies and control boards in obtaining environmental clearance for project. Public hearing. Environmental impacts of thermal power plants, sugar and cement industry. Environmental management plan. The environmental rules 1999 (sitting of industries).		
Text Books: **T1** H. V. N. Rao and M. N. Rao, Air Pollution, TMH, Publication. **T2** KVSG Murali Krishna, Air Pollution, USP.		
Reference Books: **R1.** Perkins, Air Pollution, US **R2.** Stern, Air Pollution,Academic Press **R3.** K. Wark, C.F. Warner &W.T.Davis, Air Pollution Control: its origin and control,Pearson **R4.** Richard W. and Donald L.,Fundamentals of Air Pollution, Academic Press.		

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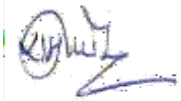

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
[CE3106] Seminar

Teaching Scheme: **PR: -2 Hours/Week**	Credit PR:1	Examination Scheme: (ORAL) Total marks : 50 Marks

Course Prerequisites :Nil

Course Objectives:

- Awareness of how to use values in improving your own professionalism.
- Implement values for bridging and harmonizing your employees.
- Learning about personal and communication styles for team building.

Course Outcome:

After successful completion of the course, students will able to:

CO1. Evaluate current civil engineering research, emerging techniques, advancements, and interdisciplinary applications.
CO2. Formulate seminar topic by utilizing technical resources/ Journals/ web sources.
CO3. Carry out detailed review of available literature.
CO4. Prepare a structured technical report.
CO5. Demonstrate command of voice modulation, voice projection, and pacing during presentation.
CO6. Recognize the need for lifelong learning in context with technological changes.

Course guidelines

- The students with consultation with faculty adviser shall arrive at topic of seminar based on exhaustive literature review, current civil engineering scenario, latest techniques or materials etc.
- The students shall review available information and compile the information.
- The students shall prepare technical report.
- The students shall present their seminar to the review committee.
- The seminar topic shall be chosen during the 2nd week of the semester.
- The review and organizing the seminar shall be completed during 6th week.
- The seminar report shall be submitted during 10th week.
- The presentation will be held during 10th week.

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Note: - In order to arouse the interest of students and engage them in active learning, mini projects/ complex problems may be given in groups of maximum 4students, covering different aspects involved in Civil engineering so as to also enable the students to submit separate individual reports as required above.

- The award of marks is based on the following criteria
  - Selection of Topic for the seminar and its relevance -10%
  - The quality of Seminar Report- 40%
  - Presentation skills and depth of knowledge - 30%
  - Viva and discussion – 20%

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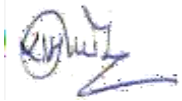

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T. Y. B. Tech (Civil Engineering)
2019 Pattern (SEM-V)
Audit Course III

Teaching Scheme:	Credit	Examination Scheme:
-	-	-

List of Courses to be opted (Any one) under Audit Course **III**

Code	Name of Course	Link
HS3106	Essence of Indian Knowledge Tradition -I	https://www.aicte- india.org/sites/default/files/Model Curriculum/UG-2/ug-vol2.pdf
HS3108	Cultural Studies	https://onlinecourses.swayam2.ac.in/aic19_as04/preview
CE 3113	Urbanization and Environment	https://onlinecourses.nptel.ac.in/noc21_hs96/preview

GUIDELINES FOR CONDUCTION OF AUDIT COURS

A student shall be awarded the bachelor's degree if he/she earns 170 credits and clears all the audit courses specified in the syllabus. The student shall be awarded grade as AP (Audit Course Pass) on successful completion of audit course. The student may opt for one of the audit courses per semester, starting from second year first semester. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course shall be done. Method of conduction and method of assessment for audit courses are suggested.

Using NPTEL Platform:
NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in

- Student can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with certificate.

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Guidelines for Assessment:

The assessment of the course will be done at the institute level. The department has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.

- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as "Present" and the student will be awarded the grade AP on the mark sheet.

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) Semester -VI
[CE3107]: Infrastructure Engineering

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	03	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks Total: 100 Marks

Course Prerequisites : Basic Civil & Environmental Engineering, Concrete Technology, Engineering Geology, Geotechnical Engineering.

Course Objective:

- To understand the contribution of infrastructure in Indian economy.
- To understand the importance of infrastructure asset management
- To study types of machinery and techniques used on construction projects
- To study the various fundamentals of transportation modes like Railway engineering, Docks & Harbors
- To Study the construction techniques of tunneling.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Describe the importance of Infrastructure in development of India.
CO2: Identify the importance of infrastructure asset management.
CO3: Explain the various equipment's and techniques to require for construction of various structures.
CO4: Explain the fundamental concepts and components of railway engineering.
CO5: Discuss the fundamental of Docks & Harbours.
CO6: Describe the fundamentals of tunnel engineering.

Course Contents

UNIT-I	Introduction to Infrastructure Engineering	06 Hours

Meaning and Scope of Infrastructure Engineering: Scope of Infrastructure Engineering in National and Global development, Forthcoming Infrastructure projects at national and global level, Necessity, Advantages and disadvantages of PPP (Public Private Partnership), Salient features of smart city , AMRUT, PPP and Funding of public infrastructure; power stations, refineries Case studies.

UNIT-II	Infrastructure Asset Management	06 Hours

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Basic discussion of concepts of Infrastructure Assets and their Management, Performance of Infrastructure Assets, Stakeholders involved along with factors affecting the demand and supply of public works services; Introduction to the basic policies and initiatives of the Government in the area of Infrastructure Asset creation and Management (JNNURM, Smart cities, etc.); Case studies including Bridge Management Systems, Pavement Management System, Oil and gas Pipeline Asset Management, Hydro-system Asset Management.

