D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada

Accredited by NBA (B. Tech – CSE, ECE & EEE) & NAAC with A^{++} Grade

Balusumudi, Bhimavaram-2, West Godavari District, Andhra Pradesh

Ph: 08816-221238 Email: dnrcet@gmail.com **website:** https://dnrcet.org

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DEPARTMENT OF CIVIL ENGINEERING

THIRD BOARD OF STUDIES (BOS) MEETING

(Held on 07-01-2026, A.Y: 2025-26)

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THIRD BOARD OF STUDIES (BOS) MEETING

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INDEX

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DEPARTMENT OF CIVIL ENGINEERING

Date: 05-01-2026

CIRCULAR

This is to inform all faculty members that the second Board of Studies (BoS) meeting of the Civil Engineering Department will be held on 07-01-2026 (Wednesday) at 2:30 PM in the Board Room, DNRCET (A), through online mode. All BoS members are requested to attend the meeting on time without fail.

Agenda

1. To Discuss the B.Tech (DR24) III Year detailed syllabus
2. To Discuss the Academic Regulations of M.Tech (DR25)
3. To Discuss the M.Tech (DR25) detailed Syllabus
4. Any other item with the permission of the chair.

HoD 05/01/2026

Head of the Department
Civil Engineering
DNR College of Engg. & Tech.
BHIMAVARAM-534 202.

Copy to
1. The faculty members of BOS
2. The Principal, DNRCET (A)
3. To Dean Academics
4. Office File

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Faculty signatures

1. P. Chakradhar Prasad – 5/1/26
2. K. L. A. V. Harnadh – 5/1/26.
3. M. Venkata krishna – 5/01/26
4. P. V. V. S. Kishore – 5-01-26
5. Md. B. WASIM – 5/1/26
6. M. Yesuratnam – 5/1/26.
7. CH. VINAY CHANDRA SEKHAR – 5/1/26
8. V. S. Divya Teja – 5/1/26.
9. M. L. Kumar – 5/1/26

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DEPARTMENT OF CIVIL ENGINEERING

INVITATIONS

Gmail

DNR CIVIL <dnrcet.civil@gmail.com>

Invitation to Civil Engineering BoS-3 Meeting@DNRCET(A)

DNR CIVIL <dnrcet.civil@gmail.com> Wed, Jan 7, 2026 at 12:12 PM
To: "Dr P V Surya Prakash Principal, PYCE , Kakinada" <princengg@pydah.edu.in>, M Pavan Kumar <pavanidea@gmail.com>, Bhadradri Raghuram Kadali <brkadali@nitw.ac.in>, srpalivela@jntucek.ac.in, Vijayakumar Peeram <vijayakumarpeeram@gmail.com>

DNRCET Autonomous is inviting you to a scheduled Zoom meeting.

Dear Sir,

You are kindly requested to join the **Civil Engineering BoS–3 Meeting**, scheduled for today, **07-01-2026 at 2:45 PM**, through the **Zoom platform (Online).** Please find the link herewith

Thank you.

Dr.B.V.Ramana Murthy

HoD–Civil Engineering

Topic: CIVIL BOS-3 MEETING, DNRCET(AUTONOMOUS)
Time: Jan 7, 2026 02:45 PM India
Join Zoom Meeting
https://us06web.zoom.us/j/83936554688?pwd=TJU5hyoUbGvKaPgzWrR4bROsISayad.1

Meeting ID: 839 3655 4688
Passcode: 661546

One tap mobile
+15642172000,,83936554688#,,,,*661546# US
+16469313860,,83936554688#,,,,*661546# US

Join instructions
https://us06web.zoom.us/meetings/83936554688/invitations?signature=OPNhTzLHZxH6ScYAI0xASPIwX_dITJ13Mrr6KVQW0FY

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Gmail

DNR CIVIL <dnrcet.civil@gmail.com>

Invitation to BOS-3 Meeting – Department of Civil Engineering

DNR CIVIL <dnrcet.civil@gmail.com> Tue, Jan 6, 2026 at 6:56 PM
To: "Dr P V Surya Prakash Principal, PYCE , Kakinada" <princengg@pydah.edu.in>, M Pavan Kumar <pavanidea@gmail.com>, Bhadradri Raghuram Kadali <brkadali@nitw.ac.in>, srpalivela@jntucek.ac.in, Vijayakumar Peeram <vijayakumarpeeram@gmail.com>

Dear Sir,

I warmly welcome you to attend the **BOS-3 Meeting of the Department of Civil Engineering** at **DNR College of Engineering & Technology (Autonomous)**, scheduled on **07-01-2026 at 2:45 PM**.

Agenda:

1. To discuss the B.Tech (DR24) III Year detailed syllabus
2. To discuss the Academic Regulations of M.Tech (DR25)
3. To discuss the M.Tech (DR25) detailed syllabus
4. Any other item with the permission of the Chair

We look forward to your valuable presence and suggestions. The **Zoom** link will be shared tomorrow morning. Relevant copies are attached for your reference.

Thanking you.

Yours sincerely,

Dr.B.V.Ramana Murthy

HoD-Civil Engineering

DNRCET(A),Bhimavaram,West Godavari

2 attachments

M.TECH -STRUCTURES (CIVIL ENGG)- DR25-Final.pdf
1007K

CIVIL_B.Tech_3 yr SYLLABUS_7-1-26 FINAL COPY.pdf
1007K

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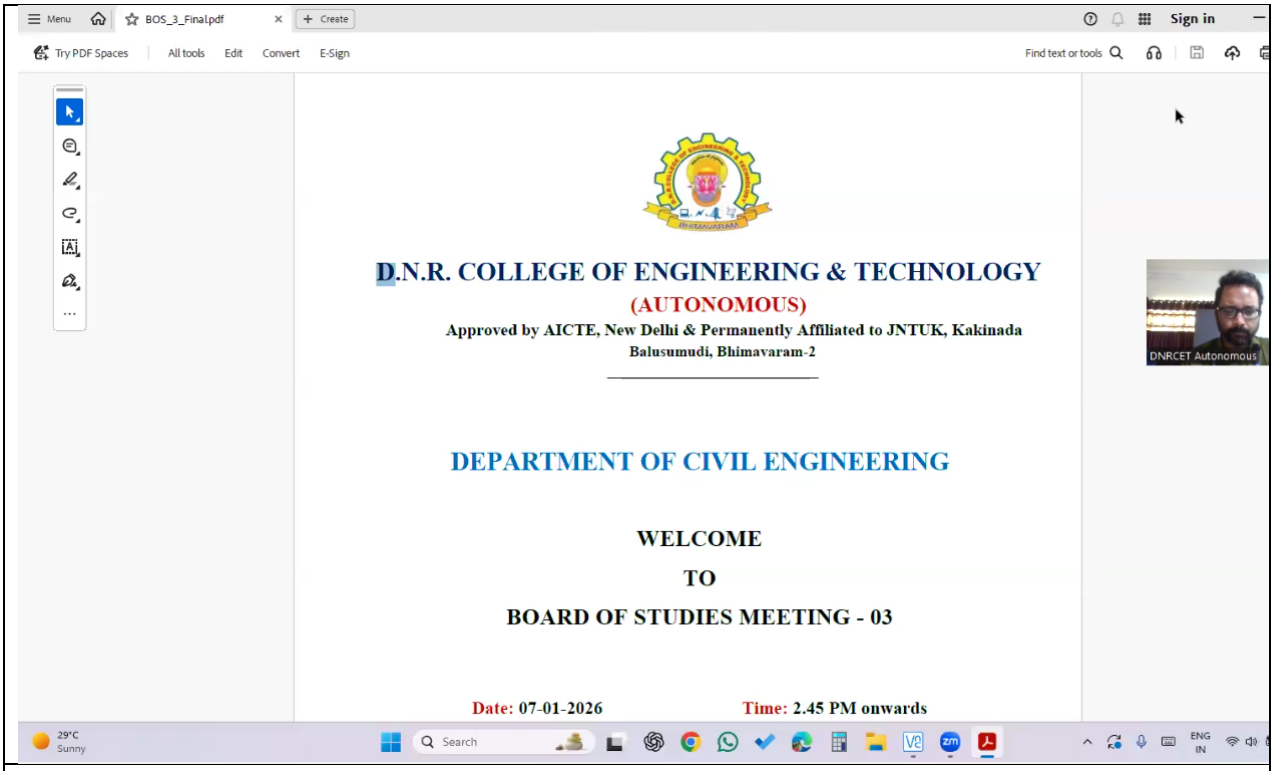
DEPARTMENT OF CIVIL ENGINEERING

Screenshots taken during the Online BOS meeting on 7th January 2026



HoD - Civil Engineering Department Welcoming the BOS members

Discussion on UG (DR24) III year I & II semester syllabus

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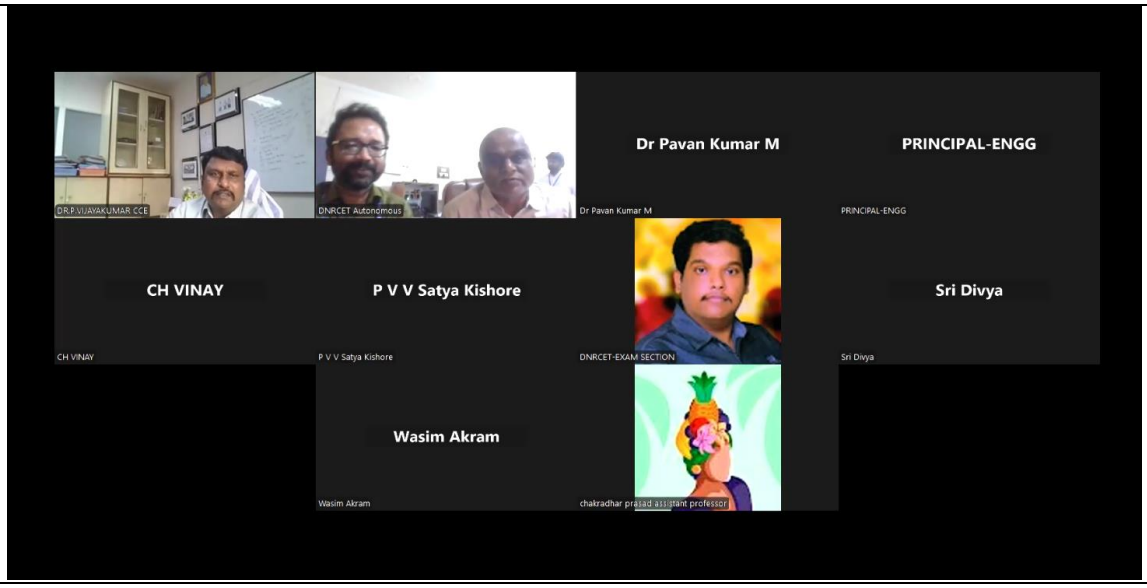
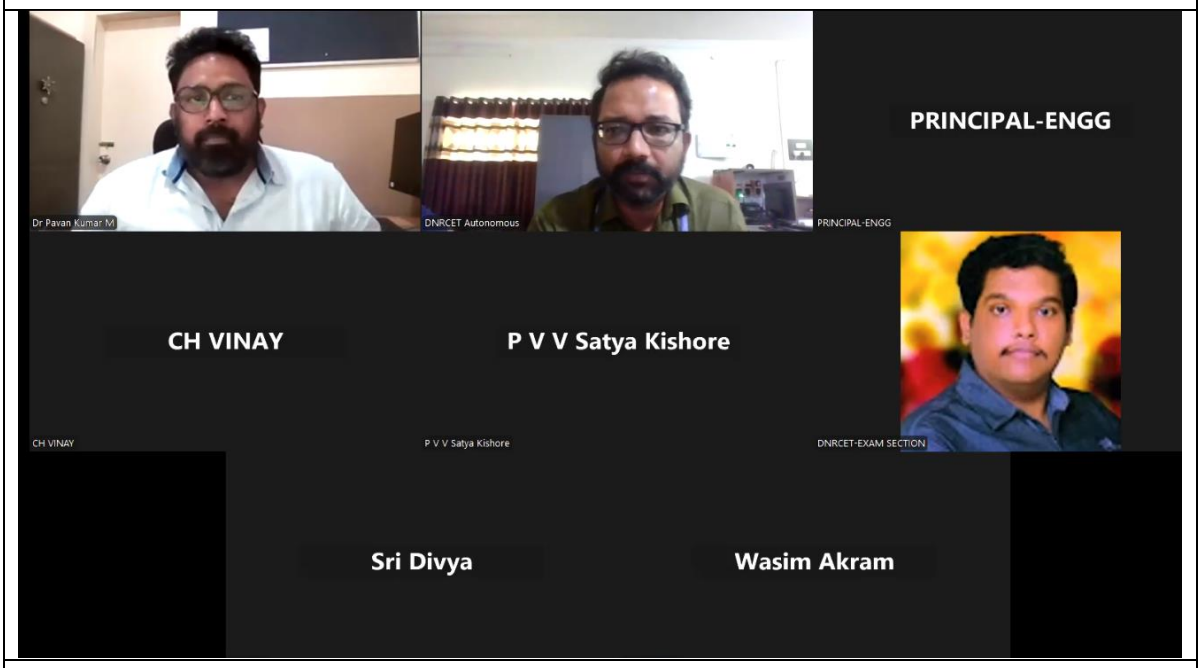
Screenshots taken during the Online BOS meeting on 7th January 2026



Discussion on PG_DR25-Civil (S.E) regulations



Discussion on PG_DR25 -Civil (S.E) syllabus

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DEPARTMENT OF CIVIL ENGINEERING

BOS Meeting-03 (A.Y. 2025-26)

Venue: Board Room, DNRCET (A)

Date & Time: 07-01-2026 & 2.45 PM - 4.40 PM

Mode of conducting meeting: Zoom (online platform)

Meetinglink:

https://us06web.zoom.us/j/83936554688?pwd=TJU5hyoUbGvKaPgzWrR4bROslSayad.1

Agenda:

1. To Discuss the B.Tech (DR24) III Year detailed syllabus
2. To Discuss the Academic Regulations of M.Tech (DR25)
3. To Discuss the M.Tech (DR25) detailed Syllabus
4. Any other item with the permission of the chair.

Minutes of meeting with the following Resolutions

Dr.B.V.Ramana Murthy, Head of the Department & Chairman, BOS Civil Engineering, welcomed and introduced the eminent members of BOS Meeting. The chairman of BOS placed the agenda for the deliberation of the members. The BOS members expressed their appreciation for novel structure of curriculum and content of the course. The following deliberations were made as per the items of circular agenda.

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Agenda 1: To Discuss the B.Tech (DR24) III Year I and II semester detailed syllabus

Discussion: The Course structure of **B.Tech (DR24) III Year Civil Engineering** subjects in the First and Second Semesters along with Honours & Minor Courses and their respective credits and categories, have been listed and the detailed syllabus of each subject have been discussed. BOS members have also suggested that the revised PO's (PO1-PO11) needs to be incorporated in the UG and PG syllabus.

It was also observed that in the B.Tech. III Year I Semester, the Fluid Mechanics and Hydraulic Machines Laboratory has a modification in the 9th experiment title.

Resolution:

- There are no changes in the B.Tech (DR24) III-year detailed syllabus, and it has been followed as prescribed by JNTUK, Kakinada, without any modifications.
- As per the new NBA 2024 guidelines, up to PO11 has been added to the UG and PG syllabus.
- It was resolved that the modification in the title of the 9th experiment of the B.Tech. III Year I Semester **Fluid Mechanics and Hydraulic Machines Laboratory.**

Name of the existing experiment	Name of the revised experiment
Determination of coefficient of dead loss due to a sudden expansion/ contraction in a pipeline.	Determination of coefficient of head loss due to friction in a sudden expansion/ contraction in a pipeline.

……..

Agenda 2: To Discuss the Academic Regulations of M.Tech (DR25)

Discussion: The BOS members has discussed the M.Tech (DR25) regulations

Resolution:

There are no changes in the M.Tech (DR25) regulations, and they have been adopted as prescribed by JNTUK, Kakinada, without any modifications.

……..

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Agenda 3: To Discuss the M.Tech (DR25) detailed Syllabus

Discussion:

1. The BOS members discussed the structure of the M.Tech courses in detail. During the discussion, it was observed that the number of Course Outcomes (COs) should be standardized to six for each course.
2. The members also deliberated on the inclusion of additional Program Outcomes (POs) and recommended increasing the total number of POs to eleven.
3. Further, it was suggested that the CO–PO mapping for all M.Tech courses be revised and updated accordingly.
4. Further, the BOS members reviewed the M.Tech I Semester Advanced Concrete Technology Laboratory syllabus and suggested corrections to the titles of Experiments (1,2 and 6).
5. Advanced Structural Engineering Laboratory and suggested that the experiment titled "Calculation of Young's Modulus of Elasticity of Concrete" be revised.
6. For Advanced concrete technology laboratory and Advanced structural engineering laboratory, COs were identified as similar and suggested to update them.
7. It is suggested that in Advanced concrete technology laboratory, a new experiment can be added related to the strength of the concrete.
8. It is identified that in computer aided design laboratory, there's a typographical error in the software name and COs were not clear**.**
9. It has been identified that the Course Outcomes (COs) in the Structural Design Laboratory need to be updated.

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Resolution:

1. Resolved that the number of Course Outcomes (COs) for each M.Tech course shall be standardized to six (06), as per the institutional guidelines as prescribed.

2. The number of Pos (11) were incorporated in the M.Tech curriculum.

3. Resolved that the CO–PO mapping for all M.Tech courses are revised and updated in accordance with the revised COs and POs.

4. Resolved that in the I semester Advanced Concrete Technology Laboratory, the titles of experiments 1, 2, and 6 are revised as follows:

S.No	Name of the existing experiment	Name of the revised experiment
1	Study on Water / Cement Ratios Vs Workability of different concretes	Study on Water–Cement Ratios vs **workability** of different concretes with different cements and admixtures
2	Study on Water / Cement Ratios Vs Strength of different concretes	Study on Water–Cement Ratios vs **Strength** of different concretes with different cements and admixtures
3	Non-destructive testing- Impact Hammer test, UPV test	Non-Destructive Testing – Rebound Hammer Test and Ultrasonic Pulse Velocity (UPV) Test.

5. Resolved that in the Advanced Structural Engineering Laboratory, the experiment titled "Calculation of Young's Modulus of Elasticity of Concrete" was renamed as **"Elastic Modulus of Concrete"** for standard in practice.

6. For both Advanced concrete technology laboratory and Advanced structural engineering laboratory, COs were updated.

7. In Advanced concrete technology laboratory, a new experiment named as Determination of flexural strength of self-compacted concrete.

8. In computer aided design laboratory, software name spelling was corrected as STAAD.Pro and COs were updated.

9. It was resolved that the Course Outcomes (COs) of the Structural Design Laboratory have been updated.

……..

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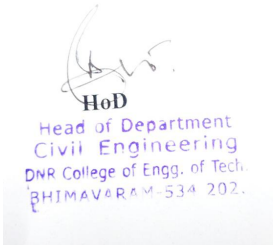
Agenda 4: Any other item with the permission of the chair

The B.Tech and M.Tech end semester examinations model question paper format was discussed.



Dr.B.V.Ramana Murthy
Head of the Department and Chairman of BOS

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MEMBERS OF BOARD OF STUDIES (BOS)

S.No	Category	Name	Positionn	Signature
1	Chairman	Dr.B.V.Ramana Murthy	HOD Dept.of Civil Engineering DNR College of Engineering &Technology,Bhimavaram-534202.AP	
2	Expert Nominated by the Vice-Chancellor (University Nominee)	Dr.P.SubbaRao	Professor Dept of Civil Engineering UCEK,JNTUK,Kakinada-533003, AP	online
3	Subject Experts from outside Parent Universities	Dr.Bhadradri.Raghu Ram Kadali	Assistant Professor Gr-I Dept. of Civil Engineering NIT Warangal	online
		Dr.Surya Prakash	Professor & Principal Dept. of Civil Engineering Pydah College Of Engineering Kakinada	online
4	Representative from the Industry Expert	Dr.M.Pavan Kumar	Head Design Ignite consultants & engineers near [illegible] Junction, Madhurawada, Vishakhapatnam-[illegible]	online
5	College Alumni	Dr.P.VijayKumar	Chief Executive Officer, [illegible]FilmCity, Hyderabad.	online
6	Faculty	Dr.M.L.Kumar	Associate Professor, Civil Engineering Department DNR College of Engineering & Technology, Bhimavaram-534202	M.L.K.
		Mr.K L A V Harnadh	Assistant Professor Civil Engineering Department DNR College of Engineering & Technology, Bhimavaram-534202	
		Mr.P.Chakradhar prasad	Assistant Professor Civil Engineering Department DNR College of Engineering & Technology, Bhimavaram-534202	

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		Mr.CH.Vinay Chandra sekhar	Civil Engineering Department DNR College of Engineering & Technology Bhimavaram-534202	Professor	
		Mrs.V.S.Divya teja	Civil Engineering Department DNR College of Engineering & Technology Bhimavaram-534202	Professor	
		Mr.M.Venkata Krishna	Civil Engineering Department DNR College of Engineering & Technology Bhimavaram-534202	Professor	
		Mr.M.Yesuratnam	Civil Engineering Department DNR College of Engineering & Technology Bhimavaram-534202	Professor	
		Mr.B.Manikanta	Civil Engineering Department DNR College of Engineering & Technology Bhimavaram-534202	Professor	
		Mr.P.V.V Satya Kishore	Civil Engineering Department DNR College of Engineering & Technology Bhimavaram-534202	Professor	

HoD

Head of Department
Civil Engineering
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DEPARTMENT OF CIVIL ENGINEERING

THIRD BOARD OF STUDIES (BOS) MEETING

ANNEXURE - I

(Pages: 01 - 131)

D.N.R COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF CIVIL ENGINEERING

B.Tech programme

DR24- III Year I & II Semesters

Course structure

B.Tech. III Year I Semester (DR24) - Civil Engineering

S.No.	Category	Title	Subject code	L	T	P	Credits
1	Professional Core	Design and Drawing of Reinforced Concrete Structures	BT24CE3101	3	0	0	3
2	Professional Core	Engineering Hydrology	BT24CE3102	3	0	0	3
3	Professional Core	Geotechnical Engineering -I	BT24CE3103	3	0	0	3
4	Professional Elective-I	1. Advanced structural analysis 2. Architecture and town planning 3. Construction Technology and Management	BT24CE31P1A BT24CE31P1B BT24CE31P1C	3	0	0	3
5	Open Elective-I	Entrepreneurship Development & Venture Creation OR 1.Green Buildings 2.Construction technology and management 3. Climate Change impact on Eco system	BT24HS3101 BT24CE31O1A BT24CE31O1B BT24CE31O1C	3	0	0	3
6	Professional Core	Geotechnical Engineering Lab	BT24CE3104	0	0	3	1.5
7	Professional Core	Fluid Mechanics & Hydraulic Machines Lab	BT24CE3105	0	0	3	1.5
8	Skill Enhancement course	Estimation, Specifications & Contracts	BT24CE3106	0	1	2	2
9	Engineering Science	Tinkering Lab	BT24CE3107	0	0	2	1
10	Evaluation of Community Service Internship	Community Service Internship	BT24BS3101	-	-	-	2
Total				**15**	**1**	**10**	**23**

B.Tech. III Year II Semester (DR24) - Civil Engineering

S.No	Category	Title	Subject code	L	T	P	Credits
1	Professional Core	Design and Drawing of Steel Structures	BT24CE3201	3	0	0	3
2	Professional Core	Highway Engineering	BT24CE3202	3	0	0	3
3	Professional Core	Environmental Engineering	BT24CE3203	3	0	0	3
4	Professional Elective-II	1. Ground Improvement Techniques 2. Repair and Rehabilitation of Structures 3 Valuation and Quantity Survey	BT24CE32P2A BT24CE32P2B BT24CE32P2C	3	0	0	3
5	Professional Elective-III	1. Finite element method 2. Bridge Engineering 3. Water Resource Engineering	BT24CE32P3A BT24CE32P3B BT24CE32P3C	3	0	0	3
6	Open Elective-II	1.Disaster management 2.Sustainability in Engineering practices 3.Water Supply Systems	BT24CE32O2A BT24CE32O2B BT24CE32O2C	3	0	0	3
7	Professional Core	Environmental Engineering lab	BT24CE3204	0	0	3	1.5
8	Professional Core	Highway Engineering lab	BT24CE3205	0	0	3	1.5
9	Skill Enhancement course	CAD Lab	BT24CE3206	0	1	2	2
10	Audit course	Technical paper writing & IPR	BT24HS3201	2	0	0	-
Total				**20**	**1**	**08**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation							

OPEN ELECTIVES

S.NO	Category	Titles
1	Open Elective -1	1.Green Buildings 2.Construction technology and anagement 3. Climate Change impact on Eco system
2	Open Elective-2	1.Disater management 2.Sustainability in Engineering practices 3.Water Supply Systems
3	Open Elective-3	1.Building technology for engineers 2.Environmental impact assessment
4	Open Elective-4	1.Geo-Spatial Technologies 2. Solid waste management

Honors Degree courses

1. Introduction to Earthquake Engineering
2. Structural dynamics
3. Traffic Engineering and Management
4. Advanced Hydrology
5. Geosynthetics Engineering: In theory and practice
6. Environmental Geotechnics
7. Seismic Analysis of Structures
8. Environmental Air Pollution
9. Soil Dynamics
10. Advanced Transportation Engineering

Minors Degree courses

1. Surveying
2. Mechanics of solids
3. Soil Mechanics
4. Fluid Mechanics
5. Civil Engineering- Building Materials and Construction
6. Building Planning and drawing
7. Estimation and Costing
8. Sustainable Materials and Green building
9. Safety in Construction
10. Construction planning and Management

Note: Students can opt any course in Honors and Minors through NPTEL/MOOCs/JNTUK, Kakinada University approved courses.