UNIT-III	**Construction Equipment and Techniques**	**06 Hours**

Earthwork moving equipment , Dredging and dewatering techniques, Asphalt construction: Asphalt pavers, Compactors for asphalt concrete and other construction methods, Concrete construction: Mixing and placement-pumps, Ready-Mix Concrete trucks, Plant operational equipment, Concrete paving technology, Continuous concreting operation of various shapes & varying sections, Pre-cast concrete and Steel construction: Launching techniques for heavy decks, handling &Erecting components on tall structures, In-situ pre-stressing in high-rise structures and others; Pre-stressed concrete construction, Post-tensioning of slab-aerial transporting and others.

UNIT-IV	**Railway Engineering**	**06 Hours**

Introduction to Railway Engineering- Feasibility studies, Gauges, Wheel and Axles, Coning of Wheels, tilting of rail, Resistances, Stresses, Stresses in Components of Track, Rails, Creep in Rails, Wears & Failures in Rails, Jointed or Welded rails, Sleepers, Ballast, Fastenings, Geometric Design - Alignment of Track, Horizontal Curve and Super elevation, Speeds on Track, Transition Curve & Widening of Track, Vertical Curve & Gradients, Turnouts - Components, Crossing and Design of Turnout, Track Junctions and Designs, Train Control Systems, Interlocking of Track, High Speed Tracks- Bullet train, Metro rail, concept of Monorail

UNIT-V	**Docks & Harbors**	**06 Hours**

Introduction, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Various components of ports, break waters- types, comparison, design criteria, methods of construction, Tetra pod, Tri bar, Hexapod, Quay wall, Wet & dry dock, Floating dock, Wharves, Jetties, Types of fenders, Dolphins, Marin railway

UNIT-VI	**Tunneling**	**06 Hours**

Tunneling, functions & types of tunnel, Criteria for selection of size & shape of tunnels. Pilot tunnel, shaft, addit and portal, Needle beam, NATM, TBM & earth pressure balance method of tunneling in soft soil, Drilling & blasting method of tunneling including various operations like mucking, Drainage in tunneling- Pre drainage and permanent drainage, Ventilation in tunneling temporary and permanent, Micro tunneling and trenchless tunneling.

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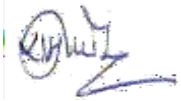

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Reference Books:

R1. Construction Planning Methods &Equipment: Puerifoy –Tata MC Graw Hill
R2. Construction Equipment's& its Management: S.C Sharma, Khanna Publication
R3. Railway Engineering, 2/E by Chandra—Oxford University Press
R4. Railway Track Engineering: J.S.Mundrey, Tata McGraw Hill
R5. Harbour, Dock& Tunnel Engineering: R. Srinivasan
R6. Dock &Harbour Engineering:Hasmukh P.Oza & Gautam H.Oza-Charoter Book Stall
R7. Construction Project Scheduling & Control, 2ed—Mubarak--Wiley.

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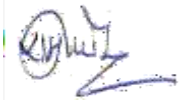

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) Semester -VI
[CE3108]: Hydrology and Water Resources Engineering

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3Hours/Week	TH: 3	In Sem. Evaluation:15 Marks
PR: 2-Hours/Week	PR: 1	Mid Sem. Exam: 25 Marks
		End Sem. Exam : 60 Marks
		LAB (Oral): 50 Marks
		Total :150Marks

Course Prerequisites : Engineering Mathematics and Surveying

Course Objective:

To understand the relation between different processes involved in rainfall runoff process along with peak flood analysis.

To find water requirement of different crops along with feasibility study of reservoirs.

To analyze ground water flow to estimate the yield of the well and effective use of water resource.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Estimate the distribution rainfall in various processes.

CO2: Solve the problems on water requirement of crop.

CO3: Calculate the ground water flow and yield of well.

CO4: Estimate peak flood.

CO5: Investigate the feasibility of a reservoir.

CO6: Analyze the water management system.

Course Contents

UNIT-I	Introduction to Hydrology	6 Hours

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Hydrological cycle, Application of hydrology Precipitation: Types of precipitation, measurement, Rain gauge network, Preparation of data-estimation of missing data, Consistency test, Presentation of rainfall data-mass rainfall curves, Hyetograph, Point rainfall, Moving average, Mean precipitation over an area-arithmetic mean method, Thiessen's polygon, isohyetel method, Concepts of depth-area-duration analysis, Frequency analysis - frequency of point rainfall and plotting position, Intensity-duration curves, Maximum Intensity-duration- frequency analysis

Abstractions of Precipitation: Intersection, Depression storage, Evaporation- Elementary concepts, factors affecting, Measurement of evaporation, Transpiration, Evapotranspiration- process and measurement, Infiltration –introduction, Infiltration capacity, Infiltrometer, Horton's method and infiltration indices

Stream Gauging: Selection of site, various methods of discharge measurement (velocity-area method, dilution method, slope-area method), Advance techniques/equipments used in gauge discharge measurements such as Radar, Current meter, ADCP (Acoustic Doppler Current Profiler)

UNIT-II	**Introduction to Irrigation**	**6 Hours**

Definition, Functions, Advantages and Necessity, Methods of Irrigation, Surface Irrigation, Subsurface Irrigation, Micro-Irrigation

Water Requirements of Crops: Soil moisture and Crop water relationship, Factors governing Consumptive use of water, Principal Indian crops, their season and water requirement, Crop planning, Agricultural practices, Calculations of canal and reservoir capacities – duty, delta, irrigation efficiency Assessment of Canal Revenue: Various methods (Area basis or crop rate basis, volumetric basis, seasonal basis, composite rate basis, permanent basis or betterment levy basis)

UNIT-III	**Ground Water Hydrology**	**6 Hours**

Occurrences and distribution of ground water, Specific yield of aquifers, Movement of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well, Well Irrigation: Tube wells, Open wells and their construction

UNIT-IV	**Runoff**	**6 Hours**

Introduction, Factors affecting runoff, Rainfall-Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph- Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall, Unit hydrograph theory, S-curve hydrograph, uses and limitations of Unit Hydrograph

Floods: Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods

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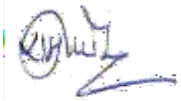

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UNIT-V	Reservoir Planning	6 Hours
Introduction, Term related to reservoir planning (Yield, Reservoir planning and operation curves, Reservoir storage, Reservoir clearance), Investigation for reservoir planning, Significance of mass curve and demand curves, Applications of mass curve and demand curves, Fixation of reservoir capacity from annual inflow and outflow, Fixation of reservoir capacity using elevation capacity curve and dependable yield, Reservoir regulation, Flood routing- Graphical or I.S.D method, Trial and error method, Reservoir losses, Reservoir sedimentation- Phenomenon, Measures to control reservoir sedimentation, Density currents Significance of trap efficiency, Useful life of reservoir, Costs of reservoir, Apportionment of total cost, Use of facilities method, Equal apportionment method, Alternative justifiable expenditure method.		
UNIT-VI	**Water Management and climate change**	**6 Hours**
Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Cooperative water distribution systems, Introduction to auto weather station Water Logging and Drainage: The process of water logging, Causes of water logging, Effects of water logging, preventive and curative measures Climate Change : Introduction, Effect of climate change on Water Resources		
Lab Contents		
Guidelines for Assessment		
Continuous assessment of practical work is to be done based on overall performance and lab practical /assignments performance of student. Maximum number of students in a group, if any, should not be more than three to five for the term work design assignments. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.		
List of Laboratory Assignments/Experiments (minimum 7 to be covered)		
1	Analysis of rainfall data (Double mass curve technique/Missing rainfall data).	
2	Marking catchment area on a topo-sheet and working out average annual precipitation and determining yield by various methods.	
3	Analytical method of measurement of infiltration	

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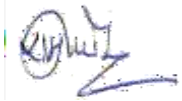

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4	Flood frequency studies assuming Gumbel‘s extreme value distribution.
5	Determination of peak flood discharge in a basin using unit hydrograph technique.
6	Determination of storage capacity of a reservoir using mass curve of inflow and outflow.
7	Application of HEC-RAS for Hydrologic routing.
8	Site visit to Meteorological station
9	Measurement of / video demonstration of evaporation by Pan Evaporimeter
10	Measurement of / video demonstration of infiltration by Infiltrometer

Reference Books:

R1. Irrigation Engineering - S. K. Garg, Khanna Publishers

R2. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House.

R3. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Standard Publisher

R4. Elementary Engineering Hydrology- M.J.Deodhar-Pearson Education

R5. Engineering Hydrology. –Ojha—Oxford University Press

R6. Engineering hydrology – K. Subramanyam Tata McGraw Hill.

R7. Hydrology- Principles, Analysis and Desin, Raghunath, New Age International

R8. Irrigation Engineering-Raghunath—Wiley

R9. Groundwater Hydrology, 3ed—Todd—Wiley

R10. Applied Hydrology – Chow, Maidment, Mays, McGraw-Hill

R11. Principles of Hydrology- Ward and Robinson, Tata McGraw Hill

R12. Irrigation Engineering - Bharat Singh

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) Semester –VI
[CE3109] Design of Reinforced Concrete structure

Teaching Scheme: TH: 03 Hours/Week LAB: 04 Hours/Week	Credit TH:03 LAB: 02	Examination Scheme: In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks LAB : 50 Marks Total :150Marks

Course Prerequisites : Material properties of concrete and steel, load calculation , Bending moments and shear force calculations for different types of beams

Course Objective:
To design all structural members in RC building and show proper detailing and schedule of reinforcement of RC building.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Explain the design philosophy of reinforced concrete structures
CO2: design rectangular and flanged beam
CO3: design one way, two ways, continuous and cantilever slab
CO4: design reinforced concrete staircase.
CO5: design axial, uniaxial and bi-axial columns.
CO6: design isolated and combined footing.

Course Contents

UNIT-I	Introduction	6 Hours

Introduction to various design philosophies R.C structures: Working stress method, Ultimate load method and Limit state method. loads on structures, Role of structural engineer. Study of Structural Properties of Concrete Limit state method: Limit state of collapse, Limit state of serviceability and Limit state of durability. Characteristic strength, Characteristic load, concept of Safety - Probabilistic approach, Semi probabilistic approach. Partial safety factors for material strengths and loads. Provisions in Indian standard code of practice

UNIT-II	Design of flexural members	6 Hours

Assumptions of Limit State Method, Strain variation diagram, Stress variation diagram, Analysis and design of Singly and Doubly Reinforced rectangular sections, singly reinforced flanged beams. Design of flexural members: For Shear, Bond and Torsion.

UNIT-III	Design of slab	6 Hours

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Design of slab: One way, simply supported, Cantilever and Continuous slabs by using IS code coefficients. Two way slabs: Simply supported, Continuous and Restrained.		
UNIT-IV	**Design of staircase**	**6 Hours**
Design of staircase: Dog legged and Open-well. Redistribution of moments in continuous reinforced concrete beam. Design of continuous beam.		
UNIT-V	**Design of column**	**6 Hours**
Introduction, Strain and Stress variation diagrams, axially loaded Short Column with minimum eccentricity requirements. Design of Short Column for axial load, Uni-axial, Biaxial bending using interaction curves.		
UNIT-VI	**Design of footing**	**6 Hours**
Design of Isolated Column footing for axial load and uni-axial bending. Design of combined footing, Eccentric footing		

Lab Contents (Plan A)

Guidelines for Assessment

1. Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student.
2. Students will be divided into groups. Maximum number of students for projects not more than four.
3. Oral Examination shall be based on the term work.