UG - Civil Engineering Programme
III Year I Semester
Detailed Syllabus

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3101		3	0	0	3
DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES							

Course Learning Objectives:

The objective of this course is:

1. Familiarize Students with different types of design philosophies.
2. Equip student with concepts of design of flexural members.
3. Understand Concepts of shear, bond and torsion.
4. Familiarize students with different types of compressions members and Design.
5. Understand different types of footings and their design.

Course Outcomes:

At the end of this course the student will be able to

1. Work on different types of design philosophies
2. Carryout analysis and design of flexural members and detailing
3. Design structures subjected to shear, bond and torsion.
4. Design different type of compression members and footings
5. Design of slabs and stair case
6. Design of one way and two-way slabs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	1	–	1	–	–	2	2
CO2	3	3	3	2	1	–	1	–	–	2	2
CO3	3	3	3	2	1	–	1	–	–	3	3
CO4	3	3	3	2	1	–	1	–	–	2	3
CO5	3	3	3	1	2	–	1	–	–	1	3
CO6	3	2	3	1	2	–	1	–	–	2	2

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	2	3
CO4	2	2
CO5	3	2
CO6	3	3

UNIT –I

Introduction: Working stress method Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads, elastic theory, design constants, modular ratio, neutral axis depth and moment of resistance, balanced, under-reinforced and over-reinforced sections, working stress method of design of singly and doubly reinforced beams.

Limit State Design: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

UNIT –II

Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement Maximum Flexural Steel- Design of Flanged Sections (T)- Effective width of flange – Behavior- Analysis and Design.

UNIT – III

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion for L Beam – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing. **Limit state design for serviceability:** Deflection, cracking and code provision.

UNIT – IV

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – Braced and un-braced columns – I S Code provisions.

Footings: Different types of footings – Design of isolated footings, Square footings – Rectangular footings – circular footing – spread & sloped footings - subjected to axial loads.

UNIT – V

Slabs: Classification of slabs, design of one - way slabs, two - way slabs, and continuous slabs using IS Coefficients (conventional), design of waist-slab staircase.

NOTE: All the designs to be taught in Limit State Method. Drawing classes must be conducted every week and the Following plates should be prepared by the students.

- Reinforcement detailing of T-beams, L-beams and continuous beams and cantilevers.
- Reinforcement detailing of columns and isolated footings.
- Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Textbooks:

1. 'Limit State Design' by A. K. Jain
2. 'Reinforced Concrete Structures' by S. Unnikrishna Pillai &Devdas Menon, Tata Mc.Graw Hill, New Delhi.

Reference books:

1. 'Design of concrete structures' by N. Krishna Raju.
2. 'Reinforced Concrete Structures' by Park and Pauley, John Wiley and Sons.

IS Codes:

1. IS -456-2000 (Permitted to use in examination hall)
2. IS – 875, 3(SP-16)

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3102		3	0	0	3
ENGINEERING HYDROLOGY							

Course Learning Objectives:

The course is designed to make the students,

1. Understand hydrologic cycle and its relevance to Civil engineering.
2. Learn physical processes and their interactions in hydrology.
3. Learn measurement and estimation of the components of hydrologic cycle.
4. Have an overview and understanding of Hydrographs.
5. Learn flood frequency analysis, design flood and flood routing methods.
6. Study the concepts of groundwater movement and well hydraulics.

Course Outcomes:

At the end of the course the students are expected to

1. Have a thorough understanding of the theories and principles governing the hydrologic processes.
2. Be able to quantify hydrologic components and apply concepts in hydrologic design of water resources projects.
3. Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
4. Develop design storms and carry out frequency analysis.
5. Estimate flood magnitude and carry out flood routing.
6. Determine aquifer parameters and yield of wells.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	–	–	–	–	–	–	2
CO2	3	3	1	2	–	–	–	–	–	–	3
CO3	3	3	2	2	–	–	–	–	–	–	3
CO4	3	3	3	2	2	–	–	–	–	–	2
CO5	3	3	2	2	3	–	–	–	–	–	3
CO6	3	3	2	2	3	–	–	–	–	–	2

	PSO1	PSO2
CO1	–	–
CO2	2	–
CO3	2	–
CO4	3	2
CO5	3	3
CO6	3	2

UNIT - I

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

UNIT-II

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, Evapotranspiration: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

UNIT-III

Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, introduction to IUH.

UNIT-IV

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

Flood Routing: Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

UNIT-V

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation-steady radial flow to wells in confined and unconfined aquifers, yield of an open well-recuperation test.

Textbooks:

1. 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013), New Delhi.
2. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
3. 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt Ltd, (2011), New Delhi.

4. 'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press, (2010).

Reference books:

1. 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2. 'Hydrology' by Raghunath. H.M., New Age International Publishers, (2010)
3. 'Engineering Hydrology – Principles and Practice' by Ponce V.M., Prentice Hall International, (1994)
4. 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications, (2011).

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3103		3	0	0	3
GEOTECHNICAL ENGINEERING– I							

Course Learning Objectives:

The objective of this course is:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

Course Outcomes:

Upon successful completion of this course, student will be able to

1: Understand soil formation, its index properties and classification.

2: Understand soil moisture and flow of water through soils and its effects.

3: Understand stress distribution in soils.

4: Understand Compressibility characteristics under partially saturated and fully saturated conditions.

5: Understand shear strength of soil at different loading & drainage conditions for different oils.

6: Analyse the stress strain of soils with different mechanisms

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	–	–	1	–	–	–	3
CO2	3	2	–	2	–	2	2	–	–	–	2
CO3	3	3	–	2	2	2	–	–	–	–	2
CO4	3	3	–	2	2	–	–	–	–	2	3
CO5	3	3	–	2	–	–	–	–	–	2	1
CO6	3	2	-	2	–	–	–	–	–	–	2

	PSO1	PSO2
CO1	3	–
CO2	–	–
CO3	3	–
CO4	–	–
CO5	2	2
CO6	3	2

SYLLABUS:

UNIT – I

Introduction: Soil formation – Structure of Soils – Texture of Soils – Three phase system and phase relationships.

Index Properties and Classification Tests of Soils: Index properties – Density Index - Grain size analysis – Sieve and Hydrometer methods – Consistency of Clay Soils – Activity of Clays – Thixotropy of clays - soil Classification – Unified soil classification and I.S. Soil classification.

UNIT – II

Soil moisture and Capillarity: Soil moisture and modes of occurrence – Total, Neutral and Effective Pressures – Capillary Rise in soils.

Permeability: Flow of water through soils –- One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems.

UNIT –III

Seepage and Flow Nets: Flow net for one-dimensional flow – two-dimensional flow – Basic equation for Seepage – Flow nets & Characteristics and Uses – Quicksand condition – Seepage forces

Stress Distribution in Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method. - Pressure Blubs.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

Consolidation: Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT - V

Shear Strength of Soils: Basic mechanism of shear strength - Mohr – Coulomb Failure theories – total and effective shear strength parameters – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions – stress paths.

Text books:

1. Soil Mechanics and Foundation Engineering by Dr. K.R. Arora, Standard Publishers and Distributors, New Delhi.
2. Basic and Applied Soil Mechanics' by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
3. Soil Mechanics and Foundation Engineering' by V.N.S.Murthy ,CBS publishers
4. Geotechnical Engineering' by C. Venkataramaiah, New Age International Publishers.

Reference books:

1. Fundamentals of Soil Mechanics' by D.W.Taylor., Wiley.
2. An introduction to Geotechnical Engineering' by Holtz and Kovacs; Prentice Hall
3. Principles of Geotechnical Engineering, BrajaM.Das, Cengage Learing.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31P1A		3	0	0	3
ADVANCED STRUCTURAL ANALYSIS							

Course Learning Objectives:

1. Understand the concepts of strain energy, energy theorems, and their application to determinate and indeterminate structures.
2. Analyze indeterminate trusses, arches, frames, cables, and suspension bridges using classical and approximate methods.
3. Apply displacement-based methods such as moment distribution, slope deflection, and Kani's method for structural analysis.
4. Interpret structural response through shear force and bending moment diagrams, elastic curves, and evaluate the effects of temperature and support conditions.

Course Outcomes:

At the end of this course; the student will be able to

1. Differentiate Determinate and Indeterminate Structures
2. Carry out lateral Load analysis of structures
3. Analyze Cable and Suspension Bridge structures
4. Analyze structures using Moment Distribution, Kani's Method
5. Analyze structures using Matrix method.
6. Analyze continuous beams using Kani's Method

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-
CO3	2	3	3	2	-	-	-	-	-	-	2
CO4	2	3	1	1	-	-	-	-	-	-	2
CO5	2	3	2	2	-	-	2	-	-	-	1
CO6	2	2	1	2	1	-	2	-	-	-	-

	PSO1	PSO2
CO1	-	-
CO2	3	2
CO3	2	3
CO4	3	2
CO5	2	-
CO6	2	-

UNIT–I Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams and pin jointed plane trusses.

Indeterminate Trusses: Determination of static and kinematic indeterminacies –
Analysis of trusses having single and two degrees of internal and external indeterminacies – Castigliano's second theorem.

UNIT-II Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question)

UNIT-III Approximate Methods of Analyses: Application to building frames. (i) Portal Method (ii) Cantilever Method (iii) Substitute frame method for approximate analysis of multi-storey frames subjected to gravity loads and lateral loads. Shear force and bending moment diagrams - Elastic curve.

UNIT – IV Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

UNIT – V Moment Distribution Method: Analysis of Portal frames – including Sway- Substitute frame analysis by two cycle. Slope deflection method: Analysis of Portal frames – including Sway. Analysis of inclined frames. Shear force and bending moment diagrams - Elastic curve.

Kani's Method: Analysis of continuous beams–including settlement of supports and single bay portal frames with and without side sway. Shear force and bending moment diagrams - Elastic curve.

Text Books:

1 Structural Analysis by R.C. Hibbeler, Pearson, New Delhi.

2 Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi**.**

Reference books:

1. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
2. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31P1B		3	0	0	3
ARCHITECTURE AND TOWN PLANNING							

Course Learning Objectives:

The objectives of this course are:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, and Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. Enabling the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, landscaping and expansion of towns.

Course Outcomes:

Upon the successful completion of this course, the student should be able to:

CO1 Explain the evolution of Western and Indian architecture.
CO2 Identify major religious architectural styles and monuments.
CO3 Apply basic principles of residential planning and design.
CO4 Describe the contribution of post-classic and modern architects.
CO5 Explain the historical development of town planning in India and abroad.
CO6 Apply modern town planning principles, standards, and town expansion concepts.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	2	–	1	2	–	–	2
CO2	3	2	1	1	3	–	2	3	–	–	3
CO3	3	3	1	2	2	1	2	–	–	–	1
CO4	3	3	1	2	–	–	2	–	–	–	3
CO5	2	3	1	2	–	–	2	–	–	–	1
CO6	2	2	1	–	1	–	2	–	–	–	2

	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	2	2
CO4	3	3
CO5	3	–
CO6	3	3

UNIT–I

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization.

Temples of Religions: Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhubaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

UNIT-II

Principles of designing and Planning: Principles of planning a residence-site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

Post-classic Architecture: Introduction of post-classic architecture-contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping.

UNIT–III

Historical Back Ground of Town Planning: Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjo- Daro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT–IV

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

UNIT–V

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns-garden cities, satellite towns-floating towns-skyscraperspyramidal cities.

Text books:

1. ‘The great ages of World Architecture ’by G.K.Hiraskar.
2. ‘Planning and Design of Buildings by Section of Architecture’ by Y.S.Sane.
3. ‘Professional Practice’by G.K. Krishnamurthy, S.V.Ravindra, PHI Learning,New Delhi.
4. ‘Indian Architecture–Vol.I&II’byPercy Brown, Taraporevala Publications, Bombay.
5. ‘Fundamentals of Town Planning’ by G.K.Haraskar.

Reference books:

1. ‘Drafting and Design for Architecture’by Hepler, Cengage Learning
2. ‘Architect’s Portable Hand book’ by John Patten Guthrie–McGraw Hill International Publications.
3. ‘Modern Ideal Homes for India’by R.S.Deshpande.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31P1C		3	0	0	3
CONSTRUCTION TECHNOLOGY & MANAGEMENT							

Course Learning Objectives: The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. To introduce the importance of safety in construction projects

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

CO1 Appreciate the importance of construction planning and project management techniques.

CO2 Understand the functioning and selection of earth moving and construction equipment.

CO3 Know the methods of production of aggregates and concreting operations.

CO4 Apply construction management knowledge to project planning, scheduling, and execution.

CO5 Analyze construction methods, equipment productivity for efficient project delivery.

CO6 Apply principles of quality control, safety engineering, and BIM in construction projects.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	1	–	–	–	1
CO2	3	2	2	1	–	–	2	1	–	–	2
CO3	3	3	2	2	–	–	2	2	–	–	2
CO4	3	3	–	2	–	–	2	2	–	–	1
CO5	2	2	1	2	–	–	3	–	–	–	2
CO6	3	2	2	2	3	1	3	–	–	–	2

CO	PSO1	PSO2
CO1	3	–
CO2	2	–
CO3	3	–
CO4	2	3
CO5	2	3
CO6	2	3

UNIT-I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique–cost analysis updating crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earth work equipment–hoists–cranes–tractors-bulldozers–graders–scrapers–draglines-clam shell buckets

UNIT-IV

Concreting equipment— concrete mixers– Batching plants, mobile using plants like "Ajax"etc. mixing and placing of concrete – consolidating and finishing.

UNIT-V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

Textbooks:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha(2011), Pearson.
3. 'Construction Technology' by Subir K.Sarkar and Subhajit Sarasvati, Oxford University press

Reference books:

1. 'Construction Project Management-An Integrated Approach'by Peter Fewings,Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by TreforWilliams , Cengage learning

III	Year	I	Semester	L	T	P	C
Course Code:		BT24HS3101		3	0	0	3
ENTRPRENEURSHIP DEVELOPMENT&VENTURE CREATION (Open Elective - 1)							

Course Objectives:

By the end of the program, students will be/able to:

1. Inspired; develop entrepreneurial mind-set and attributes; entrepreneurial skill sets for venture creation and entrepreneurial leadership
2. Apply process of problem-opportunity identification and feasibility assessment through developing a macro perspective of the real market, industries, domains and customers while using design thinking principles to refine and pivot their venture idea.
3. Analyze Customer and Market segmentation, estimate Market size, develop and validate Customer Persona.
4. Initiate Solution design, Prototype for Proof of Concept. Understand MVP development and validation techniques to determine Product-Market fit
5. Craft initial Business and Revenue models, financial planning and pricing strategy for profitability and financial feasibility of a venture. Understand relevance and viability of informal and formal funding with respect to different business models.
6. UnderstandanddevelopGo-to-Marketstrategieswithafocusondigitalmarketingchannels.

Course Outcomes

At the end of the course, students will be able to

1. Develop an entrepreneurial mindset and appreciate the concepts of entrepreneurship, cultivate essential attributes to become an entrepreneur or Entrepreneur and demonstrate skills such as problem solving, team building, creativity and leadership
2. Comprehendtheprocessofproblem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution
3. Analyse and refine business models to ensure sustainability and profitability
4. Build Prototype for Proof of Concept and validate MVP of their practice venture idea
5. Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture
6. Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	1	–	–	–	1
CO2	3	2	2	1	–	–	2	1	–	–	2
CO3	3	3	2	2	–	–	–	2	–	–	2
CO4	3	3	–	2	–	–	–	2	–	–	1
CO5	2	2	1	2	–	–	–	–	–	–	2
CO6	3	2	2	2	3	–	–	–	–	–	–

CO	PSO1	PSO2
CO1	3	–
CO2	-	–
CO3	3	–
CO4	-	–
CO5	2	–
CO6	–	–

Unit I: Entrepreneurship Fundamentals & Context

Meaning and concept, attributes and mindset of entrepreneurial and entrepreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skillets, attributes and networks while on campus. Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

Unit II: Problem &Customer Identification

Understanding and analyzing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problem using Design thinking principles. Analyzing problem and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity. Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the Building'

And Venture Activity.

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of-concept and iterate on the

prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity.Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity.

Unit IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach,9block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.

Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance.

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options.

Core Teaching Tool: Founder Case Studies–Sama and Securely Share; Class activity and discussions; Venture Activities

Unit V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale visa is your venture idea. Persuasive Story telling and its key components. Build an Investor ready pitch deck. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Reading:

1. Hisrich, R. D., Peters, M. P., Shepherd, D. A., & Sinha, S. (2020). Entrepreneurship. McGraw Hill, 11th Edition.
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.
3. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
4. Sinek, S. (2011). Start with Why. Penguin Books Limited.
5. Brown, T. (2019). Change by Design (Revised & Updated): How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.
6. Thapar, N. (2022). The Dolphin and the Shark: Stories on Entrepreneurship. Penguin Books Limited.
7. Sarasvathy, S. D. (2008). Effectuation: Elements of Entrepreneurial Expertise. Edward Elgar Publishing Ltd.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31O1A		3	0	0	3
GREEN BUILDINGS							

Course Objectives

At the end of the course, the students will be able to:

1. Understand the concepts, importance, benefits, and key requirements of green buildings in the Indian context.
2. Familiarize with green building rating systems, sustainable materials, energy efficiency, and water conservation practices.
3. Understand green building design strategies, renewable energy integration, and energy demand reduction techniques.
4. Gain knowledge of HVAC systems, energy modeling, and eco-friendly power generation for sustainable buildings.
5. Appreciate material conservation, indoor environmental quality, and occupational health aspects in green buildings.

Course Outcomes:

CO1: Explain the concept, need, benefits, and essential requirements of green buildings.

CO2: Describe green building concepts, practices, and rating systems with special reference to the Indian context.

CO3: Analyze green building design strategies for reducing energy demand and integrating renewable energy sources.

CO4: Explain HVAC system design, energy modeling, and energy-efficient building services used in green buildings.

CO5: Apply material conservation techniques and waste management strategies in sustainable construction.

CO6: Evaluate indoor environmental quality measures and their impact on occupant health and comfort in green buildings.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	–	–	–	–	–	–	–	1
CO2	2	3	1	2	–	2	–	–	–	–	1
CO3	2	3	–	2	–	2	3	–	–	–	2
CO4	2	3	1	2	–	3	2	–	–	–	2
CO5	2	3	–	2	–	–	–	–	–	–	2
CO6	2	2	2	–	–	–	–	–	–	–	2

CO	PSO1	PSO2
CO1	2	–
CO2	–	–
CO3	2	2
CO4	2	2
CO5	2	–
CO6	2	–

UNIT – 1:

Introduction

What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

UNIT – 2:

Green Building Concepts And 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, LEED India Rating System and Energy Efficiency,

UNIT-3:

Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise 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- 4:

Air Conditioning Introduction, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller selection, pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco-friendly captive power generation for factory, Building requirement.

UNIT –5:

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, Indore 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,

Text Books:

- Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
- Green Building Hand Book by Tom woolley and Samkimings, 2009. Recommended Reference bookss:
  Complete Guide to Green Buildings by Trish riley Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31O1B		3	0	0	3
CONSTRUCTION TECHNOLOGY & MANAGEMENT							

Course Learning Objectives:

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. To introduce the importance of safety in construction projects

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Appreciate the importance of construction planning
2. Understand the functioning of various earth moving equipment
3. Know the methods of production of aggregate products and concreting
4. Apply the gained knowledge to project management and construction techniques
5. Explain the working mechanism of concrete batching plants
6. Discuss the importance of safety in different construction works

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	1	–	–	–	1
CO2	3	2	1	1	–	–	2	–	–	1	1
CO3	3	3	2	2	–	2	–	3	2	2	2
CO4	3	3	2	2	2	–	–	–	–	2	2
CO5	2	3	2	2	–	–	–	1	2	2	2
CO6	3	3	1	2	–	–	–	2	1	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	2	–
CO4	2	2
CO5	1	1
CO6	2	3

SYLLABUS:

UNIT-I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique–cost analysis-updating–crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers Hoisting and earth work equipment–hoists–cranes–tractors-bull dozers–graders–scrapers– draglines clam shell buck

UNIT-IV

Concreting equipment— concrete mixers–Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

UNIT-V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

Text books:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K.Sarkarand Subhajit Sarasvati, Oxford University press

Reference books:

1. 'Construction Project Management-An Integrated Approach 'by Peter Fewings, Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31O1C		3	0	0	3
CLIMATE CHANGE IMPACT ON ECO-SYSTEM							

Course Objectives

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

1. Explain the fundamentals of the climate system, atmospheric processes, radiation balance, and temperature variations in the atmosphere and soil.
2. Analyze the hydrologic cycle and climate variables influencing precipitation, runoff, evapotranspiration, floods, droughts, and other climate extremes.
3. Describe and interpret climate change causes, climate variability, and climate modeling approaches including GCMs, downscaling techniques, and IPCC scenarios.