List of Laboratory Assignments/Experiments (minimum -- to be covered)

A)	Design of G + 2 (Residential/Commercial/Public) building covering all types of Slabs, Beams, Columns, Footings and Staircase (first and intermediate flights).
1	Minimum plan area of each floor shall be more than 150 square meter
2	Designof all plinth and ground beams.
3	Design of all slabs(One way , two way, cantilever) and beams of first floor.
4	Design of three types columns for, (a) axial load, (b)axial load + uniaxial BM, (c)axial load + biaxial BM), from terrace level to footing along with detailed load calculations and footing for columns with (a) axial load (b)axial load + uniaxial BM
5	Detailing of reinforcement on full imperial sheetas per SP-34 & IS 13920
6	Full imperial drawing sheets in five numbers. Out of which only structural plan drawing sheet shall be drawn by using any drafting software (AUTOCAD)
7	Design any one element by using spread sheet.
B	Reports of two site visits. (Building under construction)

Lab Contents (Plan B)

Guidelines for Assessment

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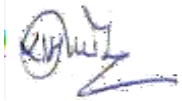

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1. Continuous assessment of laboratory work of 25 marks is to be done based on overall performance and lab practical's /assignments performance of student.
2. Students will be divided into groups. Maximum number of students for projects not more than Four.
3. Oral Examination of 50 marks shall be based on the term work

List of Laboratory Assignments/Experiments

A	The plan prepared in Architectural and building planning S.Y.B Tech sem -II is taken for the R.C.C. Design covering all types of Slabs, Beams, Columns, Footings and Staircase (first and intermediate flights).
1	Design of all plinth and ground beams.
2	Design of all slabs(One way , two way, cantilever) and beams of first floor.
3	Design of three types columns for, (a) axial load, (b)axial load + uniaxial BM, (c)axial load + biaxial BM), from terrace level to footing along with detailed load calculations and footing for columns with (a) axial load (b)axial load + uniaxial BM
4	Detailing of reinforcement on full imperial sheet as per SP-34 & IS 13920
5	Full imperial drawing sheets in five numbers. Out of which only structural plan drawing sheet shall be drawn by using any drafting software (AUTOCAD)
6	Design any one element by using spread sheet.
B	Reports of two site visits. (Building under construction)

Text Books:

R1. V.L.Shah, S.L.Karve " Limit State Theory & Design of Reinforced Concrete", structures publications

R2. B.C Punmia, A.K.Jain "Comprehensive Design of R.C. Structures", Standard Book House, New Delhi

R3. N.C Sinha, S.K.Roy " Fundamentals of reinforced concrete", S. Chand and company ltd., New Delhi

Reference Books:

R1. P.C. Vargese, "Limit state design of Reinforced Concrete", PHI, New Delhi.

R2. P. Dayaratnram, "Limit State Analysis and Design", Wheeler Publishing company', Delhi

R3. V.L. Shah and S.R. Karve, "Illustrated Design of Reinforced Concrete Buildings (G+3)", Structures Publications', Pune

R4. Pillai Menon, "Reinforced Concrete Design", Tata McGraw Hill, New Delhi

R5. IS 456 -2000 , SP-34 ,SP-16, IS 13920 -2016

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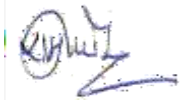

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) Semester –VI
[CE3110] Water supply & Waste water Treatment

Teaching Scheme:	Credit	Examination Scheme:
TH: - 03Hours/Week	TH:03	In Sem. Evaluation:15 Marks
LAB: -02Hours/Week	LAB: 01	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 50 Marks
		Total : 150 Marks

Course Prerequisites:
Basics of Hydraulics, Engineering Chemistry, Environmental Science

Course Objective:
To develop the ability to design water and waste water treatment processes and apply the concepts to solve engineering problems.

Course Outcome:
After successful completion of the course, students will able to:

CO1: Determine quality and calculate quantity of water and waste water
CO2: Design Primary and Preliminary treatment process for water and wastewater.
CO3: Design of clariflocculator and filter for water.
CO4: Design secondary treatment for Waste water.
CO5: Describe Tertiary and Miscellaneous Treatments of water and wastewater.
CO6: Explain water distribution system and sewer system.

Course Contents

UNIT-I	Quality and Quantity of Water and Waste Water	6 Hours

Introduction to water supply scheme: Data collection for water supply scheme, components and layout. Design period, factors affecting design period. Issues related to rural water supply schemes.
Quality and Quality of Water: Physical, Chemical, Radioactivity and Bacteriological Characteristics. Standards as per IS: 10500 (2012) Rate of water consumption for various purposes like domestic, industrial, institutional, commercial, fire demand and water system losses, factors affecting rate of demand, Population forecasting, Methods of sampling.
Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation, Effect of change of life style on sewage quality.
Characteristics of sewage: Physical, chemical and biological characteristics, effluent discharge standards as per CPCB norms, interpretation and practical significance of test results.

UNIT-II	Preliminary and Primary Treatment	6 Hours

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Water treatment: Principles of water treatment processes. Introduction to different types of water treatment flow sheets.
Aeration: Principle and Concept, Necessity, Methods, Removal of taste and odour. Design of aeration fountain. Sedimentation: Plain and chemical assisted - principle, efficiency of an ideal settling basin, settling velocity, types of sedimentation tanks, design of sedimentation tank. Introduction & design of tube settlers.
Sewage treatment: Introduction to sewage treatment, preliminary, primary Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Sludge Disposal. Primary sedimentation tank as per the Manual of CPHEEO and Sludge Disposal.

UNIT-III	Chemically assisted sedimentation and Filtration of Water	6 Hours

Theory & design of secondary water treatment units
Coagulation and flocculation: Theory, common coagulants alum & ferric salts, introduction to other coagulant aids and natural coagulants, design of flocculation chamber, Design of clari-flocculator.
Filtration: Theory of filtration, mechanism of filtration, filter materials, types of filters- Rapid gravity filter, slow sand filter and pressure filter, multimedia and dual media filters, working and cleaning of filters, operational troubles, Design of rapid sand gravity filters.

UNIT-IV	Secondary treatment for Waste Water	6 Hours

Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, Activated sludge process: Theory and design of ASP, modifications in ASP,
Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high-rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contractors. Anaerobic Treatment for Sludge and its Disposal.

UNIT-V	Tertiary and Miscellaneous Treatments	6 Hours

Tertiary Treatment Disinfection: Theory, factors affecting disinfection, types of disinfectants, types and methods of chlorination, break point chlorination, bleaching powder estimation. Introduction, Principles, Advantages and Disadvantages Miscellaneous treatment: Introduction to Water Softening (lime-soda, zeolite), Demineralization (R.O., electrodialysis and ion exchange.) Adsorption (odour and colour removal using activated carbon.), Fluoridation and defluoridation.

UNIT-VI	Water Distribution and Sewerage System	6 Hours

Water distribution system: System of water supply- Continuous and intermittent system. Different distribution systems and their components. ESR- Design of ESR capacity. Wastage of Water- Detection and Prevention.

Design of Sewerage System: Design of circular sanitary sewers. Pumping of sewage, necessity, location.Hydraulic formula for determining Flow Velocity in sewer and drains. Maximum and Minimum Velocities to be generated in Sewer.

Lab Contents

Guidelines for Assessment

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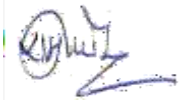

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Continuous assessment of laboratory work is to be done based on overall performance and lab practicals

/assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

- Both internal and external examiners should jointly conduct oral examination for 50 marks based on the term work completed. Oral Examination will be based on the practical conducted ,site visit to WTP and STP, and design of WTP and STP.

List of Laboratory Assignments/Experiments (Minimum08from part A, B and C are compulsory)

A	Determination of following Characteristics;
1	pH and Alkalinity of given water and waste water sample
2	Total hardness and its components
3	Chlorides
4	Chlorine demand and residual chlorine
5	Turbidity and optimum dose of alum.
6	Solids -Total solids, suspended solids, volatile solids, settleable solids & non settleable solids
7	Sludge Volume Index.
8	Dissolved oxygen.
9	Bio-Chemical Oxygen Demand.
10	Chemical Oxygen Demand.
11	Most Probable Number
12	Na and K by Flame photometer
B	**Site visit** to water treatment and waste water treatment plant
C	Assignment on Complete Design of WTP and STP using appropriate software.

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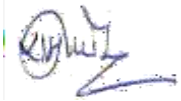

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Text Books:

T1 Environmental studies by Rajgopalan- Oxford University Press.
T2 Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.
T3 Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.
T4 Water Supply and Treatment Manual: Govt. of India Publication
T5 Waste Water Treatment-Concept Design and Approach---C.L.Karia,R.A.Christian--PHI

Reference Books:

R1. CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 1999.
R2. Water Supply Engineering: S. K. Garg, Khanna Publishers, NewDelhi.
R3. Waste Water Engg. – B.C. Punmia& Ashok Jain - Arihant Publications.
R4. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.
R5. Environmental Engg. – Davis - McGraw Hill Publication
R6. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India
R7. Standard Methods by APHA.
R8. McGhee, T.J., "Water Supply and Sewerage", McGraw Hill.
R9. Theory and practice of water and waste water treatment—Wiley

IS Codes: IS 10500: 2012, IS 3025

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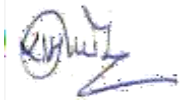

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T. Y. B. Tech (Civil Engineering)

2019 Pattern (SEM-VI)

[CE3111A]: ELECTIVE II

Remote Sensing & Geographic Information System

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	03	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks Total: 100 Marks

Course Prerequisites:
Basic civil engineering ,Surveying

Course Objective:
Understand the fundamentals of Remote sensing concepts, Geographical Information System and illustrate the types of Remote sensing platforms and sensors. Summarize the different steps and computation involved in Aerial Photogrammetric is also auxiliary objective of this course

Course Outcome:
After successful completion of the course, students will able to:

CO1: Demonstrate the fundamentals of Remote sensing concepts
CO2: Select and utilize the data available from different type of remote sensing satellites for required purpose
CO3: Interpret aerial photographs and Determine the field dimensions
CO4: Analyze the basic components of GIS
CO5: Explain the concept of Map projections and apply the techniques of remote sensing and GIS to required field
CO6: Perform geodetic survey.

Course Contents

UNIT-I	Remote sensing	07 Hours
Introduction, Ideal remote sensing system, basic principles of electromagnetic remote sensing, electromagnetic energy, electromagnetic spectrum, interaction with earth's atmosphere, interaction with earth- surface materials, spectral reflectance of earth surface materials.		
UNIT-II	**Remote sensing platforms and sensors**	**07 Hours**

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Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal), Global Positioning system-GPS satellite systems, components of GPS, positioning and relative positioning with GPS, Applications of GPS. Introduction to DGPS and its uses.