Course Outcomes

CO1 Explain the components of the climate system, atmosphere, and temperature processes.

CO2 Analyze the hydrologic cycle and global and land-based water balance models.

CO3 Interpret climate variables affecting precipitation, winds, evaporation, and runoff.

CO4 Assess climate variability and extremes such as floods, droughts, and heat waves.

CO5 Explain the causes and mechanisms of climate change using scientific principles.

CO6 Apply climate change models and IPCC scenarios for understanding future climate impacts.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	–	–	–	–	2	–	–	–	2
CO2	3	2	–	2	–	2	2	–	–	–	2
CO3	3	2	–	2	–	3	2	–	–	–	2
CO4	2	3	–	2	–	3	3	–	–	–	3
CO5	3	2	–	2	–	–	3	–	–	–	3
CO6	2	2	–	2	3	–	3	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	3	2
CO3	2	–
CO4	3	2
CO5	1	–
CO6	2	–

UNIT I:

Climate System; Climate, weather and Climate Change; Overview of Earth's Atmosphere; Vertical Structure of Atmosphere; Radiation and Temperature; Laws of Radiation; HeatBalance of Earth Atmosphere System; Random Temperature Variation; Modelling Vertical Variation in Air Temperature; Temporal Variation of Air temperature; Temperature Change in Soil; Thermal Time and Temperature Extremes.

UNIT II:

Hydrologic Cycle: Introduction; Global water balance; Cycling of water on land, a simple water balance model.

UNIT III:

Climate Variables affecting Precipitation: Precipitation and Weather, Humidity, Vapor Pressure, Forms of Precipitation, Types of Precipitation; Cloud; Atmospheric Stability; Monsoon; Wind Pattern in India; Global Wind Circulation; Evaporation and Transpiration, Processes of Vadose Zone, Surface Runoff, Stream flow

UNIT IV:

Climate Variability: Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

UNIT V:

Climate Change: Introduction; Causes of Climate Change; Modeling of Climate Change, Global Climate Models, General Circulation Models, Downscaling; IPCC Scenarios

Text books:

1. Barry, R. G., and Chorley, R. J. Atmosphere, Weather and Climate, 9th Edition, Routledge, Taylor & Francis Group, London, UK, 2010.
2. Wallace, J. M., and Hobbs, P. V. Atmospheric Science: An Introductory Survey, 2nd Edition, Academic Press (Elsevier), Amsterdam, Netherlands, 2006.
3. Ahrens, C. D., and Henson, R. Meteorology Today: An Introduction to Weather, Climate, and the Environment, 11th Edition, Cengage Learning, Boston, USA, 2016.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3104		0	0	3	1.5
GEOTECHNICAL ENGINEERING LAB							

Learning Objectives:

The objective of this course is

1. To determine the index properties for soil classification– Grain size distribution & Atterberg's limits.
2. To determine the engineering properties–Permeability, Compaction, consolidation, shear strength parameters & CBR value.
3. To find the degree of swelling by DFS test.
4. To impart knowledge of determination of index properties required for classification of soils.
5. To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
6. To teach how to determines shear parameters of soil through different laboratory tests.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Determine index properties of soil and classify them.
2. Determine permeability of soils.
3. Determine Compaction, Consolidation
4. Determine shear strength characteristics
5. Determine Unconfined Compression test
6. Determine Triaxial Compression test

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	2	2	–	–	–	2
CO2	3	2	1	–	2	–	2	–	–	–	2
CO3	3	3	2	2	–	–	2	–	–	–	3
CO4	2	3	2	–	2	3	3	–	–	–	2
CO5	3	3	2	–	–	3	3	–	–	–	3
CO6	3	3	2	–	–	3	2	–	–	–	2

CO	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	2	–
CO4	3	–
CO5	3	2
CO6	2	2

SYLLABUS:

LIST OF EXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soil-Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Shear test
9. Triaxial Compression test
10. Unconfined Compression test
11. Vane Shear test
12. Differential free swell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

At least **Eight** experiments shall be conducted.

LIST OF EQUIPMENT:

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrink age limits 3. Field density apparatus for
   a) Core cutter method
   b) Sand replacement method
4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for
   a) Constant head test
   b) Variable head test
7. Universal auto compactor fo rI. Slight and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10tons loading frame with proving rings of 0.5 tons and 5tons capacity
11. One dimensional consolation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (rangeoftemperature50-150 ^{0}C)
16. Field plate load Test equipment
17. Field CBR test equipment

Reference books:

1. 'Determination of Soil Properties'by J.E.Bowles.
2. IS Code2720 –relevant parts.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3105		0	0	3	1.5
FLUID MECHANICS AND HYDRAULIC MACHINES LAB							

Course Objectives

The objectives of this laboratory course are:

1. To verify fundamental principles of fluid mechanics through laboratory experiments.
2. To determine discharge coefficients, head losses, and friction characteristics in pipe flow.
3. To calibrate flow-measuring devices such as venturimeters, orificemeters, and notches.
4. To develop experimental skills in conducting, observing, and interpreting fluid flow experiments.

Course Outcomes

1. Verify Bernoulli's equation and explain the distribution of energy in fluid flow.
2. Determine the coefficient of discharge for orifices, mouthpieces, and notches using laboratory experiments.
3. Calibrate flow-measuring devices such as venturi meters, orifice meters, and notches.
4. Evaluate friction factor of pipes and head losses due to bends, sudden expansion, and contraction in pipelines.
5. Conduct fluid mechanics experiments systematically and interpret experimental observations and results.
6. Analyze experimental data and present results effectively through laboratory records and reports.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	–	–	2	–	–	–	2
CO2	3	3	2	2	–	–	2	–	–	–	2
CO3	3	3	2	2	–	–	2	–	–	1	2
CO4	3	3	2	2	–	–	1	–	–	1	1
CO5	3	3	–	2	–	–	2	–	–	1	1
CO6	3	2	2	2	–	1	–	–	–	1	1

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	3	–
CO4	2	–
CO5	1	–
CO6	3	–

List of Experiments:

1. Verification of Bernoullis' equation.
2. Calibration of Venturimeter.
3. Calibration of orificemeter.
4. Determination of coefficient of discharge of a small orifice by constant head method
5. Determination of coefficient of discharge of an external cylindrical mouth piece by variable head method.
6. Calibration of a contracted rectangular notch.
7. Calibration of a triangular notch.
8. Determination of friction factor of the pipe material.
9. Determination of coefficient of head loss due to friction a sudden expansion/ contraction in a pipeline.
10. Determination of head loss coefficient due to a bend in pipe line.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3106		0	1	2	2
ESTIMATION, SPECIFICATION AND CONTRACTS							

Course Learning Objectives:

The objective of this course is to enable the students to:

1. Understand the quantity calculations of different components of the buildings.
2. Understand the rate analysis of different quantities of the buildings components.
3. Learn various specifications and components of the buildings.

Course Outcomes:

Upon the successful completion of this course:

1. Explain types of contracts, contract documents, conditions of contract, valuation of buildings, and modern procurement methods.
2. Apply principles of quantity take-off and prepare approximate estimates for building works.
3. Perform rate analysis for various items of work including earthwork, RCC, and reinforcement.
4. Prepare bar bending schedules and estimate material requirements for building and road works.
5. Prepare detailed estimates of buildings using the individual wall method.
6. Prepare detailed estimates of buildings using the centre line method and standard estimation software.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	1	2	–	–	2	2
CO2	3	3	2	2	1	1	3	–	–	2	2
CO3	3	2	2	2	2	1	2	–	–	2	2
CO4	3	3	2	2	2	2	3	–	–	2	2
CO5	3	3	3	2	1	1	3	–	–	3	2
CO6	3	2	2	–	–	1	2	–	–	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	2	–
CO4	2	3
CO5	3	2
CO6	3	3

UNIT–I

Contracts–Types of contracts–Contract Documents–Conditions of contract, Valuation of buildings-concepts of e-procurement and reverse auctions. Standard specifications for different items of building construction.

UNIT–II

General items of work in Building–Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT–III

Rate Analysis– Working out data for various items of work over head and contingent charges. Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT-IV

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings.

UNIT-V

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

Text books:

1. 'Estimating and Costing' by B.N.Dutta,UBS publishers, 2000.
2. 'Civil Engineering Contracts and Estimates' by B.S.Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.

Reference books:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS1200 (PartsItoXXV-1974/ Method of Measurement of Building & Civil Engg Works
3. 'Estimation, Costing and Specifications' by M.Chakraborthi; Laxmi publications.
4. National Building Code

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3107		0	0	2	1
TINKERING LAB							

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives:

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning
3. Impart Skill Development
4. Foster Collaboration and Teamwork
5. Enable Interdisciplinary Learning
6. Impart Problem-Solving mind-set
7. Prepare for Industry and Entrepreneurship

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

Course Outcome

CO1 Build and test basic electrical and electronic circuits using breadboards.

CO2 Design and demonstrate sensor-based systems using Arduino and ESP32.

CO3 Simulate and implement microcontroller programs using appropriate software tools.

CO4 Develop IoT-based applications for remote monitoring and control.

CO5 Design, model, and fabricate functional prototypes using 3D printing.

CO6 Apply design thinking principles to develop innovative engineering solutions.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	–	1
CO2	3	3	–	2	1	1	–	–	–	–	1
CO3	3	2	–	2	–	2	2	–	–	1	2
CO4	3	2	2	2	–	2	1	–	–	1	1
CO5	3	3	–	2	1	1	2	–	–	1	1
CO6	3	2	2	–	–	2	–	–	–	–	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	3	3
CO6	3	3

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinker CAD.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.
10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike. Students need to refer to the following links:
    1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
    2) https://atl.aim.gov.in/ATL-Equipment-Manual/
    3) https://aim.gov.in/pdf/Level-1.pdf

III	Year	I	Semester	L	T	P	C
Course Code:		BT24BS3101		0	0	0	2
EVALUATION OF COMMUNITY SERVICE INTERNSHIP							

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3201		3	0	0	3
DESIGN AND DRAWING OF STEEL STRUCTURES							

Course Learning Objectives:

The objective of this course is to:

1. Familiarize students with different types of connections and relevant IS codes
2. Equip student with the concepts of designing flexural members
3. Understand design concepts of tension and compression members in trusses
4. Familiarize students with different types of columns and column bases and their design
5. Familiarize students with Plate girder and Gantry Girder and their design

Course Outcomes:

At the end of this course the student will be able to

1. Analyze and design steel structural members with relevant IS codes
2. Carryout analysis and design of flexural members and detailing
3. Design compression members of different types with connection detailing
4. Design of purlins, members and joints.
5. Design Plate Girder and Gantry Girder with connection detailing
6. Produce the drawings pertaining to different components of steel structures

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	1	–	1	–	–	2	2
CO2	3	3	3	2	1	–	1	–	–	2	2
CO3	3	3	3	2	1	–	1	–	–	3	3
CO4	3	3	3	2	1	–	1	–	–	2	3
CO5	3	3	3	1	2	–	1	–	–	1	3
CO6	3	2	3	1	2	–	1	–	–	2	2

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	2	3
CO4	2	2
CO5	3	2
CO6	3	3

SYLLABUS:

UNIT – I

Connections: Riveted connections – definition, rivet strength and capacity, Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT – II

Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

UNIT –III

Tension Members and compression members: Effective length of members, slenderness ratio-permissible stresses. Design compression members subjected to axial and eccentric loading. Design of members subjected to direct tension and bending. **Roof Trusses:** Different types of roof trusses – Design loads – Load combinations as per IS Code recommendations, structural details –Design of purlins, members and joints.

UNIT – IV

Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.

Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected to moment.

UNIT – V

Design of Plate Girder: Design consideration – IS Code Recommendations Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

Design of Gantry Girder: impact factors - longitudinal forces, Design of Gantry girders.

NOTE: Welding connections should be used in Units II – V. Drawing classes must be conducted every week and the students should prepare the following plates.

Plate 1 Detailing of simple beams

Plate 2 Detailing of Compound beams including curtailment of flange plates.

Plate 3 Detailing of Column including lacing and battens. Plate 4

Detailing of Column bases – slab base and gusseted base Plate 5

Detailing of steel roof trusses including joint details.

Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners. Plate 7

Detailing of gantry girder.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part-B is 60%.

Textbooks

1. 'Steel Structures Design and Practice' by N.Subramanian, Oxford University Press.
2. 'Design of Steel Structures' by Ramachandra, Vol – 1, Universities Press.
3. 'Design of steel structures' by S.K. Duggal, Tata Mcgraw Hill, and New Delhi

Reference books

1. 'Structural Design in Steel' by Sarwar Alam Raz, New Age International Publishers.
2. 'Design of Steel Structures' by P. Dayaratnam; S. Chand Publishers
3. 'Design of Steel Structures' by M. Raghupathi, Tata Mc. Graw-Hill
4. 'Structural Design and Drawing' by N. Krishna Raju; University Press,

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3202		3	0	0	3
HIGHWAY ENGINEERING							

Course Learning Objectives:

The objectives of this course are:

- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements
- To acquire design principles of Intersections

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Plan high way network for a given area.
2. Determine High way alignment and design high way geometrics.
3. Acquire design principles of Intersections
4. Design Intersections and prepare traffic management plans.
5. Judge suitability of pavement materials and design flexible and rigid pavements
6. Design of flexible and rigid pavements as per IRC codes.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	–	–	1	1	1	–	–	3
CO2	3	3	3	1	1	1	–	–	–	3	2
CO3	3	3	2	2	–	2	2	–	–	2	2
CO4	3	2	2	2	–	2	1	–	–	1	2
CO5	3	3	2	2	1	2	2	–	–	1	3
CO6	3	2	3	–	–	2	–	–	–	–	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	3	3
CO4	2	–
CO5	3	3
CO6	3	3

UNIT-I

Highway Planning and Alignment: Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans– First, second, third road development plans, road development vision 2021, Rural Road Development

Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT – II Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical Alignment- Gradients- Vertical curves.

UNIT – III Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method.

UNIT –IV

Highway Materials: Sub grade soil: classification –Group Index–Subgrade soil strength – California Bearing Ratio–Modulus of Subgrade Reaction. Stone aggregates: Desirable properties– Tests for Road Aggregates–Bituminous Materials: Types–Desirable properties— Testson Bitumen - Bituminous paving mixes: Requirements – Marshall Method of Mix Design

UNIT–V

Design of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors

Flexible Pavements*:* Design factors–Flexible Pavement Design Methods–CBR method–IRC method–Burmister method–Mechanistic method–IRC Method for Low volume Flexible pavements.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses–Combination of stresses–Design of slabs–Design of Joints–IRC method– Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

Textbooks:

1. Highway Engineering, Khanna S.K., Justo C.E.G and Veeraragavan A,Nem Chand Bros., Roorkee. Traffic Engineering and Transportation Planning, KadiyaliL. R,Khanna Publishers, New Delhi.

Reference books:

1. Principles of Highway Engineering, KadiyaliL .R,Khanna Publishers, NewDelhi
2. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das,PHI Learning Private Limited, Delhi

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3203		3	0	0	3
ENVIRONMENTAL ENGINEERING							

Course Learning Objectives:

The course will address the following:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of water quality requirement for domestic usage and knowledge on design of water distribution network
3. Selection of valves and fixture in water distribution systems
4. Outline the planning and design of Sewerage System for a community/town/city 5. To impart knowledge on waste water treatment and disposal

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Plan and design the water and distribution networks and sewerage systems
2. Able to identify the appropriate source of water based on quality and quality requirements
3. Select a suitable treatment for raw water treatment as well as sewage treatment
4. Decide the manner of disposal of wastewater
5. Analyze water demand, population forecasting, and hydraulic behavior of water and sewer networks.
6. Apply modern treatment technologies, sustainability concepts, and standards in water and wastewater engineering.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2	–	2	–	–	–	2
CO2	3	2	–	1	1	3	3	–	–	–	1
CO3	3	3	2	2	2	2	3	–	–	–	2
CO4	2	3	2	2	1	3	3	–	–	2	2
CO5	3	3	2	2	2	2	2	–	–	2	2
CO6	2	2	2	2	3	–	3	–	–	2	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	1	1
CO4	2	2
CO5	–	–
CO6	3	3

SYLLABUS:

UNIT–I

Introduction: Importance and Necessity of Protected Water Supply systems. Water borne diseases. Planning of public water supply systems. Per capita demand and factors influencing it, types of water demands and its variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

Sources of Water: Various surface and subsurface sources considered for water supply and their comparison- Capacity of storage reservoirs, Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes and Pipe joints.

UNIT-II

Physical, Chemical and Biological characteristics of water. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system–Laying and testing of pipe lines.

UNIT-III

Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation, flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and odors – Removal of Iron and manganese – Fluoridation and De-fluoridation –Ion Exchange - Ultra filtration- Reverse Osmosis.

UNIT-IV

Characteristics and composition of sewage — population equivalent -Sanitary sewage flow estimation — Sewer materials — Hydraulics of flow in sanitary sewers — Sewer design — Storm drainage-Storm runoff estimation — sewer appurtenances — corrosion in sewers — prevention and control — sewage pumping-drainage in buildings-plumbing systems for drainage Primary Treatment of Sewage

Objectives — Unit Operations and Processes — Selection of treatment processes — Onsite sanitation — Septic tank- Grey water harvesting — Primary treatment — Principles, functions and design of sewage treatment units — screens — grit chamber-primary sedimentation tanks — Construction, Operation and Maintenance aspects.

UNIT–V

Objectives — Selection of Treatment Methods — Principles, Functions, — Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor (SBR) — Membrane Bioreactor — UASB — Waste Stabilization Ponds — Other treatment methods -Reclamation and Reuse of sewage — Recent Advances in Sewage Treatment — Construction, Operation and Maintenance aspects.

Disposal of Sewage

Standards for– Disposal — Methods — dilution — Mass balance principle — Self purification of river - Oxygen sag curve — de-oxygenation and re-aeration — Streeter– Phelps model — Land disposal — Sewage farming — sodium hazards — Soil dispersion system.

Text books :

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – McGraw-Hill Book Company, New Delhi, 1985.
2. Water Supply Engineering. Dr. P.N. Modi, Standard Book House, Delhi.

Reference books:

1. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd.
2. Water Supply Engineering.– Dr. B.C. Punmia, A.K. Jain and A.K. Jain. Laxmi Publications
3. Water Supply and Sanitary Engineering – G.S. Birdie and J.S. Birdie

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P2A		3	0	0	3
GROUND IMPROVEMENT TECHNIQUES							

Course Learning Objectives: The objective of this course is:

1. To make the student appreciate the need for different ground improvement methods adoptedforimprovingthepropertiesofremoldedandin-situsoilsbyadoptingdifferent techniques such as in situ densification and dewatering methods.
2. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
3. To enable the students to know how geotextiles and geo synthetics can be used to improve the engineering performance of soils.
4. To make the student learn the concepts, purpose and effects of grouting.

Course Outcomes:

1. By the end of the course, the student should be able to possess the knowledge of various methods of ground improvement and their suitability to different field situations.
2. The student should be in a position to design are in forced earth embank ment and check its stability.
3. The student should know the various functions of Geosynthetics and their applications in Civil Engineering practice.
4. The student should be able to understand the concepts and applications of grouting.
5. Analyze soil stabilization, dewatering, and densification methods for improving ground performance.
6. Apply modern ground improvement methods considering sustainability, safety, and practical constraints.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	1	–	2	–	–	–	2
CO2	3	3	3	–	2	–	–	–	–	–	2
CO3	3	2	2	–	2	–	–	–	–	–	2
CO4	2	2	2	–	3	–	–	–	–	2	2
CO5	3	3	3	2	2	–	2	–	–	2	2
CO6	2	2	2	2	3	–	3	–	–	3	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	2	–
CO4	2	–
CO5	2	2
CO6	3	3

UNIT-I

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – insitu densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT-II

Dewatering–sumps and interceptor ditches –single and multi-stage well points–vacuum well points, horizontal wells – criteria for choice of filler material around drains – electro osmosis.

UNIT- III

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization–use of industrial wastes like fly a shand granulated blast furnace slag. Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting–hydraulic fracturing in soils and rocks –post grouttests. Introduction to Liquefaction & its effects & applications.

UNIT-IV

Reinforce earth–principles–components of reinforced earth–design principles of reinforced earth walls – stability checks – soil nailing.

UNIT-V

Geosynthetics–geotextiles–types–functions, properties and applications – geogrids, geomembranes and gabions - properties and applications.

Text books:

1. Ground Improvement Techniques' by Purus Hotham Raj, Laxmi Publications, New Delhi.
2. Ground Improvement Techniques' by Nihar Ranjan Patro,Vikas Publishing House(p) limited ,New Delhi.
3. An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, Universities Press.

Reference books:

1. 'Ground Improvement 'by MP Moseley, Blackie Academic and Professional, USA.
2. 'Designing with Geosynethetics 'by RM Koerner, Prentice Hall

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE32P2B		3	0	0	3
REPAIR AND REHABILITATION OF STRUCTURES							

Course objectives:

1. To understand the mechanisms of deterioration and durability issues in concrete structures.
2. To impart knowledge of field investigation, monitoring, and non-destructive evaluation techniques for concrete structures.
3. To develop the ability to design and recommend appropriate repair and strengthening methods, including the use of composite materials.
4. To assess the serviceability and residual life of existing concrete structures for effective rehabilitation and sustainable use.

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

1. Recognize the mechanisms of degradation of concrete structures and to design durable Concrete structures.
2. Conduct field monitoring and non-destructive evaluation of concrete structures.
3. Design and suggest repair strategies for deteriorated concrete structures including
4. Repairing with composites
5. Understand the methods of strengthening methods for concrete structures
6. Assessment of the service ability and residual life span of concrete structures by Visual inspection and in situ tests

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	1	–	–	–	2	2
CO2	3	3	1	2	1	1	–	–	–	3	2
CO3	3	2	2	2	1	1	2	–	–	2	2
CO4	3	2	2	2	1	2	1	–	–	2	2
CO5	3	3	2	2	1	2	2	–	–	3	2
CO6	3	2	2	2	1	2	2	–	–	2	2

CO	PSO1	PSO2
CO1	**2**	**–**
CO2	**2**	**–**
CO3	**2**	**–**
CO4	**2**	**–**
CO5	**3**	**3**
CO6	**3**	**3**

UNIT:I

Materials for repair and rehabilitation-Admixtures-types of admixtures-purposes of using admixtures-chemical composition-Natural admixtures-Fibers-wraps-Glass and Carbon fiber wraps-Steel Plates-Nondestructive evaluation :Importance-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Visual investigation- Acoustical emission methods-Corrosion activity measurement- chloride content–Depth of carbonation-Impact echo methods-Ultra sound pulse velocity methods- pull out tests.