UNIT-III	Aerial Photogrammetry	07 Hours

Introduction, basic geometric characteristics of aerial photographs, photographic scale, ground coverage of aerial photographs, Area measurement, relief displacement of vertical features, image parallax, ground control for aerial photography, mapping with aerial photographs, flight planning, Basics of stereoscopy, stereoscopes.
Self-Learning Topics: Basics of stereoscopy, stereoscopes

UNIT-IV	Fundamentals of Geographical Information System	07Hours

Definition of GIS, History of GIS, Key Components of GIS, Data structures in GIS, Geospatial data, GIS operations, Data overlay, Data input and editing, Data display and Cartography

UNIT-V	Coordinate systems &Applications	07 Hours

Geographical Coordinate System, Datum, Map projections, Types of Map Projections, Projected Coordinate System.
Applications -Integration of Remote Sensing and GIS, Applications of Remote sensing and GIS, Software's scenario in Remote sensing and GIS.

UNIT VI	Geodetic surveying and trigonometric leveling	07 Hours

Geodetic Surveying: Objects, Methods of Geodetic Surveying, Introduction to triangulation, Classification of triangulation systems, Triangulation figures, Concept of well-conditioned triangle, selection of stations, Indivisibility and height of stations, Triangulation adjustment
Trigonometric Levelling :- Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations

Reference Books:

R1. Lillesand T.M., and R.W. Kiefer, "Remote sensing and image interpretation." John Wiley & Sons, Fourth edition, 2000.
R2. Kang tsuang Chang "Introduction to Geographical Information Systems"– Tata McGraw Hill, New Delhi, Fourth edition, Twelfth edition reprint, 2013.
R3. M. Anji Reddy, "Remote Sensing and Geographical Information systems", BS Publications, Fourth edition, Twelfth edition reprint, 2017
R4. M. Chandra and S. K. Gosh. "Remote Sensing and GIS", Narosa Publishing Home, New Delhi 2009.
R5. James B. Campbell and Randolph H. Wynne, "Introduction to Remote Sensing", The Guilford Press, 2011
R6. Paul Longley, "Geographic Information systems and Science", John Wiley & Sons, 2005.

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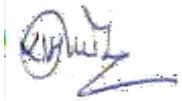

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) - SEM-VI
[CE3111B]: ELECTIVE II
Finite Element Method in Civil Engineering

Teaching Scheme: TH: - 3Hours/Week	Credit TH:3 ,	Examination Scheme: In Sem. Evaluation: 15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60Marks

Course Prerequisites: Knowledge of Strength of material, structural analysis, partial differential equations, matrix methods of analysis

Course Objective:
FEM is a global tool for the precise numerical analysis which encompasses all engineering and science problems. This course aims at providing the students' knowledge of basic concepts of FEM, Development of stiffness matrix for 1-D, 2-D and 3-D elements and relevant structural applications.
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Course Outcome:
After successful completion of the course, students will able to:
CO1: Explain fundamentals of theory of elasticity.
CO2: Describe fundamentals of Finite element method.
CO3: Identify the concept of 2D elements in FEM.
CO4: Discuss the concept of 3D and isoperimetric elements.
CO5: Analyze truss and beam using FEM.
CO6: Analyze frame and grid problems using FEM.

Course Contents

UNIT-I	Theory of elasticity	7 Hours
Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress, plane strain and axisymmetric problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems.		
UNIT-II	**Fundamentals of FEM**	**7Hours**
General steps of the finite element method, Applications and advantages of FEM, concept of finite element for continuum problems, discretization of continuum, use of polynomial displacement function, Pascal 's triangle, convergence criteria. Principle of minimum potential energy, formulation of stiffness matrix for truss element using vibrational principles.		
UNIT-III	**2D elements in FEM**	**7 Hours**

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Displacement function for 2D triangular (CST and LST) and rectangular elements, Use of shape functions, Area co-ordinates for CST element, Shape functions in cartesian and natural coordinate systems, shape functions for one dimensional element such as truss and beam, shape functions of 2D Lagrange and serendipity elements.

UNIT-IV	3D elements in FEM	7 Hours

Introduction to 3D elements such as tetrahedron and hexahedron. Iso-parametric elements in 1D, 2D and 3D analysis, Jacobian matrix, Formulation of stiffness matrix for 1D and 2D Isoperimetric elements in plane elasticity problem.

UNIT-V	Analysis of truss and beam using FEM	7 Hours

Formulation of stiffness matrix, analysis of spring assemblage, member approach for truss and beam element, node numbering, assembly of element equations, formation of overall banded matrix equation, boundary conditions and solution for primary unknowns, applications to truss and beam not involving unknowns more than three.

UNIT-VI	Analysis of frames using FEM	7 Hours

Formulation of stiffness matrix using member approach for portal frame and grid elements, transformation matrix, applications to frame and grid not involving unknowns more than three.

Text Books:

T1. Finite Element Analysis – S.S. Bhavikatti, New Age International (P) Ltd.
T2. Introduction to the Finite Element Method – Desai & Abel, CBS Publishers & Distributors, Delhi
T3. A first course in the finite element method-Daryl L. Logon, Thomson Publication.

Reference Books:

R1. Nonlinear finite element analysis by Reddy- Oxford University Press.
R2. Introduction to Finite Elements in Engineering – T.R. Chandrupatla& A.D. Belegundu Prentice Hall of India Pvt. Ltd.
R3. Matrix, Finite Element, Computer & Structural Analysis – M. Mukhopadhyay, Oxford & IBH Publishing Co. Pvt. Ltd.
R4. Finite Element Analysis – Theory & Programming – C.S. Krishnmoorthy, TATA McGraw Hill Publishing Co. Ltd.
R5. An Introduction to the Finite Element Method – J.N. Reddy, TATA McGraw Hill Publishing Co. Ltd.
R6. Theory & Problems – Finite Element Analysis – Gorge R. Buchanan, Schaum's Outline series. TATA Mc Graw Hill Publishing Co. Ltd.
R7. The Finite Element Method – O.C. Zienkiewicz, TATA McGraw Hill Publishing Co. Ltd.