UNIT:II

Strengthening and stabilization-Techniques-design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.

UNIT:III

Bonded installation techniques-Externally bonded FRP-Wetlay upsheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding-CDC debonding-plate end de bonding-strengthening of floor of structures post grout tests. Introduction to Liquefaction & its effects & applications.

UNIT:IV

Fiber reinforced concrete-Properties of constituent materials-Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete-applications of fiber reinforced concretes-Light weight concrete-properties of light weight concrete-No fines concrete-design of light weight concrete-Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes

UNIT:V

High performance concretes-Introduction-Development of high-performance concretes- Materials of high-performance concretes-Properties of high-performance concretes-Self Consolidating concrete-properties-qualifications.

Text books:

1. Maintenance Repair Rehabilitation & Minor works of Buildings -P.C.Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures–P.I.Modi,C.N.Patel, PHI Publications
3. Rehabilitation of Concrete Structures-B.Vidivelli,Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation-V.K.Raina, Shroff Publishers and Distributors.

Reference books:

1. Concrete Technology Theory and Practice-M.S.Shetty,SChand and Company
2. Concrete Repair and Maintenance illustrated-Peter Hemmons

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P2C		3	0	0	3
VALUATION AND QUANTITY SURVEY							

Course Objectives

1. To introduce basic concepts of estimation, quantity surveying, contracts, and valuation related to civil engineering works.
2. To develop the ability to interpret drawings, specifications, and standard data for estimation and rate analysis.
3. To impart skills in preparing detailed measurements, bar bending schedules, and bills of quantities for civil engineering projects.
4. To enable students to assess the valuation of land and buildings using standard valuation methods.

Course Outcomes

1. Define basic terms related to estimation, quantity surveying and contract document
2. Interpret the item of work from drawings and explain its general specification and unit of measurement
3. Make use of given data from CPWDDAR/DSR for calculating the unit rate of different items of work associated with building Construction
4. Develop detailed measurement (including BBS) and BoQ of a various work like buildings, earth work for road, sanitary and water supply work
5. Explain various basic terms related to valuation of land and Building
6. Develop valuation of buildings using different methods of valuation.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	2	–	–	2	2
CO2	3	3	–	2	1	1	2	–	–	3	2
CO3	3	–	–	2	2	2	2	–	–	–	2
CO4	3		2	2	3	1	1	–	–		2
CO5	3	3	–	2	1	1	2	–	–	3	2
CO6	3	2	2	–	–	–	–	–	–	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	3	–
CO3	2	–
CO4	3	–
CO5	3	3
CO6	3	3

UNIT I

Introduction- Quantity Surveying- Basic principles, Role/responsibility of Quantity surveyor at various stages of construction. Estimate-Details required, Type of estimate, purposes. Contingencies, Work-charge establishment, Tools and Plant, centage charge, Day work, Prime cost, Provisional sum & provisional Quantity, Overhead charges, Cost index, Contract documents (Brief description only)Bill of Quantity-Typical format-use Item of works- Identifyvariousitemofworkfromthedrawings-unitsofmeasurementofvarious materials and works (focus may give to RCC residential building) General rule & method of measurement with reference to Indian Standard Specifications- IS1200.

UNIT II

Introduction to the use of CPWD schedule of rates as per latest DSR and Analysis of rate as per latest DAR. Specifications-Generalspecificationofallitemsofaresidentialbuilding.Detailed specification (CPWD specifications) of major item of work like Earth work excavation in foundation, masonry, Reinforced cement concrete, finishing of building work Analysis of rates for Earth work in excavation for foundation, mortars, reinforced cement concrete Works, finishing work, masonry work, stone works, flooring with reference to latest DSR and latest DAR (Data should be given).

UNIT III

Detailed Estimate- Preparation of detailed measurement using Centre line method & Short wall long wall (separate wall) method for RCC single storied building (Flat roof) including stair cabin-Residential/office/school building. BOQ preparation of a single storied RCC building work. Material quantity calculation of the items of work (Rubble, Brick work, Concrete work, Plastering) in detailed estimate prepared for building work. (Data for unit quantity should be provided from DAR)

UNIT IV.

Bar Bending Schedule- Preparation of BBS of RCC beams, slabs, Column footings, Retaining wall. Roadestimation-Estimationofearthworkfromlongitudinalsectionmetaledroad.Estimation of sanitary and water supply work -Water tank, Septic tank, Manhole (No Detailed estimate needed-concept of item of work, its general specification and unit of measurement).(Valuation – purpose, factor affecting, introduction to terms-Value, Cost, Price, kinds of values Income- Gross income, net income, outgoings, annuity, sinking fund,

Year's purchase, Depreciation, obsolescence -Free hold and leasehold properties.)

UNIT V

Methods of calculating depreciation – straight line method – constant percentage method, sinking fund method and quantity survey method. Methods of valuation–rental method, direct comparison of capital cost, valuation based on profit, depreciation method. Various method of valuation of land (Brief description only)

Text Books:

1. B.N.Dutta, Estimation and costing in civil engineering, UBS publishers
2. Rangwala, Estimation Costing and Valuation, Charotar publishing house pvt.ltd
3. Dr. S. Seetha Raman, M.Chinna swami, Estimation and quantity surveying, Anuradha publications Chennai.
4. M Chakraborthy, Estimating, Costing, Specification and valuation, published by the author, 21 B, Babanda Road, Calcutta 26

Reference books:

1. BS Patil, Civil Engineering contracts and estimates, university press
2. VNVazirani & SPChandola, Civil Engineering Estimation and Costing, Khanna Publishers
3. IS1200-1968; Methods of measurement of building & civil engineering works
4. CPWDDAR2018andDSR2018orlatest
5. CPWDSpecificationsVol1&2(2019orlatestedition)

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P3A		3	0	0	3
FINITE ELEMENT METHOD							

Course Objectives

1. To introduce the fundamental concepts and formulation procedures of the finite element method.
2. To develop the ability to formulate and solve simple engineering problems using FEM.
3. To familiarize students with stiffness matrices, system equations, and interpretation of FEM results.
4. To impart practical exposure to finite element software for structural, thermal, and modal analysis.

Course Outcomes

1. Develop finite element formulations for single degree of freedom problems and solve them.
2. Use finite element software to perform stress, thermal, and modal analyses.
3. Compute stiffness matrices of different finite elements and assemble system matrices.
4. Interpret displacements, strains, and stress resultants obtained from finite element analysis.
5. Analyze planar structural systems using finite element modelling techniques.
6. Apply advanced finite element concepts such as iso-parametric elements, numerical integration, and convergence checks.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	–	–	–	–	–	–
CO2	2	2	2	2	3	–	–	–	–	–	1
CO3	3	3	3	2	1	–	3	–	–	–	–
CO4	2	3	2	3	1	3	2	–	2	–	–
CO5	3	3	3	2	2	2	3	–	2	–	2
CO6	2	2	2	2	3	–	1	–	–	–	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	3	2
CO4	2	3
CO5	3	3
CO6	3	3

UNIT I

Introduction: Review of stiffness method-Principle of Stationary potential energy-Potential energy of anelastic body-Rayleigh-Ritz method of functional approximation-variational approaches-weighted residual methods

UNIT II

Finite Element formulation of truss element: Stiffness matrix-properties of stiffness matrix – Selection of approximate displacement functions-solution of a planetruss-transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports-Galerkin's methodfor1-Dtruss– Computation of stress in a truss element.

UNIT III

Finite element formulation of Beam elements: Beam stiffness-assemble age of beam stiffen matrix-Examples of beam analysis for concentrated and distributed loading-Galerkin's method – 2 Darbitrarily oriented beam element–inclined and skewed supports–rigid plane frame examples

UNIT IV

Finite element formulation for plane stress, plane strain and axi symmetric problems Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems-comparison of CST and LST elements–convergence of solution-interpretation of stresses

UNIT V

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element-shape functions, evaluation of stiffness matrix, consistent modal load vector- Gauss quadrature-appropriate order of quadrature–element and mesh instabilities–spurious zero energy modes, stress computation-patch test.

Textbooks:

1. A first course in the Finite Element Method–Daryl L.Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis–Robert D.Cook, Michael EPlesha, JohnWiley & Sons Publications

Reference books:

1. Introduction to Finite Elements in Engineering-Tirupati R.Chandrupatla, Ashok D. Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers)Wail N Rifaie, Ashok K Govil.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P3B		3	0	0	3
BRIDGE ENGINEERING							

Course Learning Objectives:

The objective of this course is to:

1. Familiarize students with different types of Bridges and IRC standards
2. Equip student with the concepts and design of Slab Bridges,T Beam Bridges,Box Culverts
3. Understand concepts of design of Plate Girder Bridges
4. Familiarize with different methods of inspection of bridges and their maintenance

Course Outcomes:

At the end of this course the student will be able to

1. Explain different types of Bridges with diagrams and Loading standards
2. Carry out analysis and design of Slab bridges, T Beam bridges, Box culvers and suggest structural detailing
3. Carry out analysis and design of Plate girder bridges
4. Organize for attending inspections and maintenance of bridges and prepare reports.
5. Select suitable bridge type, site, foundation, and bearings based on functional and economic considerations.
6. Apply codal provisions, sustainability, and safety principles in bridge design and maintenance practices.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	–	1	1	–	–	2	1
CO2	3	3	3	2	2	2	2	–	–	2	1
CO3	3	3	3	2	2	1	1	–	–	3	1
CO4	2	2	3	3	1	1	2	–	–	1	1
CO5	3	2	2	1	1	2	2	–	–	2	2
CO6	2	2	1	2	3	2	3	–	–	2	3

CO	PSO1	PSO2
CO1	1	1
CO2	2	2
CO3	3	3
CO4	2	2
CO5	3	3
CO6	3	3

SYLLABUS:

UNIT-I

General Introduction to types of Bridges- (Slab bridges, TBeam, Arch bridges, Cable Stayed bridges, pre stressed concrete bridges, Truss Bridges, Culverts) - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

UNIT-II

Slab bridges- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs-dispersion length-Design of interior panel of slab-Guyon's–Massonet Method–Hendry-Jaegar Methods- Courbon's theory- Pigeaud's method

UNIT-III

T-Beam bridges- Analysis and design of various elements of bridge–Design of deck slab, longitudinal girders, Secondary beams- Reinforcement detailing

UNIT-IV

Plate Girder Bridges: Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.

UNIT-V

Box Culverts: Loading–Analysis and Design-Reinforcement detailing.

Inspection and Maintenance of Bridges: Procedures and methods for inspection–Testing of bridges- Maintenance of Sub Structures and Super structures-Maintenance of bearings-Maintenance Schedules.

Text books:

1. 'Essentials of Bridge Engineering 'by Johnson Victor D
2. 'Design of Bridge Structures' by T.R. Jagadeesh, M.A. Jayaram, PHI
3. 'Design of RC Structures' by B. C.Punmai, Jain & Jain, Lakshmi Publications

Reference books:

1. 'Design of Concrete Bridges' by Aswini, Vazirani,Ratwani
2. 'Design of Steel Structures' by B.C.Punmai, Jain & Jain, Lakshmi Publications
3. 'Design of Bridges' by Krishna Raju

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P3C		3	0	0	3
WATER RESOURCES ENGINEERING							

Course Learning Objectives:

The course is designed to make the students,

1. Learn the types of irrigation systems.
2. Understand the concepts of planning and design of irrigation systems.
3. Study the relationships among soil, water and plant and their significance in planning an irrigation system.
4. Understand design principles of erodible and non-erodible canals.
5. Know the principles of design of weirs on permeable foundations.
6. Know the concepts for analysis and design of storage head works.
7. Learn design principles of canal structures.

Course Outcomes

At the end of the course the student will be able to

1. Estimate irrigation water requirements.
2. Design irrigation canals
3. Design irrigation canal structures
4. Plan and design diversion head works
5. Analyze stability of gravity and earth dams.
6. Design hydraulic ogee spillways

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	1	2	–	–	–	2	1
CO2	3	3	3	2	1	1	2	–	–	3	2
CO3	3	3	3	2	2	2	2	–	–	–	3
CO4	3	2	2	2	3	1	2	–	–	–	1
CO5	3	3	3	2	1	2	3	–	–	3	1
CO6	3	2	2	2	1	2	3	–	–	2	2

CO	PSO1	PSO2
CO1	1	–
CO2	3	2
CO3	3	3
CO4	2	3
CO5	3	3
CO6	3	3

SYLLABUS:

UNIT-I

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT-II

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

UNIT- III

Canal Structures:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall. (Description only)

Regulators: Head and cross regulators, design principles (Description only)

Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage. (Description only)

Outlets: Types, proportionality, sensitivity and flexibility **River**

Training: Objectives and approaches

UNIT-IV

Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-V

Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

Dams: Types of dams, selection of type of dam, selection of site for a dam.

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis.

Earth Dams: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters.

Spillways: Types, design principles of Ogee spillways, types of spillways crest gates.

Textbooks:

1. 'Irrigation and Waterpower Engineering' by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi
2. 'Irrigation and Water Resources Engineering' by Asawa G L (2013), New Age International Publishers
3. 'Irrigation Engineering' by Raghunath H.M (2012), Wiley India.
4. 'Irrigation Water Resources and Waterpower Engineering' by Modi P N (2011), Standard Book House, New Delhi

Reference books:

1. 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2. 'Irrigation Engineering' by Sharma R.K. and Sharma, T. K (2012), S. Chand & Co Publishers.
3. 'Water Resources Engineering' by Satyanarayana Murthy Challa (2008), New Age International Publishers.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32O2A		3	0	0	3
DISASTER MANAGEMENT							

Course Learning Objectives: The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

1. Affirm the usefulness of integrating management principles in disaster mitigation work
2. Distinguish between the different approaches needed to manage pre- during and post- disaster periods
3. Explain the process of risk management
4. Relate and apply concepts of risk transfer and financial management in disaster scenarios.
5. Analyze the role of technology, RS & GIS, and infrastructure systems in disaster mitigation and preparedness.
6. Apply community-based disaster management and resilience-building principles for sustainable disaster risk reduction.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	–	–	1	2	–	–	–	2
CO2	2	3	2	1	–	2	2	–	2	–	2
CO3	3	3	2	2	1	2	3	–	–	2	2
CO4	2	2	2	1	–	2	2	–	1	2	3
CO5	3	2	2	2	3	2	2	–	–	–	1
CO6	2	2	2	1	1	2	3	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	3
CO6	3	3

SYLLABUS:

UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III

Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

Text books:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers & Distributors Pvt.Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

Reference books:

1. 'Disaster Management' edited by H K Gupta (2003), Universities press.
2. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universities press. R. Nishith, Singh AK,
3. "Disaster Management in India: Perspectives, Issues and strategies" New Royal Book Company."

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32O2B		3	0	0	3
SUSTAINABILITY IN ENGINEERING PRACTICES							

Course Objectives

1. To introduce the concepts of sustainable development and international environmental agreements and protocols.
2. To create awareness of environmental issues arising from human activities and the role of renewable energy resources.
3. To understand local and global environmental challenges and strategies for sustainable urban and industrial development.
4. To impart knowledge of renewable energy technologies and green practices for achieving environmental sustainability.

Course Outcomes

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

1. Explain sustainable development and different environmental agreements and protocols.
2. Discuss real-time activities causing environmental issues and methods of utilizing renewable energy resources.
3. Explain local and global environmental issues.
4. Differentiate carbon emissions of regular and sustainable cities and explain practices to move industries towards sustainability.
5. Discuss renewable energy resources and explain methods to implement green technologies.
6. Explain the cconventional and non- conventional forms of energy, solar energy, fuel cells, wind energy

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	2	2	–	–	2	3
CO2	3	3	2	2	2	3	3	2	–	3	2
CO3	3	2	2	2	2	3	2	2	–	2	2
CO4	3	2	2	–	2	3	2	2	2	–	3
CO5	3	3	3	2	1	3	3	–	2	3	2
CO6	3	2	2	2	2	2	2	–	–	2	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	–
CO5	3	–
CO6	3	3

UNIT-I

Introduction to Sustainable Engineering- Sustainable development, concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's pyramid model, prism model, principles of sustainable development, sustainable engineering, threats for sustainability.

Environmental Ethics and Legislations – Environmental ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India – The Water Act, The Air Act, The Environment Act.

UNIT-II

Local Environmental Issues- Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

Global Environmental Issues- Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

UNIT-III

Tools for Sustainability - Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA), environmental auditing, bio mimicking, case studies.

UNIT-IV

Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment(GRIHA),leader ship in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system.

Sustainable Industrialization and Urbanization – Sustainable urbanization,

industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

UNIT-V

Renewable energy resources- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydroplants, biogas systems, biofuels, energy from ocean, geothermal energy, conservation of energy**.**

Green technology and Green Business: Sustainable business, green technology, green energy, green construction, green transportation, green chemistry, green computing

Text Book:

1.R.L. Ragand Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2nd Edition, PHI Learning Pvt. Ltd., 2016.

Reference books:

1. D.T.Allenand D.R.Shonnard. Sustainability Engineering: Concepts, Design and Case Studies, 1st Edition, Prentice Hall, 2011.
2. A.S.Bradley,A.O.Adebayo,P.Maria. Engineering applications in sustainable design and development, 1st Edition, Cengage learning, 2016.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32O2C		3	0	0	3
WATER SUPPLY SYSTEMS							

Course Objectives

1. To introduce the importance of water and its various uses in daily life.
2. To understand the origin, characteristics, and treatment requirements of natural waters.
3. To impart knowledge of non-potable water utilization and water supply systems.
4. To understand the characteristics and significance of wastewater in environmental engineering.

Course Outcomes

At the end of the course, students will be able to:

1. Outline the various facets of water usage in daily life.
2. Explain the origin of natural waters and methods to make them suitable for regular use.
3. Discuss the utilization of non-potable water.
4. Describe the water supply system from a reservoir.
5. Explain the characteristics of wastewater.
6. Explain the quality, sources and characteristics of waste water

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	2	2
CO2	3	3	–	2	1	1	2	2	–	3	2
CO3	3	–	–	2	–	–	2	2	–	2	2
CO4	3	2	2	2	–	–	2	2	–	2	2
CO5	2	2	–	3	2	–	–	2	2	2	2
CO6	2	3	2	3	2	1	2	2	–	2	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	–
CO6	3	3

UNIT-I

WATER AND LIFE: Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

UNIT-II

SOURCES OF WATER: Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

UNIT-III

DUAL SUPPLY OF WATER: Potable and non-potable water – Protected water – Grey water – Black water – Water bornediseases – water related diseases – Sewage Irrigation.

UNIT-IV

DISTRIBUTION OF WATER: Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow. Service Reservoirs – Continuous supply – Intermittent supply – Networks of distribution– Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

UNIT-V

INDUSTRIAL WATER: Location of Industry with reference to surface sources of water – Quality of water required for industrial operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water.

Text books:

1. K.N. Duggal, "Elements of Environmental Engineering", 7thEdition, S. Chand Publishers, 2010.
2. Hammer and Hammer "Water and wastewater Technology", 4th Edition, Prentice hall of India, 2003.
3. Howard S. Peavy, Donand P. Rowe, George Technobanoglous, "Environmental Engineering", 1stEdition Mc Graw –Hill Publications, Civil Engineering Series, 1985.

Reference books:

1. B.C.Punmia, "Water Supply Engineering", Vol. 1, "Waste water Engineering Vol. II", 2nd Edition, Ashok Jain &Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi, 2008.
2. Fair, Geyer and Okun, "Water and Waste Water Engineering", 3rdEdition, Wiley, 2010.
3. Metcalf and Eddy, "Waste Water Engineering", 3rd Edition, Tata Mc Graw Hill, 2008.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3204		0	0	3	1.5
ENVIRONMENTAL ENGINEERING LAB							

Learning Objectives:

The course will address the following:

- Estimation of some important characteristics of water and wastewater in the laboratory
  It also gives the significance of the characteristics of the water and wastewater

Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Estimate some important characteristics of water and wastewater in the laboratory
2. Draw some conclusion and decide whether the water is suitable for construction or not, drinking or not; ultimate disposal as per effluent standards or not.
3. Decide whether the water body is polluted or not with reference to the state parameters in the list of experiments
4. Estimate and study the strength of the raw and treated effluents in terms of BOD, COD, P^H, TDS and chloride of the neutralization tank treating effluents from Chemistry lab or Environmental Engineering Laboratory
5. Determination of chlorine demand
6. Determine the optimum coagulant dose.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	–	–	–	–	–	–	2	2
CO2	3	3	3	2	2	–	3	–	3	3	2
CO3	3	2	2	2	2	–	2	–	–	–	2
CO4	3	2	2	2	2	2	2	–	–	–	2
CO5	3	2	2	–	–	2	2	–	–	–	–
CO6	3	2	2	–	–	2	–	–	–	–	–

CO	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	–	–
CO4	–	–
CO5	3	–
CO6	3	–

SYLLABUS:

List of Experiments

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chlorides in water and soil
5. Determination and Estimation of Total Solids, Organic Solids and Inorganic Solids and Settleable Solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method and B.O.D.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Presumptive Coliform test.
14. Visit a Water Treatment Plant and give a technical report.

NOTE: At least 10 of the above experiments are to be conducted.

List of Equipments

1. pH meter
2. Turbidity meter
3. Conductivity meter
4. Hot air oven
5. Muffle furnace
6. Dissolved Oxygen meter
7. U–V visible spectrophotometer
8. COD Reflux Apparatus
9. Jar Test Apparatus
10. BOD incubator
11. Autoclave
12. Laminar flow chamber
13. Hazen's Apparatus

Textbooks

- Standard Methods for Analysis of Water and Waste Water – APHA
- Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi

Reference book:

1. Relevant IS Codes. Chemistry for Environmental Engineering by Sawyer and Mc. Carty

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3205		0	0	3	1.5
HIGHWAY ENGINEERING LAB							

Course Learning Objectives:

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

At the end of the course, the student will be able to

1. Test aggregates and judge the suitability of materials for the road construction
2. Test the given bitumen samples and judge their suitability for the road construction.
3. Obtain the optimum bitumen content for Bituminous Concrete
4. Determine the traffic volume, speed and parking characteristics.
5. Draw highway cross sections and intersections.
6. Determine the earthwork calculations.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	–	1	–	–	–	2
CO2	3	2	2	2	1	–	1	–	–	–	2
CO3	3	3	2	2	–	–	2	–	–	2	2
CO4	3	3	2	2	–	2	2	–	–	3	3
CO5	2	1	1	1	–	–	2	–	–	3	3
CO6	3	2	1	1	–	–	–	–	–	3	3

CO	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	3	3
CO4	2	2
CO5	3	3
CO6	2	3

SYLLABUS:

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

TRAFFIC SURVEYS:

2. Traffic volume study at mid blocks.
3. Traffic Volume Studies (Turning Movements) at intersection.
4. Spot speed studies.
5. Parking study.

DESIGN & DRAWING

6. Earthwork calculations for road works
7. Drawing of road cross sections
8. Rotary intersection design

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup. 9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

Textbooks:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veera raghavan, Neam Chan Brothers New Chand Publications, New Delhi.

Reference books:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3206		0	1	2	2
CAD LAB							

Course Objectives: The objectives of the course are to

1. Learn the usage of any fundamental software for design
2. Create geometries using pre-processor
3. Analyze and Interpret the results using post processor
4. Design the structural elements

Course Outcomes

After the completion of the course student should be able to

1. Model the geometry of real-world structure Represent the physical model of structural element/structure
2. Perform analysis
3. Interpret from the Post processing results
4. Design the structural elements and a system as per IS Codes
5. Analysis & Design of Roof Trusses
6. Detailing of RCC beam and RCC slab

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	3	–	–	–	–	2	2
CO2	3	3	3	2	3	–	–	–	2	3	2
CO3	3	3	2	2	2	3	–	–	2	3	3
CO4	3	3	3	–	2	2	–	–	2	2	2
CO5	2	1	3	–	–	2	–	–	–	3	2
CO6	3	2	2	–	–	–	–	–	–	2	3

CO	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	2	3
CO5	3	3
CO6	2	3

LISTOFEXPERIMENTS

Analysis & Design determinate structures using a software

1. Analysis &Design of fixed &continuous beams using a software
2. Analysis & Design of Plane Frames
3. Analysis & Design of space frames subjected to DL & LL
4. Analysis & Design of residential building subjected to all loads (DL, LL,WL,EQL)
5. Analysis & Design of Roof Trusses
6. Design and detailing of built up steel beam
7. Developing a design program for foundation using EXCEL Spread Sheet
8. Detailing of RCC beam and RCC slab
9. Detailing of Steel built up compression member

Note: Drafting of all the exercises is to be carried out using commercially available designing software.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24HS3201		2	0	0	-
AUDIT COURSE TECHNICAL PAPER WRITING & IPR							

Course Objective:

1. The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Course Outcomes

After completion of this course, the students will be able to:

1. Compose clear and effective technical sentences and reports using appropriate structure, transitions, and tenses.
2. Plan and organize technical documents by identifying the audience, purpose, format, and required sections, including minutes of meetings.
3. Draft, revise, and proofread technical reports to improve clarity, grammar, readability, and adherence to plain English principles.
4. Prepare summaries and present technical reports effectively through written and verbal communication, including proposal writing basics.
5. Use word processing tools proficiently to manage document features such as table of contents, references, citations, tracking changes, document comparison, and security settings.
6. Explain intellectual property concepts including patents, copyrights, designs, trademarks, and understand the patenting process and international IP frameworks.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	–	–	–	–	1	–	–	2	2	3	2
CO2	–	–	–	–	2	–	–	3	3	3	3
CO3	–	–	–	–	3	–	–	2	1	3	2
CO4	–	–	–	–	2	–	–	3	2	3	3
CO5	–	–	–	–	3	–	–	1	2	2	1
CO6	–	–	–	–	1	–	–	2	2	2	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	–	–
CO6	–	–

Unit I: Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.
Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II: Drafting report and design issues: The use of drafts, Illustrations and graphics.
Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III: Proofreading and summaries: Proofreading, summaries, Activities on summaries.
Presenting final reports: Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Unit IV: Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V: **Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Department of Civil Engineering

Honors Degree Courses

S.No	Course Name	Code
1	Introduction to earthquake engineering	BT24CEH01
2	Structural dynamics	BT24CEH02
3	Traffic engineering and management	BT24CEH03
4	Advanced hydrology	BT24CEH04
5	Geosynthetics engineering: in theory and practice	BT24CEH05
6	Environmental geotechnics	BT24CEH06
7	Seismic analysis of structures	BT24CEH07
8	Environmental air pollution	BT24CEH08
9	Soil dynamics	BT24CEH09
10	Advanced transportation engineering	BT24CEH10

Minors Degree Courses

S.No	Course Name	Code
1	Surveying	BT24CEM01
2	Mechanics of solids	BT24CEM02
3	Soil mechanics	BT24CEM03
4	Fluid mechanics	BT24CEM04
5	Civil engineering- building materials and construction	BT24CEM05
67	Building planning and drawing	BT24CEM06
7	Estimation and costing	BT24CEM07
8	Sustainable materials and green building	BT24CEM08
9	Safety in construction	BT24CEM09
10	Construction planning and management	BT24CEM10

Note: Students can opt any course in Honors and Minors through NPTEL/MOOCs/JNTUK, Kakinada University approved courses.

Department of Civil Engineering

(DR24)

Syllabus for Honors

HONORS		L	T	P	C
Course Code:	BT24CEH01	3	0	0	3
INTRODUCTION TO EARTHQUAKE ENGINEERING					

Course outcomes:

1. Explain the fundamentals of engineering seismology, seismic waves, earthquake mechanisms, and Indian seismicity.
2. Interpret seismic design concepts, load paths, structural configurations, and code provisions (IS 1893 & IS 13920).
3. Analyze earthquake loads and understand 3D structural modeling concepts for seismic analysis.
4. Design and detail ductile RC structural elements (beams, columns, shear walls) following seismic design philosophy.
5. Evaluate cyclic behavior of structural systems and assess modern seismic protection systems such as base isolation and adaptive systems.
6. Assess earthquake-induced damage and propose appropriate retrofitting and restoration techniques for buildings.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	1	1	–	–	–	–	2
CO2	3	3	2	–	2	2	–	–	–	–	1
CO3	3	3	3	2	3	2	–	–	–	–	2
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	3	2	–	–	–	–	2
CO6	2	3	2	3	3	3	1	–	–	–	3

CO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	3
CO4	3	3
CO5	2	3
CO6	3	2

UNIT - I

Introduction to seismology: Engineering seismology– rebound theory – plate tectonics – seismic waves- earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects.

UNIT – II

Seismic design concepts: EQ load on simple building –load path–floor and roof diaphragms – seismicresistantbuildingarchitecture–planconfiguration–verticalconfiguration– pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF – Infill wall – Non- structural elements.

UNIT - III

Calculation of loads: EQ load – 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls.

UNIT-IV

Earthquake loads: Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts-Base isolation – Adaptive systems – case studies.

UNIT-V

Concept of damages: Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

Text books:

1. Agrawal, P. and Shrikhande, M. (2006), "Earthquake resistant design of structures", Prentice Hall of India, Inc.
2. Chopra, A.K. (2007), "Dynamics of structures: Theory and application to earthquake engineering", 2nd edition, Prentice Hall of India.
3. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice – Hall of India, 2007, New Delhi.
4. Bullet K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

Reference books:

1. Chowdhary, I. and Dasgupta, S.P. (2009). "Dynamics of structure and foundation – A unified approach : 2 Applications", CRC Press, Balkema.
2. Clough, R. W. and Penzien, J. (1993). "Dynamics of structures", McGraw Hill, Inc., New York.
3. Datta, T. K. (2010). "Seismic analysis of structures", John Wiley & Sons (Asia) Pte Ltd. Singapore.
4. Hart, G. C. and Wong, K. (2000). "Structural dynamics for structural engineers", John Wiley & Sons, Inc.,

HONORS		L	T	P	C
Course Code:	BT24CEH02	3	0	0	3
STRUCTURAL DYNAMICS					

Course outcomes:

1. Explain the basic concepts of structural dynamics, prescribed loads, degrees of freedom, and vibration parameters such as frequency, period, and amplitude.
2. Analyze the free and forced vibration response of single degree of freedom (SDOF) systems with and without damping under harmonic and dynamic excitation.
3. Develop mathematical models for multi degree of freedom (MDOF) systems and determine natural frequencies and mode shapes using analytical methods.
4. Apply mode superposition and stiffness matrix concepts for dynamic analysis of shear buildings, beams, frames, and trusses.
5. Evaluate the earthquake response of SDOF and MDOF systems using response spectra and seismic provisions of IS 1893.
6. Interpret seismic design concepts and codal provisions for earthquake-resistant design of building structures.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	1	–	–	–	2	1
CO2	3	3	2	2	2	1	–	–	–	3	1
CO3	3	3	3	2	2	1	–	–	–	3	2
CO4	3	3	3	2	3	1	–	–	–	2	2
CO5	2	3	2	2	3	2	–	–	–	3	2
CO6	2	3	2	3	3	3	–	–	–	3	3

CO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	2
CO4	3	3
CO5	2	3
CO6	3	2

UNIT – I

Introduction to Structural Dynamics – Types of prescribed Loads – Analysis of Dynamical behaviour of structures – Mathematical and Analytical Models – Degrees of Freedom. Single degree freedom – Un-damped and Damped Systems - Free body diagram – Solution of Differential equation of Motion – Frequency, Period and Amplitude – Logarithmic decrement – Simple Problems.

UNIT – II

Free Vibration of SDOF Systems – Response of SDOF System to Harmonic Excitation, Dynamic Excitation – Rayleigh's method- Vibration measuring instruments, Types of Damping Systems – Response Spectra.

UNIT – III

Mathematical model of MDOF Systems – Vibration of Un-damped two Degrees of Freedom system Simple Problems – Free Vibration of MDOF System – Natural Frequencies & Mode shapes – Mode Superposition method as per IS 1893 Code of Provisions.

UNIT – IV

Shear Building – Free Vibration of Shear Building – Dynamic Analysis of Simple Beam, Plane Frame

and Plane Truss – Equation of Motion – Formulation of Element Stiffness Matrix only.

UNIT – V

Introduction to Earth Quake Response of Structures – Response of SDOF and MDOF systems to earthquake excitation – Simple problems on SDOF System - Concept on Seismic Design – IS 1893 (1984) – Provisions for Seismic Design of Buildings.

Text books :

1) Dynamics of Structures by R.W. Clough & J. Penzien
2) Dynamics of Structures by Anil . K. Chopra
3) Earth quake Engineering by A.R. Chandrasekharn & Jaikrishna

HONORS		L	T	P	C
Course Code:	BT24CEH03	3	0	0	3
TRAFFIC ENGINEERING AND MANAGEMENT					

Course Outcomes :

1. Explain the roles and responsibilities of a traffic engineer, traffic system components, road user behavior, vehicle characteristics, and traffic data collection methods.
2. Analyze traffic volume, speed, density, capacity, level of service, peak hour factor, and accident data for traffic system evaluation.
3. Evaluate parking characteristics and design on-street and off-street parking facilities based on traffic and demand studies.
4. Analyze traffic control and regulation systems including signs, markings, unsignalised and signalised intersections, and signal coordination techniques.
5. Explain Intelligent Transportation Systems (ITS), public transport systems, congestion management strategies, and environmental impacts of traffic.
6. Assess highway safety issues, accident causes, and apply engineering, enforcement, educational measures, and road safety audit principles.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	1	1	–	2	–	–	–
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	2	1	–	–	–	–	1
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	3	2	2	–	–	–	2
CO6	2	3	2	3	3	3	2	1	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	3	3
CO5	2	3
CO6	3	2

UNIT-I

Traffic Engineer Responsibility, Ethics & Liability; Modern Problems Components of traffic & characteristics: Road users: Visual, Perception-Reaction Time, Pedestrian, Impacts of Drugs, Alcohol & Aging, Psychological & Personality related factors. Vehicle: Concept of Design Vehicle, Turning, Braking & acceleration Characteristics Traffic measurement: Volume: Volume, Demand & Capacity; Volume Patterns & Characteristics. Presentation; Peak Hour Factor Speed: Spot Speed Studies, Uses, Measurement; Travel-Time Studies, Volume, Speed, Density Relation Accidents: Data Collection, Site Analysis-Collision & Condition Diagram, IRC accident data forms.

UNIT-II

Definition of Capacity – Importance of capacity – Factors affecting Capacity- Concept of Level of Service- Different Levels of Service- Concept of Service Volume- Peak Hour Factor. Parking studies: Types of parking facilities – On street and Off Street Parking Facilities; Parking Studies- Parking Inventory Study – Parking Survey by Patrolling Method- Analysis of Parking Data and parking Characteristics, Accumulation & Duration –Design Aspects- parking dimensions- Multi Story Car Parking Facility-Design standards

UNIT-III

Traffic control & regulation: Level I Control: Basic Rules of the road, Level II Control: Yield and stop control, Level III: Traffic Control Signals–Advantages, Disadvantages, Warrants-Phase & Ring Diagram Unsignalised Intersection: Conflicting Volume, Critical Gap, Follow-Up Time, Potential Capacity, Shared-Lane Capacity, Estimating Control Delay & Queue Length; Roundabout. Signalised Intersection: Design by Webster & IRC Method, Signal Coordination: Time-Space Diagram for One-way & Two-way streets, Shock Waves. Vehicle Actuated Signals: Introduction, Advantages, Disadvantages.

UNIT-IV

ITS Application, Network optimization, Sensing with Detectors, In- Vehicle Routing and personal route information, The Smart Car, Electronic Toll Collection, The Smart Card, Congestion Pricing, Dynamic Assignment, Bus Transit & Paratransit-Emerging Issues. Detrimental effect of traffic on environment – Air Pollution –Pollutants due to Traffic – Measures to reduce Air Pollution due to Traffic- Noise Pollution – Measures to reduce Noise Pollution.

UNIT-V

Types of Traffic Signs- Cautionary, Regulatory and Informative Signs- Specifications- Pavement markings- Types of Markings – Lane markings and Object markings- Standards and Specifications for Road MarkingsProblem of Highway Safety – Types of Road accidents- Causes – Engineering Measures to reduce Accidents- Enforcement Measures – Educational Measures- Road Safety Audit- Principles of Road Safety Audit.

Text Books:

- Kadiyali L.K, "Traffic Engineering and Transportation Planning", 3rd Edition, Khanna Publishers", 2004.
- Mannering and Kilareski, "Highway Engineering and Traffic Analysis", 3rd Edition, John Wiley Publications, 2007.
- Roger P.Roess, Elena S. Prassas, William R. McShane, "Traffic Engineering", 3rd Edition, Prentice Hall, 2004.

Reference books:

- Khisty C. J., "Transportation Engineering – An Introduction", 3rd Edition, Prentice Hall, 2010.
- Papacostas C.S., "Fundamentals of Transportation Engineering", 2nd Edition, Prentice Hall of India, 2005.
- Partha Chakroborthy and Animesh Das, "Principles of Transportation Engineering", 2nd Edition, Prentice Hall of India, 2005.

HONORS		L	T	P	C
Course Code:	BT24CEH04	3	0	0	3
ADVANCED HYDROLOGY					

Course Outcomes

1. Explain complex storm hydrographs and apply unit hydrograph (UH), synthetic UH, and instantaneous unit hydrograph (IUH) concepts.
2. Analyze runoff estimation using SCS curve number method and evaluate snow hydrology processes including snowmelt and snowmelt hydrograph synthesis.
3. Apply flood routing techniques for reservoirs and channels using hydrologic routing models for flood control studies.
4. Explain fluvial geomorphology, hydrologic abstraction processes, arid zone hydrology, and estimation of probable maximum precipitation (PMP).
5. Develop and analyze catchment models incorporating various hydrologic components.
6. Analyze hydrologic time series data, generate synthetic hydrologic data, and evaluate the role of forest hydrology in watershed response.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	1	1	–	–	–	–	–
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	2	2	–	–	–	–	2
CO4	2	3	2	2	1	2	2	–	–	–	1
CO5	2	3	3	2	3	1	–	–	–	–	2
CO6	2	3	2	3	3	2	2	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	2
CO5	3	3
CO6	2	3

UNIT-I

Complex storm hydrograph; Synthetic UH generation techniques; IUH generation techniques; UH generation from IUH.

UNIT II

SCS runoff curve number method; Snow hydrology; Snow formation and accumulation; Melting of snowpack; Snowmelt indices; Effect of snowpack condition on runoff; Snowmelt hydrograph synthesis.

UNIT III

Flood routing; Attenuation, Prism and wedge storage; Reservoir/ storage routing – Modified Pul, Goodrich, Runge Kutta, etc.; Channel routing – Muskingum, Clark's IUH, Nash, Convex, Muskingum Cunge, etc; Flood control.

UNIT IV

Fluvial geomorphology, Models for hydrologic abstraction processes, Aspects of arid zone hydrology; Probable maximum precipitation – Estimation.

UNIT V

Types of catchment model components and Construction; Analysis of time series data – Generation of synthetic hydrologic data; Forest hydrology, etc.

Text Books:

1. Urban Hydrology: A Multidisciplinary Perspective: Timothy R. Lazaro, CRC Press
2. Applied Hydrology: R. K. Linsley Jr., MA Kohler, and JLH Paulhus, McGraw-Hill Book Co.
3. Environmental Hydrology: Andy D. Ward and Stanley W. Trimble, Le

HONORS		L	T	P	C
Course Code:	BT24CEH05	3	0	0	3
GEOSYNTHETICS ENGINEERING: IN THEORY AND PRACTICE					

Course Outcomes

1. Explain the fundamentals, types, functions, properties, manufacturing techniques, and testing methods of geosynthetic materials.
2. Select appropriate geosynthetics based on functional requirements such as separation, reinforcement, filtration, drainage, containment, and protection.
3. Analyze the mechanisms and design considerations of geosynthetic-reinforced soil structures using suitable design methodologies.
4. Apply geosynthetics in roadway and railway engineering projects considering design, construction practices, and performance benefits.
5. Evaluate geoenvironmental and hydraulic applications of geosynthetics for liners, covers, canals, reservoirs, and containment systems.
6. Assess innovations, standards, environmental impacts, long-term performance, and future trends in geosynthetic engineering.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	2	1	–	–	–	–	–
CO2	3	3	2	1	2	2	–	–	–	–	1
CO3	3	3	3	2	2	2	–	–	–	–	2
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	3	3	2	–	–	–	2
CO6	2	3	2	3	3	2	2	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	3	3
CO5	3	3
CO6	2	3

UNIT-I

Introduction to Geosynthetics; Basic description of geosynthetics; Types and functions of geosynthetics; Engineering properties of geosynthetics and their evaluation; Testing of geosynthetic materials; Design methodologies with geosynthetics; Geotechnical applications: bearing capacity, settlement, stability analysis, retaining walls, embankments; Manufacturing techniques for different types of geosynthetics. Physical, mechanical, and hydraulic properties. Standard testing methods and specifications.

UNIT-II

General applications in civil engineering projects Case studies highlighting successful applications Functions of Geosynthetics Separation, reinforcement, filtration, drainage, containment, and protection. • Design methodologies for each function. Selection criteria for geosynthetics based on project requirements. Geosynthetic Reinforcement: Mechanisms of soil reinforcement. Design considerations for reinforced soil structures.

UNIT-III

Geosynthetics in Roadway Applications: Use of geotextiles and geogrids in pavement design. Benefits in terms of durability and cost-effectiveness. Geosynthetics in Railways: Applications in track stabilization and drainage.Case studies of geosynthetics in railway projects. Design and Construction: Design considerations for roadway and railway projects.

UNIT-IV

Geoenvironmental applications: covers and liners of landfills; Hydraulic applications: liners for ponds, canals, and reservoirs. Applications in water reservoirs, canals, and ponds. Design considerations for containment systems. Analysis of successful environmental projects using geosynthetics.

UNIT-V

Innovations in geosynthetic materials and manufacturing. New applications and emerging technologies. Environmental impact of geosynthetics. Long-term performance and durability studies. International and national standards for geosynthetics. Regulatory requirements for various applications. Future directions in geosynthetics.

Text books:

1. Sanjay Kumar Shukla and Jian-Hua Yin, Fundamentals of Geosynthetic Engineering, CRC Press 2. Moseley, M.P. and Kirsch, K. Ground Improvement, Spon Press, Taylor and Francis Group
2. Robert M. Koerner., Designing with Geosynthetics, Pearson Prentice Hall.
3. Rao G. V. and Rao, G. V. S. Text Book on Engineering with Geotextiles, Tata McGraw Hill

HONORS		L	T	P	C
Course Code:	BT24CEH06	3	0	0	3
ENVIRONMENTAL GEOTECHNICS					

Course Outcomes

1. Explain the role of geoenvironmental engineering, soil–waste interactions, contaminant types, risk assessment, and engineered landfill design concepts.
2. Conduct site investigation for geoenvironmental problems and evaluate soil and waste properties through sampling, characterization, and mineralogical analysis.
3. Analyze soil behavior related to pollution such as pore size distribution, swell–shrink behavior, and cracking under environmental loading.
4. Evaluate soil remediation techniques including physical, chemical, electro-kinetic, thermal, and biological methods based on site conditions.
5. Analyze contaminated site case studies and apply containment principles including liners, barriers, and carbon dioxide sequestration techniques.
6. Apply ground improvement and containment methods such as grout curtains, ground freezing, compacted liners, geosynthetic clay liners, and comply with environmental laws and regulations.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	1	3	2	–	–	1	1
CO2	3	3	2	2	2	2	–	–	–	2	1
CO3	3	3	2	2	2	2	–	–	–	2	1
CO4	3	3	3	2	3	3	–	–	–	3	2
CO5	2	3	2	3	2	3	3	–	–	1	2
CO6	2	3	3	2	3	3	2	2	–	2	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	2	3
CO6	2	3

UNIT-I

Role of Geoenvironmental Engineering – Soil phase systems - Basic concepts related to soil pollution – Evolution of waste materials – Risk assessment - potential reusewaste disposal methods – Types and impact of contaminants – soil - waste interaction – design of Engineered Landfill- types.

UNIT-II

Site investigation for geoenvironmental problems - Soil sampling - sample handling, transportation, characterization, preservation and storage – Soil properties - Mineralogical characterization of soil and waste - pore size distribution- swell and shrink cycle – cracking

UNIT-III

Soil remediation - need and approach, Techniques – Basis of selection of techniques- soil washing, Chemical surfactants - permeable reactive barriers, solidification, Soil air sparging- vacuum extraction, electro-kinetic remediation with mechanisms, thermal desorption- soil fracturing- Bioremediation – microbial transformations -phytoremediation.

UNIT-IV

Case studies on polluted sites and issues related to the environment – Containment systems and basic principles – carbon dioxide sequestration,

UNIT-V

Grout curtains, Ground freezing, Compacted soil liners, Geosynthetic clay liners - Environmental laws and regulations.

References books:

1. Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, 2000.
2. Hari D. Sharma and Krishna R. Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.
3 Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993.

HONORS		L	T	P	C
Course Code:	BT24CEH07	3	0	0	3
SEISMIC ANALYSIS OF STRUCTURES					

Course Outcomes

1. Explain physical and mathematical modelling approaches, principles of dynamics, and vibration behavior of SDOF and 2DOF systems.
2. Describe the internal structure of the earth, plate tectonics, fault mechanisms, earthquake characteristics, and seismic wave propagation.
3. Apply the provisions of IS 1893 (Part 1) for seismic analysis of buildings using equivalent static and response spectrum methods.
4. Identify and evaluate the effects of plan and vertical irregularities in buildings and their influence on seismic response.
5. Apply ductile design principles and detailing requirements for RC beams, columns, and shear walls as per IS 13920.
6. Interpret seismic design provisions related to structural separation and special construction features as per IS 4326.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	–	–	–	–	2
CO2	3	2	2	1	1	3	–	–	–	3	2
CO3	3	3	3	2	3	2	–	–	–	2	2
CO4	2	3	2	2	2	3	–	–	–	3	2
CO5	3	3	3	2	3	2	–	–	–	3	3
CO6	2	2	2	1	2	3	–	–	–	2	2

CO	PSO1	PSO2
CO1	2	1
CO2	2	2
CO3	3	2
CO4	2	3
CO5	2	3
CO6	2	3

UNIT – I

Physical and Mathematical Modelling – Discrete and continuum Modelling. Laws of Equilibrium – Newton's Law of Motion – D'Alembert's Principle and Principle of virtual displacement. - Types of Dynamic Loading. Single Degree of Freedom System (SDOF) – Undamped Free Vibrations – Damped Free Vibrations (concept only). Two Degree of Freedom System (2DOF) – Undamped Free Vibrations – Determination of Natural frequencies and Mode shapes.