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) - SEM-VI
[CE3111C]: ELECTIVE II
TQM and MIS in Civil Engineering

Teaching Scheme:	Credit	Examination Scheme:
TH: - Hours/Week 3	TH:3 PR: 0	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks

Course Prerequisites : Building planning and construction , Concrete technology

Course Objective:

- To learn the fundamental concepts of quality management
- To learn modern tools in TQM and MIS
- To comprehend the concepts of six sigmas and its application in Civil Engineering
- To get familiar with various concepts of Management control related to civil engineering projects
- To align with the global scenario of developments in quality management in construction industry
- To understand the fundamental concepts of MIS in civil engineering

Course Outcome:
After successful completion of the course, students will able to:
CO1: Identify basic concepts of quality and global challenges in construction engineering.
CO2: Identify various applications of six sigma in construction projects.
CO3: Discuss ISO and design quality manual for construction projects.
CO4: Calculate cost of quality.
CO5: Explain various types of certifications for quality.
CO6: Design MIS for a construction.

Course Contents

UNIT-I	Quality in Construction	07 Hours

a) Quality – Various definitions and interpretation, Importance of quality on a project in the context of global challenges, Contribution of various Quality Gurus (Juran, Deming, Cross by, Ishikawa).
b) Evolution of TQM- QC, TQC, QA, QMS, TQM
c) Factors affecting quality of construction, reasons for poor quality & measures to overcome.

UNIT-II	TQM & Six Sigma	07 Hours

a) TQM – Necessity, advantages, 7QC tools,
b) Quality Function Deployment(QFD). Defects & it's classification in construction. Measures to prevent and rectify defects,
c) Six sigma – Importance, levels

UNIT-III	ISO & Quality Manual	07 Hours

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a) Study of ISO 9001 principles.
b) Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity.
c) Corrective and Preventive actions, Conformity and NC reports.

UNIT-IV	Management Control & Certifications	07 Hours

a) Benchmarking in TQM, Kaizen in TQM.
b) Quality Circle. Categories of cost of Quality.
c) CONQAS, CIDC-CQRA certifications.

UNIT-V	Techniques in TQM Implementation and awards	07 Hours

a) Kaizen, 5 S'techniques.
b) Failure Mode Effect Analysis (FMEA). Zero Defects.
c) National & International quality awards- Rajeev Gandhi Award, Jamuna lal Bajaj Award, Golden Peacock Award, Deming Prize, Malcolm Baldrize award

UNIT-VI	MIS	07 Hours

a) Introduction to Management Information systems (MIS) Overview, Definition.
b) MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control.
c) Study of an MIS for a construction organization associated with building works

Reference Books:

R1. Total Quality Management-- Dr. GunmalaSuri and Dr. Puja Chhabra Sharma—Biztantra
R2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company
R3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra 4.Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd
R4. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges.
R5. Management –Principal, process and practices by Bhat – Oxford University Press

Text Books:

T1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra.
T2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company.
T3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra.
T4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) - SEM-VI
[CE3111D]: ELECTIVE II
Advanced Concrete Technology

Teaching Scheme:	Credit	Examination Scheme:
TH: - 03/Week	TH:3	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam : 60 Marks Total :100Marks

Course Prerequisites: Basic civil engineering/ Basics of construction materials like lime, cement, natural & artificial sand, plain cement concrete. Chemistry / chemical reaction between cement & water and Concrete technology

Course Objective:

The course is focused on advanced cement-based composites, emerging materials, and green materials. Material properties are evaluated using conventional and innovative non-destructive evaluation methods. The course will include a project component focusing on specialized concretes and emerging materials not limited to Fiber Reinforced Concrete, Self-consolidating concrete, High Strength Composites, Light Weight Concrete, and Carbon Negative Concrete

It helps the students to gain the knowledge of various topics suchas durability and quality control. It also aims to impart the knowledge regarding concrete mix design of special concrete

Course Outcome:

After successful completion of the course, students will able to:

CO1: Discuss the concrete ingredients and its influence at gaining strength.
CO2: Explain the recent developments in Special concretes.
CO3: Design of concrete mix of special types of concrete
CO4: Describe the application and use of fiber reinforced concrete and non-destructive testing of concrete
CO5: Demonstrate durability of concrete & quality control
CO6:Discuss Ferro cement & Precast structure.

Course Contents

UNIT-I	Introduction	07 Hours

Cement and its types: general, hydration of cement, Grading curves of aggregates, Manufactured sand as fine aggregate, copper slag as fine aggregate.
Concrete: properties of concrete, w/b ratio, gel space ratio, Problems on maturity concept, Effect of admixtures.

UNIT-II	Special types of Concrete	07 Hours

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Structural Light weight concrete, ultra-light weight concrete, vacuum concrete, mass concrete, waste material based concrete, ultra-rapid hardening, gap graded concrete, high strength concrete, high performance concrete ,Self-curing concrete, Pervious concrete, Geo polymer concrete, smart concrete		
UNIT-III	**Mix Design of Special concrete**	**07 Hours**
Design of high strength concrete mixes, design of light weight aggregate concrete, design of fly ash cement concrete mixes , Design of pumpable concrete mixes, Design of self-compacting concrete.		
UNIT-IV	**Fiber Reinforced Concrete and NDT**	**07 Hours**
Properties of artificial and naturally occurring fibers. Interaction between fibers and matrix, basic concepts and mechanical properties: strength and behavior in tension, compression and flexure of steel fiber reinforced concrete, Advanced non-destructive testing methods: ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods etc.		
UNIT-V	**Durability of Concrete and Quality Control**	**07 Hours**
Introduction, Permeability of concrete, chemical attack, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456- 2000 requirement for durability. .Guidelines for Quality control & Quality assurance of concrete.		
UNIT-VI	**Ferro cement & Precast structure**	**07 Hours**
Ferrocement: Properties & specifications of ferrocement materials ,analysis and design of prefabricated concrete structural elements, precast construction, erection and assembly techniques.		