UNIT – II

: Introduction- Internal structure of earth – Chemical properties – Physical properties – Continental drift theory – Plate tectonics – Movement of plate Boundaries – Movement of Indian plate – Faults – Types of faults – Elastic Rebound theory. Earthquakes – Earthquake terminology – Classification of Earthquakes – Causes and effects of Earthquakes –Earthquake waves – Quantification of Earthquakes – Intensity and Magnitude – Recording Earthquakes.

UNIT – III

Reviews of latest I.S : 1893 (Part 1) provisions for buildings - General principles and design criteria – Assumptions – Design Acceleration spectrum – Horizontal seismic coefficient – Design acceleration – Seismic zones of India – Importance factor – Response reduction factor – Design lateral force – Design imposed loads for Earthquake force calculation –Seismic weight – Analysis by Equivalent Static Method and Dynamic Method (Response Spectrum Method) – Storey drift limitation.

UNIT – IV

Introduction – Regular and Irregular Buildings. Plan Irregularities – Torsion Irregularity – Re-entrant corners - Floor slabs having excessive cutouts or openings- Out of plane offsets in Vertical Elements – Non-parallel Lateral Force system. Vertical Irregularities – Stiffness Irregularity (soft storey) – Mass Irregularity – Vertical Geometric Irregularity – In-plane discontinuity in Vertical Elements resisting lateral force – strength Irregularity (weak storey) – Floating or stub columns – Irregular Modes of Oscillation in two Principle Plan Directions.

UNIT – V

DUCTILE DESIGN AND DETAILING: Review of Latest IS: 13920 provisions General specifications – Beams – Columns – Shear walls. Special confining reinforcement. Review of Latest IS: 4326 provisions - General principles – Special Construction features relating to separations of structures (above ground only).

Text books:

1. A.K. Jain “Dynamics of Structures with Mat Lab Applications” Pearson India Education Series Pvt.Ltd., Delhi, 2016
2. Pankaj Agarwal & Manish Shrikhande, “Earthquake Resistant Design of Structures”, 5th Edition Prentice Hall of India, New Delhi, 2011.
3. S.K.Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press, 1st Edition, 2012.

References books:

1. Chopra A.K., “Dynamics of Structures”, 5thEdition, Pearson Education, Indian Branch, Delhi, 2007.
2. Mario Paz, “Structural Dynamics - Theory and Computations”, 6thEdition, Pearson Education, 2005.
3. IS 456: 2000 Indian Standard Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).
4. IS 4326: 2013 Indian Standard “Earthquake Resistant Design and Construction of Buildings - Code of Practice, Bureau of Indian Standard.

HONORS		L	T	P	C
Course Code:	BT24CEH08	3	0	0	3
ENVIRONMENTAL AIR POLLUTION					

Course Outcomes

1. Explain the structure and composition of the atmosphere, sources and effects of air and noise pollutants, air quality standards, emission inventories, and global environmental issues.
2. Analyze ambient, stack, and noise sampling techniques, meteorological influences on pollutant dispersion, and air pollution modeling concepts.
3. Select and analyze particulate air pollution control equipment based on working principles, design equations, performance, and operational considerations.
4. Analyze gaseous air pollution control technologies including absorption, adsorption, condensation, biological treatment methods, and indoor air quality control.
5. Evaluate vehicular and indoor air pollution sources, emissions, control measures, noise pollution standards, and preventive strategies.
6. Assess real-world air pollution case studies and apply pollution control measures considering environmental regulations and public health impacts.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	1	1	3	3	–	–	–	1
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	3	2	–	–	–	–	2
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	2	3	2	–	–	–	2
CO6	2	3	2	3	3	3	2	2	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	2	–
CO6	3	–

UNIT-I

Structure and composition of Atmosphere – Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation and animals, Materials structures – Effects of air pollutants on the atmosphere, soil and water bodies – Long term effects on the planet – Global climate change, Ozone holes – Ambient air quality and emission standards – Air pollution indices – Emission inventories. - Greenhouse effect–Major contributions of air pollutant-Noise Pollution-Sources, classification-Monitoring techniques for noise pollution-Legislation and regulations - Noise quality management in India.

UNIT-II

Ambient and stack sampling- Analysis of particulate and gaseous pollutants -Effects of meteorology on Air pollution - Fundamentals, atmospheric stability, inversion-Wind profiles and stack plume patterns- Transport and dispersion of Air pollutants – Modeling techniques – Air pollution climatology-Ambient noise quality and emission standards-Noise pollution indices.-Manmade sources - Types of noise pollutant - effects on human health.

UNIT-III

factors affecting selection of control equipment – Gas particle interaction – Working principle, design and performance equations of gravity separators, cyclones-Fabric filters-Particulate scrubbers- Electrostatic precipitators – Operational considerations - Process control and monitoring – Costing of APC equipment – Case studies for stationary and mobile sources - Active personal particulate monitor.

UNIT-IV

Factors affecting selection of control equipment – Working principle, design and performance equations of absorption, adsorption, condensation- Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Case studies for stationary and mobile sources- Air pollution control measures - Basics of pollution control- Particulate control methods - Settling chambers, - cyclone separation, - Wet collectors-fabric filters-electrostatic precipitators- Removal of gaseous pollutants by adsorption, absorption,-Biological air pollution control technologies,-Indoor air quality-control

UNIT-V

Vehicular Pollution, automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution-Noise Pollution- Sources and Effects of Noise Pollution - Measurement - Standards -Control and Preventive measures- Sources types and control of indoor air pollutants, sick building syndrome types-Case studies on Air pollution

Text Books:

1.C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2020.
2.M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2013
3.Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2012.
4.Noel De Nevers, “Air pollution control Engineering”, McGraw Hill International Edition
5. Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 5 th Edition, 2013.

HONORS		L	T	P	C
Course Code:	BT24CEH09	3	0	0	3
SOIL DYANMICS					

Course Outcomes

1. Explain the fundamentals of free and forced vibrations of single degree of freedom systems, resonance phenomena, transmissibility, and soil–foundation natural frequency concepts.
2. Describe elastic wave propagation in soils and evaluate field and laboratory methods for determining dynamic soil properties.
3. Analyze design criteria for machine foundations considering permissible amplitudes, bearing pressures, and vibration modes of block foundations.
4. Analyze two degree of freedom systems under free and forced vibrations and apply IS code provisions for reciprocating and impact machine foundations.
5. Select suitable vibration isolation materials and methods based on dynamic performance and material properties.
6. Apply soil dynamics principles for safe and efficient design of machine foundations subjected to dynamic loads.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	–	–	–	2	1
CO2	3	2	1	2	2	1	–	–	–	1	2
CO3	3	3	3	2	2	2	–	–	–	3	2
CO4	3	3	3	2	3	2	–	–	–	3	3
CO5	2	2	2	1	3	1	–	–	–	2	1
CO6	3	3	3	2	3	3	–	–	–	1	3

CO	PSO1	PSO2
CO1	3	2
CO2	2	2
CO3	3	2
CO4	3	3
CO5	2	3
CO6	3	3

UNIT – I

Basic definitions- Free and Forced vibrations with and without damping for Single degree freedom system- Resonance and its effect – Magnification

– Logarithmic decrement – Transmissibility, Natural frequency of foundation soil system Barkan's and IS methods – Pressure bulb concept

UNIT – II

Elastic waves in Rods Waves in elastic Half space, Field and Laboratory methods of determination – Uphole, Down hole and Cross hole methods – Cyclic plate load test – Block vibration test.

UNIT – III

Design criteria, Permissible amplitudes and Bearing pressure, Degrees of freedom - Analysis under different modes of vibration of block foundation.

UNIT – IV

Analysis of Two Degree freedom systems under free and forced vibrations -Principles of Design of Foundations for reciprocating and impact machines as per IS code.

UNIT – V

Types and methods – Isolating materials and their properties.

Text books:

1. Barkan, D., "Dynamics of Bases and Foundations", 2nd Edition McGraw Hill Publishing, 1970.
2. Shamsher Prakash, "Soil Dynamics", 3rd Edition, John Wiley, 2000.

Reference book:

1. Shamsher Prakash, Soil Dynamics, McGraw - Hill, 1981.
2. Sreenivasalu and Varadarajan, Handbook of Machine Foundations, Tata McGraw -Hill, 2007.
3. IS 2974 -Part I and II,
4. Design Considerations for Machine Foundations

HONORS		L	T	P	C
Course Code:	BT24CEH10	3	0	0	3
ADVANCED TRANSPORTATION ENGINEERING					

Course outcomes:

1. Explain the principles, scope, and policies of highway geometric design as per IRC and AASHTO, including primary and dependent design controls.
2. Analyze human and vehicle factors influencing geometric design and evaluate different types of sight distance and their applications.
3. Design horizontal and vertical alignment elements, cross-sections, and super elevation considering safety, comfort, and efficiency.
4. Apply principles of highway location and alignment design including trial alignments, impact evaluation, and alignment optimization.
5. Design intersections and interchanges considering driver expectancy, turning movements, channelization, and geometric controls.
6. Use highway design software tools to evaluate alignment, sight distance, super elevation, intersections, and interchanges.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	1	1	–	–	–	–	–
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	2	2	–	–	–	–	2
CO4	3	3	3	2	2	2	–	–	–	–	2
CO5	2	3	3	2	3	2	–	–	–	–	2
CO6	2	2	2	2	3	1	–	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	3	3
CO5	2	3
CO6	3	3

UNIT – I

Introduction to highway geometric design: Development IRC and AASHTO geometric design polices, Definition and scope of geometric design, Primary and dependent design controls.

UNIT – II`

Human and vehicle factors: Concepts and application of human factors in design and typical vehicle factors used in geometric design. Sight distance: Overview of different type of sight distance, sight distance index, scaling and recording sight distance from plans, sight distance profile.

UNIT – III

Longitudinal Features of Horizontal and Vertical Profile: Factors influencing profile selection, horizontal curve, vertical curve, curves for special situation, characteristics of highway alignment, general principles of horizontal and vertical profile coordination and technique, elements of highway cross sections, developing cross sections, methods of attaining super elevation and graphical development of super elevation. Highway location and alignment design: Location study, developing trial alignment, evaluating impacts, translating graphical alignment to mathematical component, single line sketching technique.

UNIT – IV

Principles of intersection and interchange design: Design objectives, driver expectancy, geometric design controls, alignment and profile, lane width, design for turning movements, treatments for right turns, unconventional intersection and interchange design, channelization, intersection design templates, interchange design templates.

UNIT – V

Introduction to highway design software: Developing sight distance profile for highway alignment, Evaluating existing horizontal and vertical curves, Super elevation development, Intersection design, Interchange design.

Text books:

1. A policy on geometric design of highways and streets, American Association of State Highway Officials, 2011.
2. Geometric design standards for urban roads in plains (IRC: 86- 1983), The Indian Roads Congress, 1983.
3. Geometric design standards for rural (non-urban) highways (IRC: 73-1980), The Indian Roads Congress, 1980.
4. Guidelines for expressways – Part I, Ministry of Road Transport & Highways, 2010.

Department of Civil Engineering

(DR24)

Syllabus for Minors

MINORS		L	T	P	C
Course Code:	BT24CEM01	3	0	0	4.5
SURVEYING					

Course outcomes:

CO1 Apply the principle and methods of surveying and measuring of horizontal and vertical- distances and angles

CO2 Identify the source of errors and rectification methods

CO3 Apply surveying principles to determine areas and volumes

CO4 Setting out curves and using modern surveying equipment

CO5 Apply the basics of Photogrammetry Surveying in field

CO6 Determination of photographic mapping using different instruments

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	2	1	3	-	3	3	3	1
CO2	3	2	-	2	2	2	-	2	2	2	2
CO3	3	1	-	1	1	1	-	1	2	2	2
CO4	3	3	-	3	3	1	-	1	1	1	2
CO5	3	1	-	3	3	1	-	1	1	1	2
CO6	3	2	-	2	3	1	-	1	1	1	2

CO/ PSO	PSO1	PSO2
CO1	1	1
CO2	2	-
CO3	3	1
CO4	1	3
CO5	3	2
CO6	2	2

UNIT-I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, surveying accessories. Introduction to Compass, leveling and Plane table surveying.

Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections. Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip – systems and W.C.B and Q.B systems of locating bearings.

UNIT II

Leveling- Types of levels, methods of levelling, and Determination of levels, Effect of Curvature of Earth and Refraction. Contouring - Characteristics and uses of Contours, methods of contour surveying. Areas-Determination of areas consisting of irregular boundary and regular boundary.

Volumes - Determination of volume of earth work in cutting and embankments for level section, capacity of reservoirs.

UNIT III

Theodolite Surveying: Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical leveling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Introduction to Omitted measurements.

UNIT IV

Curves: Types of curves and their necessity, elements of simple, compound, reverse curves. Introduction to Tachometric Surveying.

Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station- advantages and Applications. Introduction to Global Positioning System. Introduction to Drone survey and LiDAR Survey (Light Detection and Ranging).

UNIT V Photogrammetry Surveying

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo-plotting instruments, mosaics, map substitutes.

Text Books:

1 Surveying (Vol – 1 & 2) by Duggal S K, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 5th edition, 2019.

2 Textbook of Surveying by C Venkatramaiah, Universities Press 1st Edition, 2011.

Reference books:

1 Surveying (Vol–1), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi, 18th edition 2024.

2 Surveying (Vol – 2), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain Laxmi Publications (P) ltd., New Delhi 17th 2022.

MINORS		L	T	P	C
Course Code:	BT24CEM02	3	0	0	4.5
MECHANICS OF SOLIDS					

Course outcomes:

CO1 To understand the basic materials behavior under the influence of different External loading conditions and the support conditions.

CO2 To draw the diagrams indicating the variation of the key performance features like axial forces, bending moment and shear forces in structural members.

CO3 To acquire knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams

CO4 To analyze the deflections due to various loading conditions.

CO5 To assess stresses across section of the thin, thick cylinders and columns to arrive at optimum sections to withstand the internal pressure using Lame's equation

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11
CO1	3	2	-	2	-	-	-	-	-	2	1
CO2	2	1	-	1	-	-	-	-	-	1	1
CO3	2	2	-	1	-	-	-	-	-	2	1
CO4	1	2	-	1	-	-	-	-	-	2	1
CO5	2	1	-	2	-	-	-	-	-	1	1

CO/ PSO	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	2
CO4	3	3
CO5	3	2

UNIT – I:

Simple Stresses and Strains:

Elasticity and plasticity – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – stresses in composite bars – Temperature stresses.

Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II:

Shear Force and Bending Moment:

Definition of beam – Types of beams – Concept of shear force and bending moment – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT – III:

Flexural and shear Stresses in beams:

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R, Neutral axis – Determination bending stresses – section modulus of rectangular beam sections. **Shear Stresses:** Derivation of formula – Shear stress distribution across various beam sections likerectangular, circular, I, T Angle sections.

UNIT – IV:

Deflection of Beams:

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic curve of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems – Moment area method – application to simple cases of cantilever.

UNIT – V:

Thin and Thick Cylinders:

Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders. **Thick cylinders:** Introduction: Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses.

Text books:

1. A Textbook of Strength of Materials, by R. K. Rajput, SI Units S.Chand & Co, New Delhi
2. Strength of materials by R. K. Bansal, Lakshmi Publications.

Reference books:

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.

MINORS		L	T	P	C
Course Code:	BT24CEM03	3	0	0	4.5
SOIL MECHANICS					

Course Outcomes:

Upon successful completion of this course, student will be able to

1: Understand soil formation, its index properties and classification.

2: Understand soil moisture and flow of water through soils and its effects.

3: Understand stress distribution in soils.

4: Understand Compressibility characteristics under partially saturated and fully saturated conditions.

5: Understand shear strength of soil at different loading & drainage conditions for different oils.

6: Analyse the stress strain of soils with different mechanisms

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	–	–	1	–	–	–	3
CO2	3	2	–	2	–	2	2	–	–	–	2
CO3	3	3	–	2	2	2	–	–	–	–	2
CO4	3	3	–	2	2	–	–	–	–	2	3
CO5	3	3	–	2	–	–	–	–	–	2	1
CO6	3	2	-	2	–	–	–	–	–	–	2

	PSO1	PSO2
CO1	3	–
CO2	–	–
CO3	3	–
CO4	–	–
CO5	2	2
CO6	3	2

UNIT – I

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density. **Index Properties of Soils:** Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT –II

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems.

Geostatic Stresses: Total, neutral and effective stresses –quick sand condition Seepage: 2-D flow and Laplace's equation-Seepage through soils–Flow nets: Characteristics and Uses.

UNIT – III

Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soilproperties - compaction control.

Consolidation: Compressibility of soils –e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (cv) - Over consolidated and normally consolidated clays.

UNIT – V

Shear Strength of Soils: Basic mechanism of shear strength -Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

Text books:

1. Gopal Ranjan and A.S.R.Rao,"Basic and Applied Soil Mechanics", New Age International Publishers.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers
3. M.Palani Kumar, "Soil Mechanics", PHI Learning

Reference books:

1. D.W.Taylor, "Fundamentals of Soil Mechanics", Wiley.
2. Holtz and Kovacs, "An introduction to Geotechnical Engineering" Prentice Hall
3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch.

MINORS		L	T	P	C
Course Code:	BT24CEM04	3	0	0	4.5
FLUID MECHANICS					

Course outcomes:

CO1 Understand the principles of fluid statics, kinematics and dynamics

CO2 Apply the laws of fluid statics and concepts of buoyancy

CO3 Understand the fundamentals of fluid kinematics and differentiate types of fluid flows

CO4 Apply the Principle of conservation of energy for flow measurement.

CO5 Analyze the losses in pipes and discharge through pipe network.

CO6 Analyze the flow and total energy in the pipes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	1	-	-	-	3	2	2
CO2	2	2	-	2	1	-	-	-	3	3	3
CO3	2	2	-	2	1	-	-	-	3	2	2
CO4	1	2	-	-	3	-	-	-	3	2	2
CO5	2	1	-	-	-	-	-	-	3	2	2
CO6	2	1	-	-	-	-	-	-	3	2	2

CO/ PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	1	-
CO5	1	-
CO6	2	-

UNIT I Basic concepts and definitions

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; Variation of viscosity with temperature, Newton law of viscosity; Vapor pressure, Boiling point, Surface tension, Capillarity, Bulk modulus of elasticity, Compressibility

UNIT-II Fluid statics

Fluid Pressure: Pressure at a point, Pascal‘s law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U- Tube Differential Manometer. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies

UNIT-III Fluid kinematics

Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - Dimensional continuity equations in Cartesian coordinates.

UNIT-IV Fluid Dynamics

Surface and body forces; Equations of motion - Euler‘s equation; Bernoulli‘s equation – Derivation; Energy Principle; Practical applications of Bernoulli‘s equation : Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number;

UNIT-V Analysis Of Pipe Flow

Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series.

Text Books:

1 P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House 22nd, 2019.

2 K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition 2018

References:

1 R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications(P) Ltd., New Delhi 11th edition, 2024.

2 N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.

MINORS		L	T	P	C
Course Code:	BT24CEM05	3	0	0	4.5
CIVIL ENGINEERING- BUILDING MATERIALS AND CONSTRUCTION					

Course outcomes:

CO1 Handle various linear and angular measuring instruments

CO2 Measure the linear and angular measurements

CO3 Calculate the area and volume by interpreting the data obtained from surveying activities

CO4 Handle modern equipment such as total station

CO5 Prepare field notes from survey data

CO6 Damp and waterproofing of buildings

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	1	-	-	-	3	2	2
CO2	2	2	-	2	1	-	-	-	3	3	3
CO3	2	2	-	2	1	-	-	-	3	2	2
CO4	1	2	-	-	3	-	-	-	3	2	2
CO5	2	1	-	-	-	-	-	-	3	2	2
CO6	2	2	-	-	-	-	-	-	2	2	2

CO/ PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	1	-
CO5	1	-
CO6	2	-

UNIT – I

Stones: Classification of Stones–Properties of stones in structural requirements.
Bricks: Composition of good brick earth, various methods of manufacturing of bricks.
Tiles: Characteristics of good tile–Manufacturing methods, Types of tiles.
Wood: Structure– Properties–Seasoning of timber–Classification of various types of woods used in buildings – Defects in timber Paints: White washing and distempering, Constituents of paint – Types of paints – Painting of new and old wood – Varnish.

UNIT – II

Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls.

WOOD: Structure – Properties- Seasoning of timber-Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiver – Reinforced Plastics, Steel, aluminum.

UNIT – III

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime. Cement Supplementary materials like Silica fume, Fly ash, GGBS, Rice husk ash used and properties.

UNIT – IV

Lintels, arches, vaults, staircases – types. Different types of floors – Concrete, Mosaic, and Terrazzo floors, Pitched, flat roofs, Lean-to roof, Coupled Roofs. Trussed roofs–King and Queen post Trusses, R.C.C Roofs, Madras Terrace and Prefabricated Roofs.

UNIT - V

Damp Proofing and waterproofing materials and uses – Plastering, Pointing, white washing, and distempering – Paints: Constituents of paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.

Textbooks:

1. Building Materials by S.S.Bhavikatti, Vices publications House private ltd.
2. Building Materials by B.C.Punmia, Laxmi Publications private ltd

Reference books:

1. Building Materials by S.K.Duggal, New Age International Publications.
2. Building Materials by P.C. Verghese,P HI learning (P)ltd.

MINORS		L	T	P	C
Course Code:	BT24CEM06	3	0	0	4.5
BUILDING PLANNING & DRAWING					

CO1 Plan various buildings as per the building by-laws.

CO2 Distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.

CO3 Draw signs and bonds

CO4 Draw different building units

CO5 Learn the skills of drawing building elements and plan the buildings as per requirements.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	2	-	-	3	3	2	-	2	2
CO2	1	1	2	-	-	3	2	-	-	2	1
CO3	1	1	2	-	-	3	3	2	-	2	2
CO4	1	1	2	-	-	3	3	2	-	2	2
CO5	1	1	2	-	-	3	3	2	-	2	2

CO/ PSO	PSO1	PSO2
CO1	3	3
CO2	-	-
CO3	3	3
CO4	3	3
CO5	3	3

List of Drawings:

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors & Windows.
5. Detailing & Drawing of Staircase.
6. Detailing & Drawing of Ventilators & Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.
9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

Text Books:

1. "Planning, designing and Scheduling", Gurcharan Singh and Jagdish Singh
2. "Building planning and drawing" by M. Chakraborti.
3. "Building drawing", M G Shah, C M Kale and S Y Patki, Tata McGraw Hill, New Delhi.