Text Books:

T1. M. S. Shetty, S Chand , Concrete Technology, New Delhi-110055
T2. . M. L. Gambhir ,Concrete Technology, Tata McGraw-Hill.
T3. Concrete Technology -- A R Santhakumar, Oxford University Press.
T4. Fiber Reinforced Cement Composite- P.N.Balguru&P.N.Shah.
T5. Concrete: Microstructure, Properties and Materials-- P. Kumar Mehta and P. S. M. Monteiro-- Tata Mc-Graw Hill Education Pvt. Ltd.

Reference Books:

R1. Handbook on Advanced Concrete Technology Edited by N V Nayak, A. K. Jain, Narosa Publishing House
R2. Properties of concrete by A. M. Neville, Longman Publishers.
R3. Concrete Technology by R.S. Varshney, Oxford and IBH.
R4. Concrete technology by A M. Neville, J.J. Brooks, Pearson
R5. Ferrocement Construction Mannual-Dr. D.B.Divekar-1030,Shivaji Nagar,Model Colony, Pune
R6. Concrete Mix Design-A.P.Remideos--Himalaya Publishing House (ISBN-978-81-8318- 996-5
R7. Concrete, by P. Kumar Metha, Gujrat Ambuja.
R8. Learning from failures R.N.Raikar
R9. Structural Diagnosis R.N.Raikar
R10. Concrete Mix Design Prof. Gajanan Sabnis

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T. Y. B. Tech (Civil Engineering)
(2019 Pattern) - SEM-VI
[CE3112] Employability Skill Development

Teaching Scheme: **PR: - 02 hours /Week**	Credit PR:1	Examination Scheme: Oral : 50 Marks Total :50Marks

Course Prerequisites: Nil

Course Objective:

- To enhance the employability of the students through development of their skills.
- To enrich the students ability to make them industry ready.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Develop skills and readiness for employability.
CO2: Demonstrate proficiency in essential communication skills, including writing, verbal, and non-verbal communication.
CO3: Apply presentation techniques and prepare effectively for interviews.
CO4: Apply leadership strategies for problem-solving.

Course Contents

UNIT-I	Soft Skill	04 Hours
Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills, Resume, Curriculum vitae, how to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Difference between C.V. Bio data and Resume.		
UNIT-II	**Communication Skills**	**04 Hours**
Paragraph writing, Letter writing, precise writing, Paraphrasing and e-mail writing, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing.		
UNIT-III	**Skills for interviews**	**04 Hours**
Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.		

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UNIT-IV	Employability Skills	04 Hours
Definition of Employability, Employability Skills, skills which employers expect from graduates, Career planning with action plan		
UNIT-V	**Interpersonal Skills**	**02 Hours**
Critical Thinking, Assertiveness, Decision Making, Problem Solving, Negotiation, Building Confidence, Time Management, Personal Presentation, Assertiveness, Negotiation, Avoiding Stress		
UNIT-VI	**Problem Solving Techniques**	**02 Hours**
Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions. Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes		

Lab Contents

Guidelines for Assessment

This course has been introduced with the objective of enhancing the employability of the students through development of their skills. The assessment will include the work done by students on the basis of following activities (any 2)

Case study analysis, Group presentations on any topic, Audio-video shows, Use of e-resources The term work will consist of a detailed report of any 2 activities. The activities which need to be performed in a group will have a group of not more than 4 students. However, the report for the term work will be prepared at individual level.

Suggested parameters for overall assessment include attendance, timely completion of work allotted, performance, innovation, punctuality and neatness.

Text Books:

T1. R. Gajendra Singh Chauhan, Sangeeta Sharma, Soft Skills- An integrated approach to maximize personality, ISBN: 987-81-265-5639-7, First Edition 2016, WileyWren and Martin, "English grammar and Composition", S. Chand publications.

T2. David F. Beer, David A. Mc Murrey, A Guide to Writing as an Engineer, ISBN: 9781-118- 30027-5 4th Edition, 2014, Wiley.

Reference Books:

R1. Cambridge English for Job Hunting Colm Downes---Cambridge University Press (ISBN- 978-0- 521-14470-4)

R2. Poly skills--Foundation books-- Cambridge University Press (ISBN 978-81-7596-916-2)

R3. Global Business Foundation Skills-- Foundation books-- Cambridge University Press (ISBN 978-81-7596-783-0)

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T. Y. B. Tech (Civil Engineering)
Academic Year – 2020-2021
Semester –VI
Audit Course- IV

List of Courses to be opted (Any one) under Audit Course VI

Code	Name of Course	Link
HS3107	Essence of Indian Knowledge Tradition -II	https://www.aicte-india.org/sites/default/files/Model Curriculum/UG-2/ug-vol2.pdf
HSHS3109	Introduction to Human Factors and Ergonomics	https://onlinecourses.swayam2.ac.in/aic20_ed03/preview
HS3110	Mind Education	https://onlinecourses.swayam2.ac.in/aic19_as05/preview

GUIDELINES FOR CONDUCTION OF AUDIT COURS

A student shall be awarded the bachelor's degree if he/she earns 170 credits and clears all the audit courses specified in the syllabus. The student shall be awarded grade as AP (Audit Course Pass) on successful completion of audit course. The student may opt for one of the audit courses per semester, starting from second year first semester. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course shall be done. Method of conduction and method of assessment for audit courses are suggested.

Using NPTEL Platform:
NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in

- Student can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with certificate.

Guidelines for Assessment:

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The assessment of the course will be done at the institute level. The department has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.

- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as "Present" and the student will be awarded the grade AP on the mark sheet.

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