Reference Books:

1. "National Building" Code 2016 (Volume- I & II).
2. "Principles of Building Drawing", M G Shah and C M Kale, Trinity Publications, New Delhi.
3. "Civil Engineering drawing and House planning", B. P. Verma, Khanna publishers, New Delhi.
4. "Civil Engineering Building practice", Suraj Singh: CBS Publications, New Delhi, and Chennai
5. "Building Materials and Construction", G. C Saha and Joy Gopal Jana, McGrawHill Education (P) India Ltd. New Delhi.

MINORS		L	T	P	C
Course Code:	BT24CEM07	3	0	0	4.5
ESTIMATION AND COSTING					

Course Outcomes:

Upon the successful completion of this course:

1. Explain types of contracts, contract documents, conditions of contract, valuation of buildings, and modern procurement methods.
2. Apply principles of quantity take-off and prepare approximate estimates for building works.
3. Perform rate analysis for various items of work including earthwork, RCC, and reinforcement.
4. Prepare bar bending schedules and estimate material requirements for building and road works.
5. Prepare detailed estimates of buildings using the individual wall method.
6. Prepare detailed estimates of buildings using the centre line method and standard estimation software.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	1	2	–	–	2	2
CO2	3	3	2	2	1	1	3	–	–	2	2
CO3	3	2	2	2	2	1	2	–	–	2	2
CO4	3	3	2	2	2	2	3	–	–	2	2
CO5	3	3	3	2	1	1	3	–	–	3	2
CO6	3	2	2	–	–	1	2	–	–	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	2	–
CO4	2	3
CO5	3	2
CO6	3	3

UNIT – I

Contracts – Types of contracts – Contract Documents – Conditions of contract – Tendering process – Valuation of buildings - concepts of e-procurement and reverse auctions – Standard specifications for different items of building construction – Environment Social Governance'

UNIT – II

General items of work in Building – Standard Units – Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating.

UNIT – III

Rate Analysis – Working out data for various items of work over head and contingent charges –Use of Schedule of Rates – Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules

UNIT – IV

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings – Common errors and best practices.

UNIT – V

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

Text books:

1. 'Estimating and Costing' by B.N.Dutta, UBS publishers, 2000.
2. 'Civil Engineering Contracts and Estimates' by B.S.Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.

Reference books:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS1200 (PartsItoXXV-1974/ Method of Measurement of Building & Civil Engg Works– B.I.S.)
3. 'Estimation, Costing and Specifications' by M.Chakraborthi; Laxmi publications. 4. National Building Code

MINORS		L	T	P	C
Course Code:	BT24CEM08	3	0	0	4.5
SUSTAINABLE MATERIALS AND GREEN BUILDING					

Course Outcomes:

1 Explain the fundamentals of sustainability, carbon cycle, ecological footprint, bio-capacity, embodied energy, and the role of materials in sustainable development.

2 Analyze sustainability aspects of cement production, alternative fuels, supplementary cementitious materials, and life-cycle energy of concrete.

3 Evaluate recycled aggregates, clay bricks, brick kilns, and energy concepts related to crushing, grinding, and thermal properties of materials.

4 Assess the ill-effects of building materials, emissions, radiation, urban heat island effect, and apply energy-efficient building design principles.

5 Apply ECBC, OTTV methodology, solar energy systems, and green building strategies for energy-efficient construction.

6 Compare and select sustainable construction systems such as AAC blocks, insulated formwork, tunnel form, and modular construction techniques.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	2	3	–	–	–	3
CO2	3	3	2	2	–	2	3	–	–	–	2
CO3	3	3	2	2	2	–	2	–	–	–	3
CO4	2	3	2	2	2	3	3	2	–	–	3
CO5	2	3	3	–	2	2	3	–	–	–	3
CO6	2	2	3	–	2	2	3	–	2	–	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	3
CO6	3	3

UNIT – I

Basics of Material Sustainability: Ecological footprint, bio-capacity, global hectare, planet equivalent, earth natural system, CO_2 emissions, basics of the carbon cycle, factors affecting the carbon cycle, urban environment, fundamentals of sustainability, life cycle assessment, role of materials and primary energy, secondary energy, embodied energy, energy analysis, factors affecting material sustainability, ecological footprint and bio-capacity calculation, equivalent factor, yield factor, role of cement in sustainability, and chemical exergy calculation.

UNIT – II

Sustainability in Cement Usage: Fuel required for cement production, cementitious/supplementary cementitious materials and their characterization, strength of concrete, types of composite cements, alternative fuel for cement, life cycle embodied energy and concrete sustainability, use of admixtures, curing methods, and use of wastewater for mixing and curing.

UNIT – III

Recycled Aggregates and Clay Bricks: Processing and classification of recycled aggregates, crushing and grinding of aggregates, Bond's law, operational energy, thermal conductivity models, thermal diffusivity, types of clay bricks, and comparison of various types of brick kilns.

UNIT – IV

Ill-effects of Building Materials and Radiation: Carbon balance, paints, adhesives, sealants, health hazards of building materials, emission models and testing, energy-efficient design of buildings, design optimization, urban heat island effect, radiation concepts, and evapotranspiration theory and models.

UNIT – V

Energy Conservation and Formwork Basics: Energy Conservation Building Code (ECBC 2007), ECBC-compliant methodology, OTTV methodology, solar energy and solar PV cells, solar water heating, green design strategies, green building rating systems, Autoclaved Aerated Concrete (AAC), insulated precast systems and forms, insulated concrete form, tunnel form, and modular construction.

Textbooks:

1. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology – Processes, 1st Edition, Elsevier, 2003.
2. Kubba, S., LEED Practices, Certification, and Accreditation Handbook, 1st Edition, Elsevier, 2010.
3. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1st Edition, Nabhi Publication, 2008.
4. Andrew H. Buchanan and Brian G., Energy and Carbon Dioxide Implications of Building Construction, Energy and Buildings, 20, 205–217, 1994.

Reference books:

1. Green Building Basics, California Integrated Waste Management Board https://www.ciwmb.ca.gov/GREENBUILDING/Basics.htm#What
2. Venkatarama Reddy, B.V. and Jagadish, K.S., Embodied Energy of Common and Alternative Building Materials and Technologies, Energy and Buildings, 35, 129–137, 2003.
3. Ministry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency, 2018.

MINORS		L	T	P	C
Course Code:	BT24CEM09	3	0	0	4.5
SAFETY IN CONSTRUCTION					

Course outcomes:

1 Explain the structure of the construction industry, safety issues, human factors, ergonomics, and the roles of stakeholders in ensuring construction safety.

2 Identify and analyze safety requirements and standards for construction operations such as excavation, scaffolding, tunneling, blasting, demolition, and temporary structures.

3 Apply safe practices for handling, storage, and stacking of construction materials at construction sites.

4 Demonstrate knowledge of safety measures in the operation of construction equipment, lifting devices, tools, and temporary power supply systems.

5 Interpret Indian Standards and National Building Code provisions related to construction safety and apply them in practical situations.

6 Understand and explain construction labor laws, welfare regulations, statutory provisions, and penalties applicable to construction workers.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	2	3	–	–	–	2
CO2	3	3	2	2	–	2	3	–	–	–	2
CO3	3	3	2	2	2	–	2	–	–	–	–
CO4	2	3	2	2	2	3	3	2	–	–	3
CO5	2	3	3	–	2	2	3	–	–	–	3
CO6	2	2	3	–	2	2	3	–	2	–	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	3
CO6	3	3

UNIT – I

Introduction to the Construction Industry and Safety Management: Introduction to the construction industry – Safety issues in construction – Human factors in construction safety – Roles of various groups in ensuring safety – Framing contract conditions related to safety – Relevance of ergonomics in construction safety.

UNIT – II

Safety in Construction Operations and Standards: Safety in excavation, underwater works, underpinning, and shoring – Ladders and scaffolds – Tunneling – Blasting – Demolition – Pneumatic caissons – Confined spaces – Temporary structures – Indian Standards and National Building Code provisions on construction safety.

UNIT – III

Safety in Material Handling and Storage: Safety practices in handling construction materials – Safety in storage and stacking of materials at construction sites.

UNIT – IV

Safety in Construction Equipment Usage: Safe use of vehicles, cranes, tower cranes, lifting gears, hoists, lifts, wire ropes, pulley blocks, mixers, conveyors – Pneumatic and hydraulic tools – Safety in temporary power supply.

UNIT – V

Construction Labor Laws and Welfare Regulations: Contract Labor (Regulation & Abolition) Act and Central Rules – Definitions – Registration of establishments – Licensing of contractors – Health and welfare provisions – Penalties and wage rules. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998 – Applicability – Administration – Welfare Board and Fund – Worker training – General safety, health, and welfare provisions – Penalties.

Text Books:

1. R.K. Jain and Sunil S. Rao, Safety, Health and Environment Management Systems, Khanna Publishers.
2. V. J. Davies and K. Tomasin, Construction Safety Handbook, Thomas Telford Ltd., 1996.
3. Dr. R. Chudley, Construction Technology, Volumes 1–4, Pearson Education.

Reference Books:

1. National Building Code of India 2016, Bureau of Indian Standards.
2. IS Codes related to Construction Safety, Bureau of Indian Standards.
3. Contract Labor (R&A) Act, 1970 with Central Rules, 1971
4. Building and Other Construction Workers (RE&CS) Act, 1996 and Rules, 1998

MINORS		L	T	P	C
Course Code:	BT24CEM10	3	0	0	4.5
CONSTRUCTION PLANNING AND MANAGEMENT					

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

CO1 Appreciate the importance of construction planning and project management techniques.

CO2 Understand the functioning and selection of earth moving and construction equipment.

CO3 Know the methods of production of aggregates and concreting operations.

CO4 Apply construction management knowledge to project planning, scheduling, and execution.

CO5 Analyze construction methods, equipment productivity for efficient project delivery.

CO6 Apply principles of quality control, safety engineering, and BIM in construction projects.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	1	–	–	–	1
CO2	3	2	2	1	–	–	2	1	–	–	2
CO3	3	3	2	2	–	–	2	2	–	–	2
CO4	3	3	–	2	–	–	2	2	–	–	1
CO5	2	2	1	2	–	–	3	–	–	–	2
CO6	3	2	2	2	3	1	3	–	–	–	2

CO	PSO1	PSO2
CO1	3	–
CO2	2	–
CO3	3	–
CO4	2	3
CO5	2	3
CO6	2	3

UNIT – I

Construction Project Management: Construction project management and its importance – Qualities of a good project manager – Project planning, coordination, scheduling, and monitoring – Bar charts – Milestone charts – Critical Path Method (CPM).

UNIT – II

Project Evaluation and Resource Management: Project Evaluation and Review Technique (PERT) – Cost analysis – Project crashing for optimum cost and resources – Resource allocation – Introduction to project management software – Application of PRIMAVERA or equivalent tools.

UNIT – III

Earthmoving and Material Handling Equipment: Construction equipment and economic considerations – Earthwork equipment – Trucks and handling equipment – Rear dump trucks – Capacity and productivity calculations – Compaction equipment – Rollers and types – Hoisting and earthwork equipment: hoists, cranes, tractors, bulldozers, graders, scrapers, draglines, clam shell buckets.

UNIT – IV

Concreting Equipment and Techniques: Concrete production: Batching plants, mobile units (e.g., AJAX), mixers – Mixing, placing, consolidating, and finishing of concrete – Equipment used in concreting operations.

UNIT – V

Construction Methods and Safety: Construction methods: Earthwork, piling, concrete placement, formwork, fabrication and erection – Quality control – Safety engineering – Introduction to BIM (Building Information Modelling) for civil engineering applications.

Text Books:

1. Peurifoy, Schexnayder, Shapira, Construction Planning, Equipment and Methods, Tata McGraw Hill.
2. Kumar NeerajJha, Construction Project Management: Theory and Practice, Pearson, 2011.
3. Subir K. Sarkar and Subhajit Sarasvati, Construction Technology, Oxford University Press.

Reference Books:

1. Peter Fewings, Construction Project Management – An Integrated Approach, Taylor and Francis.
2.Trefor Williams, Construction Management: Emerging Trends and Technologies, Cengage Learning.

Department of Civil Engineering

M.Tech-(Structural Engineering)

DR25 Curriculum

(Applicable for the batches admitted from 2025-26)

ACADEMIC REGULATIONS DR25 FOR M. Tech (REGULAR) DEGREE COURSE

(Applicable for the batches admitted from 2025-26)

Applicable for the students of M. Tech (Regular) Course from the Academic Year 2025-26 onwards. The M. Tech Degree of D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY, Bhimavaram affiliated to Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the JNTUK, University and Andhra Pradesh State Council of Higher Education (APSCHE) from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates (i) in national level qualifying Entrance Test (GATE), (ii) AP PGECET conducted by State Government and (iii) Few Sponsored seats notified by University on the basis of any order of merit as approved by the State Government /University, subject to reservations as laid down by the Government from time to time.

2.0 AWARD OF M. Tech DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

2.2 The student shall register for all **80 credits** and secure all the **80 credits**.

2.3The minimum instruction days in each semester are 90.

3.0 A PROGRAMME OF STUDY

The following specializations are offered at present for the M. Tech Programme of study.

M. Tech

1. M.Tech- Structural Engineering
2. M.Tech- Machine Design
3. M.Tech- Digital Electronics and Communication Systems
4. M.Tech- Computer Science & Engineering

and any other course as approved by AICTE/ University from time to time.

3.0 B. Departments offering M. Tech Programmes with specializations are noted below:

CE	M.Tech. - Structural Engineering (87)
ME	M.Tech- Machine Design (15)
ECE	M.Tech- Digital Electronics and Communication Systems (38)
CSE	M.Tech- Computer Science & Engineering (58)

4.0 ATTENDANCE

4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects/courses, and with minimum **75% in each and every course including practicals.**

4.2 Condoning of shortage of attendance (between 65% and 75%) up to a maximum of 10% (considering the days of attendance in sports, games, NSS activities and medical exigencies) in each course (Theory/Lab/Seminar) is condoned on production of valid Certificates/documents in the stipulated time mentioned here with:

4.2.1 Students who are admitted as in patients for treatment are only eligible to claim condonation of attendance. Such students under medical exigencies need to Produce (a) Doctor Medical Prescription, (ii) Medical bills duly signed by Doctor/Hospital authorities, (c) Diagnosis reports, if any, (d) Discharge summary issued at the time of discharge and any other supporting documents within two week(s) from the date of discharge to the respective institution.

Note: University at any point of time can inform the institution(s) to submit such list/proofs. Hence, respective institution shall verify and accord condonation privilege scrupulously.

4.2.2 Students participation in Sports/Games and NSS activities shall also be permitted for condonation of attendance. In such cases, they need to produce (a) invitation letter from the organising institute/agency, (ii) participation certificate and any supporting documents within two week(s) from the date of participation to the respective institution.

4.3 A prescribed fee per course shall be payable for condoning shortage of attendance after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain all the relevant documents along with the request from the students, whose attendance is condoned.

4.4 **Shortage of Attendance below 65% in any course shall in no case be condoned.**

4.5 A Student, whose shortage of attendance is not condoned in any course(s) (Theory/Lab/Seminar) in any Semester, is considered as 'Detained in that course(s), and is not eligible to write

Semester End Examination(s) of such Course(s), (in case of Seminar, his/her Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he/she has to seek re-registration for those course(s) in subsequent Semesters, and attend the same as and when offered.

4.6 A student shall put in a minimum required attendance in at least FOUR courses in I semester for promotion to II Semester; and at least FOUR courses in II semester for promotion to III Semester.

Re-admission / re-registration

4.7 A student shall not be permitted to appear for the Semester End Examinations (SEE) in a course unless they meet the prescribed attendance requirements for that course. Such students may take readmission for the course in the subsequent semester when it is offered by paying the prescribed fee, at least 30 days before the commencement of classwork. The college must obtain permission from the University by submitting the list of students eligible/applied for readmission before the commencement of classwork\

4.8 Students who fail due to **less internal marks (less than 50%)** may register for the course within the maximum permissible duration of the Program.

4.9 In such a case, the candidate must re-register for the course(s) and secure the required minimum attendance. The candidate's attendance in the re-registered course(s) shall be calculated separately to decide upon eligibility for writing the end examination in those course(s).

4.10 In a semester, students are permitted to re-register **maximum of THREE courses**.

4.11 Upon re-registration, the student's previous performance in the respective course(s) will be nullified. Re-registration must be completed by paying the prescribed fee at least 30 days prior to the commencement of classwork. The college is required to obtain approval from the University by submitting a list of eligible and interested students before the start of commencement of classwork.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of Internal Evaluation and End Semester Examination.

5.1 For the **theory** courses **60 marks** shall be awarded based on the performance in the End Semester Examination and **40 marks** shall be awarded based on the Internal Evaluation. The **continuous** / internal evaluation shall be made based on the average of the marks secured in the two CIE/Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after

the completion of instruction. Each CIE/midterm examination shall be conducted for a total **duration of 120 minutes with 4 questions** (without choice) each question for 10 marks. End semester examination is conducted for **60 marks** for all FIVE (5) questions (one question from one unit) to be answered (either or).

5.2 For **practical** courses, **60 marks** shall be awarded based on the performance in the End Semester Examinations and **40 marks** shall be awarded based on the day-to-day performance as Internal Marks. The **internal** evaluation based on the day to **day work-10 marks, record- 10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test**. The **end** examination shall be conducted by the examiners, with breakup marks of **Procedure-15, Experimentation- 25, Results- 10, Viva-voce-10.**

5.3 For **Seminar,** a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor/mentor and two other senior faculty members of the department. For Seminar, there will be only internal evaluation of **100 marks**. A candidate has to secure a **minimum of 50%** of marks to be declared successful.

5.4 A candidate shall be deemed to have secured the minimum academic requirement in a course if he secures a **minimum of 40%** of marks in the End semester Examination and a minimum aggregate of **50% of the total marks** in the End Semester Examination and Internal Evaluation taken together.

5.5 Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the second examiner shall be appointed by the University from the panel of examiners submitted by the respective college.

5.6 Students shall undergo mandatory summer **internship / industrial training (3 credits)** for a minimum of **eight weeks duration** at the end of second semester of the Programme/Summer Break. A student will be required to submit a summer internship/industrial training report to the concerned department and appear for an oral presentation before the committee. The Committee comprises of a HoD / Professor of the department and two faculty. The report and the oral presentation shall carry **40% and 60%** weightages respectively. For summer internship / industrial training, there will be only internal evaluation of **100 marks.** A candidate has to secure a **minimum of 50% of marks** to be declared successful.

5.7 The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. The examination committee will be constituted by the HoD and consist of Professor of the department and two faculty. For comprehensive viva-voce, there will be only internal evaluation of **100 marks.** A candidate has to secure a minimum of 50% of marks to be declared successful.

6.0 **EVALUATION OF SEMINAR/INTERNSHIP/DISSERTATION WORK**

All the students admitted under these regulations have to mandatorily comply the requirements of (i) Seminar-I, (ii) Seminar-II, (iii) Comprehensive Viva, (iv) Dissertation Part-A and (v) Dissertation Part-B. Out of these, (i) to (iv) are evaluated by internally by Project Review Committee (PRC) and (v) External Evaluation.

6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and Two other senior faculty members in the department.

6.2 Students are required to appear for Seminar-I and Seminar-II in First and Second semester respectively. They shall present before PRC on the topic of their choice/interest preferably on the courses listed in respective semesters. PRC shall advise the students in advance to select topics which strengthen their Dissertation Part-A and Dissertation Part-B.

6.3 Students shall undergo mandatory summer internship / industrial training **(2 credits)** for a minimum of eight weeks duration at the end of second semester of the Programme/Summer Break. A student will be required to submit a summer internship/industrial training report to the concerned department and appear for an oral presentation before PRC. The report and the oral presentation shall carry **40% and 60%** weightages respectively. For summer internship / industrial training, there will be only internal evaluation of **100 mark**s. A candidate has to secure a minimum of **50% of marks** to be declared successful.

6.4 The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. For comprehensive viva-voce, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6.5 Registration of Dissertation/Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical and duly approved by PRC.

6.6 After satisfying 6.5, student has to submit, in consultation with his project supervisor, the title,

objective and plan of action of his project work for approval

6.7 If a candidate wishes to change his/her supervisor or topic of the project, he/she can do so with the approval of PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

6.8 Continuous assessment of Dissertation-Part A and Dissertation-Part B during the Semester(s) will be monitored by PRC. Dissertation-Part A will be only internal evaluation by PRC for 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6.9 The candidate shall submit a status report to the PRC in two stages, each accompanied by an oral presentation, with a minimum interval of three months between the two.

6.10 The work on the project shall be initiated at the beginning of the III Sem and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis (***Dissertation – Part A & Part B***) only with the approval of PRC not earlier than 40 weeks from the date of registration of the project work.

6.11 Three copies of the project thesis, printed on both sides of the page and certified by the supervisor, shall be submitted to the College/Institute along with the plagiarism report.

6.12 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

6.13 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is not favourable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the University.

6.14 If the report of the examiner is favourable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination. The Board shall jointly report the candidate's work for a maximum of 100 marks. **Corresponding grade will be awarded by the University.**

6.15 If the report of the Viva-Voce is unsatisfactory **(i.e., < 50 marks),** the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the University.

7.0 Cumulative Grade Point Average (CGPA)

Marks Range (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	S	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to <80	B	Very Good	8
≥60 to <70	C	Good	7
≥50 to <60	D	Fair	6
<50	F	Fail	3
		Absent	0

Computation of SGPA

- The following procedure is to be adopted to compute the Semester Grade Point Average(SGPA) and Cumulative Grade Point Average(CGPA):
- The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e **SGPA (Si) = $\sum$ (Ci X Gi) / $\sum$ Ci**
- Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Computation of CGPA

- The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a Programme, i.e. **CGPA = $\sum$ (Ci X Si) / $\sum$ Ci**
- Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.
- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- Equivalent Percentage **= (CGPA – 0.5) x 10**

8.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Division with Distinction	≥ 7.5 (without supplementary History)	From the CGPA secured from 80 credits
First Class	≥ 6.5	
Second Class	≥ 6.0 to < 6.5	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks. If a student wants to leave the program / exit after successful completion of first two semesters, he/she will be awarded Post Graduate Diploma in the specialization concerned.

9.0 WITHHOLDING OF RESULTS

If the student is involved in indiscipline / malpractices / court cases, the result of the student will be withheld.

10.0 GENERAL

10.1 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

10.2 The academic regulation should be read as a whole for the purpose of any interpretation.

10.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

10.4 The Institution may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institution.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1.a	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any otherform of material subject of the examination (theory or concerned with or related to the practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1.b	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University
3	Impersonates any other candidate in connection with the examination.	Both the candidates involved in the malpractice will forefeit their seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in

		connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent/Controllerof Examinations/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walkout or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer- in- charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or estruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be

		permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college's expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institution for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1 Punishments to the candidates as per the above guidelines

2 Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)

I. A show cause notice shall be issued to the college. Impose a suitable fine on the college

II. Shifting the exam-center from the college to another college for a specific period of not less than one year

DR25 M.Tech CIVIL ENGINEERING
STRUCTURAL ENGINEERING COURSE STRUCTURE & SYLLABUS

Program Outcome

PO-01	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to dervelop to the solution of complex engineering problems.
PO-02	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
PO-03	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
PO-04	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
PO-05	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
PO-06	**The Engineer & the World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
PO-07	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
PO-08	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO-09	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO-10	**Project management and finance:** Apply knowledge and understanding of Engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO-11	**Life-long learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

DR25 M.Tech CIVIL ENGINEERING
STRUCTURAL ENGINEERING COURSE STRUCTURE & SYLLABUS

PROGRAM EDUCATIONAL OBJECTIVES

PEO1	Apply fundamentals for successful profession and/or for higher education in Civil Engineering.
PEO2	Use modern engineering tools for planning, design, execution and maintenance of works with ustainable development in the chosen profession.
PEO3	Exhibit professionalism, ethical attitude, communication and managerial skills, team work, social responsibility and adapt to current trends.

PROGRAM SPECIFIC OUTCOMES

PSO1	Graduates will acquire the competence to plan, design, and execute quality construction projects that meet industry requirements.
PSO2	Graduates will be able to carry out all relevant Civil Engineering works while ensuring environmental protection and safety, using modern engineering tools and advanced software.

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
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Accredited with A++ Grade by NAAC & Accredited by NBA (B. TECH – CSE, ECE & EEE)
Ph: 08816-221238 Email: dnrcet@gmail.com website: https://dnrcet.org

COURSE STRUCTURE AND SYLLABUS

DR 25 Regulations

M.Tech (STRUCTURAL ENGINEERING) Programme
(Applicable for Batches Admitted from 2025-26)

D.N.R COLLEGE OF ENGINEERING & TECHNIOLOGY
(AUTONOMOUS)
BALUSUMUDI, BHIMAVARAM-2

D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
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VISION AND MISSION OF THE UNIVERSITY

VISION

The University is primarily promoting quality of education in the areas of Science, Technology, Engineering and Mathematics (STEM) as four academic pillars of education, to excel in teaching, learning, research, consultancy and placements through innovative practices with global perspective.

MISSION

Design an Industry relevant curriculum from time to time with a Global perspective Promoting quality education by embracing ICT delivery mechanism with continuous pedagogy through elearning mechanism Spread across for industry collaborations with a focus to pre-training and placements for technology transfer to society Establishing centers of excellence to promote research and innovations in multidisciplinary areas to bring in patent culture and consultancy practices International Collaborations for student outreach Facilitating international students to study in JNTUK to infuse cross culture learning practices.

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VISION AND MISSION OF THE INSTITUTE

VISION

To Evolve as a Quality Institution in Teaching, Innovation Research, Entrepreneurship & Consultation in Engineering & Technology, empower Rural Youth globally competent & Self-Disciplinaed Technocrats.

MISSION

IM1: Inculcate Technical Knowledge, Soft Skills through Student Centric Teaching & Learning.

IM2: Strengthen Industry Institute Interaction, Provide Solutions to the ever changing Requirement.

IM3: Implant Entrepreneurial Attitude & Ethivcla Values.

IM4: Create Work Culture towards Learning, Research & Development.

IM5: Develop a Unique Practice that Instills resopnsibility & Accountability amoung the Stakeholders.

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VISION AND MISSION OF THE DEPARTMENT

VISION

To be Recognized Centre of Excellence for Providing High Quality **Civil Engineering** Education.

MISSION

DM1: Proivide Time Trusted Technical Education to Serve Industrial Needs.

DM2: Provide State-of-Art Infrastructure & Encourage Logical Thinking to Face Challenges.

DM3: Organize Training & Development Workshops with Emphasis Structural Engineering.

DM4: To Involve in Activities for Overall Development of Stake Holders with Collabrations.

DR25 M.Tech CIVIL ENGINEERING
STRUCTURAL ENGINEERING COURSE STRUCTURE & SYLLABUS

M.Tech I – Semester

S.No	Course Name	Category	Subject Code	L	T	P	C
1	Theory of Elasticity	Program Core 1	**D2518700**	3	1	0	4
2	Structural Dynamics	Program Core 2	**D2518701**	3	1	0	4
3	Matrix Analysis of Structure	Program Core 3	**D2518702**	3	1	0	4
4	Program Elective –I	Elective I		3	0	0	3
	a) Experimental Stress Analysis		**D25187A0**				
	b) Analytical & Numerical Methods for Structural Engineering		**D25187A1**				
	c) Design of Reinforced Concrete Foundation		**D25187A2**				
	d) Structural Optimization		**D25187A3**				
5	Program Elective II	Elective II		3	0	0	3
	a) Bridge Engineering		**D25187B0**				
	b) Repair and Rehabilitation of Structures		**D25187B1**				
	c) Advanced Reinforced Concrete Design		**D25187B2**				
	d) Fracture Mechanics		**D25187B3**				
6	Advanced Concrete Technology Laboratory	Laboratory-1	**D2518703**	0	1	2	2
7	Advanced Structural Engineering Laboratory	Laboratory-2	**D2518704**	0	1	2	2
8	Seminar –I	Audit	**D2518705**	0	0	2	1
Total Credits /Marks							**23**

M.Tech II– Semester

S.No.	Course Name	Category	Subject Code	L	T	P	C
1	Finite Element Methods in Structural Engineering	Program Core 4	**D2528700**	3	1	0	4
2	Earthquake Resistant Design	Program Core 5	**D2528701**	3	1	0	4
3	Stability of Structures	Program Core 6	**D2528702**	3	1	0	4
4	Program Elective III	Elective III		3	0	0	3
	a) Analysis of Tall Structures		**D25287C0**				
	b) Advanced Steel Design		**D25287C1**				
	c) Analysis of Offshore Structures		**D25287C2**				
	d) Structural Health Monitoring		**D25287C3**				
5	Program Elective IV	Elective IV		3	0	0	3
	a) Theory of Plates and Shells		**D25287D0**				
	b) Precast and Prefabricated Structures		**D25287D1**				
	c) Earth Retaining Structures		**D25287D2**				
	d) Industrial Structures		**D25287D3**				
6	Computer Aided Design Laboratory	Laboratory -3	**D2528703**	0	1	2	2
7	Structural Design Laboratory	Laboratory -4	**D2528704**	0	1	2	2
8	Seminar –II		**D2528705**	0	0	2	1
Total Credits / Marks							**23**

DR25 M.Tech CIVIL ENGINEERING
STRUCTURAL ENGINEERING COURSE STRUCTURE & SYLLABUS

M.Tech III Semester

S.No	Course Name	Category	Subject Code	L	T	P	C
1	Research methodology and IPR (Swayam 12 Week MOOC Course)		**D2538700**	3	0	0	3
2	Summer Internship/ Industrial training (8-10 weeks)**		**D2538701**	--	--	--	3
3	Comprehensive Viva***		**D2538702**	--	--	--	2
4	Dissertation Part-A****		**D2538703**	--	--	20	10
Total Credits / Marks							**18**

* Student Attended in Summer/ Year Break and Assessment will be done in 3rd Semester
**Comprehensive viva can be conducted courses completing upto Second Semester
*** Dissertation –Part A, Internal Assessment only

M.Tech IV Semester

S No.	Course Name	Category	Subject Code	L	T	P	C
1	Project / Dissertation Part-B ****		**D2548700**	0	0	32	16
Total Credits / Marks							**16**

**** External Assessment

I Semester	THEORY OF ELASTICITY (D2518700)	L	T	P	C
		3	1	0	4

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

CO1	Know the definition of stress and deformation and how to determine the components of the stress and strain tensors.
CO2	Apply the conditions of compatibility and equations of equilibrium
CO3	Understand how to express the mechanical characteristics of materials, constitutive equations and generalized Hook law.
CO4	Be able to analyze real problem and to formulate the conditions of theory of elasticity Applications
CO5	Use the equilibrium equations stated by the displacements and compatibility conditions stated by stresses
CO6	Determine the boundary restrictions in calculations. Solve the basic problems of the theory of elasticity by using Airy function expressed as bi- harmonic function

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	1	2	1	-	1	1	1	2
CO2	3	3	2	3	2	1	-	1	1	2	2
CO3	3	2	2	3	2	1	-	2	1	1	2
CO4	2	3	2	3	2	1	-	1	1	1	2
CO5	3	3	2	3	2	1	-	1	2	1	2
CO6	2	1	3	2	1	2	-	-	1	-	1
Course	**2.5**	**2.5**	**2.16**	**2.5**	**1.83**	**1.16**	**-**	**1**	**1.16**	**1**	**1.83**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	2
CO4	1	1
CO5	1	2
CO6	2	1
Course	**1.66**	**1.33**

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions- Compatibility equations - Stress function – Boundary Conditions.

UNIT: 2

Two dimensional problems in rectangular co-ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading

UNIT: 3

Two dimensional problems in polar co-ordinates - General equations in polar co-ordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co-ordinates– Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

UNIT: 4

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution – Reciprocal theorem..

UNIT: 5

Torsion of Prismatic bars – Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method.

TEXT BOOKS

1. Theory of Elasticity- Stephen Timoshenko & J. N. Goodier, Mc.Grawhill Publishers

2. Advanced Mechanics of Solids L.S. Srinath, McGraw Hill Publishers

REFERENCES

1. Elasticity: Theory, Applications and Numeric- Martin H. Sadd, Wiley Publishers

2. Theory of Elasticity -Sadhu Singh 3rd Edition, Khanna Publishers

I Semester	STRUCTURAL DYNAMICS (D2518701)	L	T	P	C
		3	1	0	4

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

CO1	Analyze free and forced vibrations of SDOF systems including damping and vibration isolation.
CO2	Formulate and solve equations of motion for SDOF structural systems under dynamic loading.
CO3	Formulate equations of motion for multi degree of freedom structural systems.
CO4	Determine natural frequencies, mode shapes, and dynamic response of MDOF systems.
CO5	Evaluate natural frequencies and mode shapes of discrete and continuous systems.
CO6	Analyze structural response to earthquake excitations using deterministic methods.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-
CO5	3	2	-	2	-	-	-	-	-	-	-
CO6	3	3	2	2	-	-	-	-	-	-	-
Course	**3**	**2.6**	**2**	**2**	-	-	-	-	-	-	-

CO-PSO Mapping

	PSO1	PSO2
CO1	1	2
CO2	1	3
CO3	1	3
CO4	1	3
CO5	1	3
CO6	1	3
Course	**1**	**2.83**

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus

UNIT I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Victorian representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle.

UNIT II

Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis-Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's Principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems : Formulation and solution of the equation of motion - Freevibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

Introduction to Earthquake Analysis: Deterministic Earthquake Response: Systems on Rigid Foundations -Types of Earthquake Excitations – Lumped SDOF Elastic Systems, Translational Excitations -Generalized coordinate -SDOF Elastic Systems, Translational Excitations, Linear Static Method – Analysis for obtaining response of multi storied RC Building.

TEXT BOOKS

1 Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers

2 Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes and Distributors

3 Elementary Structural Dynamics- V.K. Manika Selvam, Dhanpat Rai Publishers

REFERENCE:

1 Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.

2 Theory of Vibration -William T Thomson, Springer Science.

3 Structural Dynamics of Earthquake Engineering - Theory and Application using Mathematica and Matlab- S. Rajasekharan

I Semester	MATRIX ANALYSYS OF STRUCTURE (D2518702)	L	T	P	C
		3	1	0	4

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

CO1	**Describe** the fundamental concepts of matrix methods of structural analysis including static/kinematic indeterminacy, element stiffness matrices, and force-displacement relationships.
CO2	**Apply** the stiffness method for the analysis of trusses, continuous beams, and plane frames using element and global stiffness equations.
CO3	**Formulate** and **analyze** stiffness matrices for grid elements using coordinate transformations for grid-type structural systems.
CO4	**Solve** structural problems involving tapered and curved beams using appropriate stiffness method formulations.
CO5	**Analyze** structures involving complex loading and support conditions (thermal, settlement, inertial) using advanced stiffness method concepts including static condensation and sub-structuring.
CO6	**Apply** the flexibility method to analyze indeterminate structures such as plane trusses, continuous beams, and frames including side sway and settlements using system approach.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	3	2	1	-	1	1	-	-	-	-
CO2	-	3	2	1	-	1	1	-	-	-	-
CO3	1	3	2	1	-	1	1	-	-	-	-
CO4	-	3	2	1	-	1	1	-	-	-	-
CO5	-	3	2	1	-	1	1	-	-	-	-
CO6	-	3	2	1	-	1	1	-	-	-	-
Course	**1**	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**

CO-PSO Mapping

	PSO1	PSO2
CO1	-	-
CO2	-	2
CO3	-	2
CO4	-	3
CO5	-	3
CO6	-	-
Course	**-**	**2.5**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

UNIT: 1

Introduction of matrix methods of analysis – Static and kinematic indeterminacy – Degree of freedom– Structure idealization-stiffness and flexibility methods – Suitability: Element stiffness matrix for truss

element, beam element and Torsional element- Element force - displacement equations.

UNIT: 2

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT: 3

Stiffness method for Grid elements – development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT: 4

Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring –Loads between joints-Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT: 5

Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using system approach

TEXT BOOKS

1. Matrix analysis of structures, Robert E Sennet- Prentice Hall-Englewood cliffs-New Jercy
2. Advanced structural analysis, P. Dayaratnam- Tata McGraw hill publishing company limited.
3. Structural Analysis Matrix Approach - Pandit and Gupta, Mc Graw Hil Education

REFERENCES

1. Indeterminate Structural analysis, C K Wang, Amazon Publications
2. Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design, J.E. Bowls, 5e, Amazon Publications.
4. Matrix Analysis of Framed Structures 3e-William Weaver, Jr, James M. Gere, Van Nostrand Reinhold, Newyork
5. Matrix Methods of Structural Analysis Madhu B. Kanchi, Wiley Publications.
6. Indeterminate Structural Analysis by K. U. Muthu, IK International Publishing house.

I Semester	EXPERIMENTAL STRESS ANALYSYS (D25187A0)	L	T	P	C
		3	0	0	3

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

CO1	Examine the fundamentals of the theory of elasticity
CO2	Implement the principles and techniques of photo elastic measurement
CO3	Obtain the principles and techniques of strain gage measurement
CO4	Adopt the principles and techniques of moiré analysis
CO5	Apply the principles and techniques of holographic interferometer
CO6	Apply the principles and techniques of brittle coating analysis Understand the Fundamentals of the theory of elasticity

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	2	-	-	-	-	-	-
CO2	3	3	1	2	2	1	-	-	-	-	-
CO3	3	2	1	2	2	1	1	-	-	-	1
CO4	3	2	1	2	2	-	-	-	-	-	-
CO5	2	2	1	2	2	-	2	1	-	-	1
CO6	3	3	1	2	2	-	2	1	-	-	1
Course	**2.83**	**2.33**	**1**	**2**	**2**	**1**	**1.8**	**1**	**-**	**-**	**1**

CO-PSO Mapping

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1
CO6	1	1
Course	**1**	**1**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT-I

Introduction and Strain measurement methods – Model & Prototype – Dimensional analysis- Factors influencing model design – Scale factors and Model material properties – Methods of model design. Definition of strain and its relation to experimental determinations - properties of strain gauge systems – Mechanical, Optical, Acoustic and Pneumatic types

UNIT-II

Electrical resistance strain gages: Introduction – gauge construction – strain gauge adhesives - mounting methods – gauge sensitivities and gage factor – performance characteristics of wire and foil

strain gauges – environmental effects. Analysis of strain gauge data – the three element rectangular rosette – the delta rosette – correction for transverse sensitivity.

UNIT-III

Non – destructive testing: Introduction – objectives of non destructive testing. Ultrasonic pulse velocity method – Rebound Hammer method (Concrete hammer) – Acoustic Emission- application to assessment of concrete quality.

UNIT-IV

Theory of photo elasticity: Introduction – temporary double refraction – Index ellipsoid and stress ellipsoid – the stress optic law – effects of stressed model in a Polariscope for various arrangements - fringe sharpening.

UNIT-V

Two dimensional photo elasticity: Introduction – Iso-chromatic fringe patterns – isoclinic fringe patterns – compensation techniques – calibration methods – separation methods – materials for photo-elasticity – properties of photo-elastic materials.

TEXT BOOKS

1. Experimental Stress Analysis- William F. Riley and James W. Dally, Mc Graw Hill Publications
2. Advanced Mechanics of Solids 3e - L.S. Srinath, Tata Mc Graw Hill Publications

REFERENCE:

1. An Introduction to Experimental Stress Analysis – George Hamor Lee, Wiley Publishers
2. Experimental Stress Analysis- Sadhu Singh, Khanna Publishers
3. Solid Mechanics – S.M.A. Kazimi, Mc Graw Hill Publications

I Semester	ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL ENGINEERING (D25187A1)	L	T	P	C
		3	0	0	3

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

CO1	Solve one dimensional wave equation and one-dimensional heat conduction problems.
CO2	Explain functional dependency and solve Laplace and Euler's equations.
CO3	Apply separable kernel iterative method to solve integral equations of second kind
CO4	Estimate functional relationship between variables and parameters.
CO5	Apply the principles and techniques of holographic interferometer
CO6	Understand the fundamentals of theory of elasticity

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	2	3	-	-	-	-	-
CO2	2	2	3	2	1	3	-	-	-	-	-
CO3	2	1	2	3	3	3	-	1	-	-	-
CO4	1	2	2	2	3	3	1	-	-	1	1
CO5	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	1	1	3	1	-	-	-	-	-
Course	**1.75**	**1.8**	**2**	**2**	**2.5**	**2.6**	**1**	**1**	**-**	**1**	**1**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	3
CO2	2	2
CO3	2	2
CO4	1	2
CO5	1	2
CO6	2	1
Course	**1.25**	**2**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT-I

Transform Methods- Laplace transform methods for one-dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier transforms methods for one-dimensional heat conduction problems in infinite and semi-infinite rod

UNIT-II

Elliptic Equations-Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation. **Calculus Of Variations-** Variation and its properties - Euler's equation - Functionals

dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables - Some applications - Direct methods - Ritz and Kantorovich methods.

UNIT-III

Integral Equations- Fredholm and Volterra integral equations - Relation between differential and integral equations - Green's function -Fredholm equation with separable kernel - Iterative method for solving equations of second kind

UNIT-IV

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems - Richardson's extrapolation - Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

UNIT-V

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation. Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculations of Slopes & Deflections.

TEXT BOOKS

1. Introduction to Partial Differential Equations, Sankara Rao. K, , PHI, New Delhi, 1995

2. Numerical Methods For Scientific and Engineering Computations. M. K. Jain- S. R. K. Iyengar – R. K. Jain, New Age International (p) Ltd., Publishers

REFERENCE

1. Differential Equations and Calculus of Variations Elsgolts. L, Mir Publishers, Moscow, 1966

2. Fundamentals of Mathematical Statistics Gupta. S.C, & Kapoor. V.K, Sultan Chand & Sons, Reprint 1999.

3. Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K, National Publishing Company, Chennai
4. Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu Macmillan Publishers
5. Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986
6. Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers New Delhi

I Semester	DESIGN OF REINFORCED CONCRETE FOUNDATIONS (D25187A2)	L	T	P	C
		3	0	0	3

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

CO1	Ability to analyze and design centrally loaded isolated footings and column pedestals, applying empirical and theoretical methods in compliance with relevant design codes.
CO2	Capability to design reinforced and plain concrete wall footings, continuous strip wall footings, and strip footings under multiple columns, considering symmetric and unsymmetric loadings.
CO3	Competence in classifying and planning rigid and flexible raft foundations, understanding deflection criteria, load considerations, and modern analytical approaches.
CO4	Proficiency in designing flat slab rafts and beam–slab rafts using direct design and analytical models, including detailing of steel and edge beams.
CO5	Ability to evaluate and design combined piled raft foundations and special circular/annular rafts, incorporating load transfer mechanisms, settlement estimation, and theoretical analysis.
CO6	Capability to design under-reamed pile foundations for expansive soils and reinforced concrete retaining walls, considering earth pressure theories and stability requirements.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	2	-	-	-	1	1	2
CO2	3	3	3	2	2	-	-	-	1	1	2
CO3	3	3	3	2	2	-	-	-	1	1	2
CO4	3	3	3	2	3	-	-	-	1	1	2
CO5	3	3	3	2	3	-	-	-	1	1	2
CO6	3	3	3	2	3	-	-	-	1	1	2
Course	**3**	**3**	**3**	**2**	**2.5**	**-**	**-**	**-**	**1**	**1**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	1
CO4	3	3
CO5	3	2
CO6	3	1
Course	**3**	**1.8**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT – I

Foundation Structures & Design of Centrally Loaded Isolated Footings and Column Pedestals – Introduction, Rigid and Flexible Foundations, Loads and their Effects, Design Requirements, Geotechnical Design, Empirical and Exact Methods of Analysis of foundations, Design Loads for Foundations, Recommended Approach to Structural Design of Foundations.

Introduction, General Procedure for Design, Design of Square Footing of Uniform Depth (Pad Footing), Design of sloped Rectangular Footings, Design Procedure, Detailing of Steel, Design of Rectangular Pad Footings, Design of Plain Concrete Footings, Design of Pedestals, Design Calculation for Pedestals.

UNIT - II

Wall Footings – Introduction Simple Plain Concrete Wall Footings, Reinforced Concrete Continuous Strip Wall Footings, Design of continuous Strip Wall Footings, Design for Longitudinal Steel, R.C. T Beam Footings in Shrinkable Soils, Foundations of Partition Wall in Ground Floors, Summary.

Strip Footings Under Several Columns – Introduction, Design Procedure for Equally loaded and Equally Spaced Columns, Analysis of Continuous Strip Footing for Unsymmetric Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members.

UNIT – III

Raft Foundations – Introduction, Rigid and Flexible Foundations, common Types of Rafts, Deflection Requirements of Beams and Slabs in Rafts, General considerations in Design of Rigid Rafts, Types of Loadings and Choice of Rafts, Record of Contact Pressures Measured Under Rafts, Modern Theoretical Analysis.

Design of Flat Slab Rafts-Mat Foundations – Introduction, Components of Flat Slabs, Preliminary Planning of Flat Slab Rafts, Analysis of Flat Slab by Direct Design Method, Method of Analysis, Values for Longitudinal Distribution and Transverse, Redistribution, Shear in Flat Slabs, Bending of Columns in flat Slabs, Limitations of Direct Design Method for Mats, Detailing of Steel, Design of Edge Beam in Flat Slabs.

Beam and Slab Rafts – Introduction, Planning of the Raft, Action of the Raft, Approximate Dimensioning of the Raft, Design of the Beam and Slab Raft under Uniform Pressure, Structural Analysis for the Main Slab, Design of Secondary and Main Beams, Analysis by Winkler Model, Detailing of Steel.

UNIT - IV

Combined Piled Raft Foundations (CPRF) – Introduction, Types and uses of Piled Rafts, , Interaction of Pile and Raft, Ultimate Capacity and Settlement of Piles, Estimation of Settlement of Raft in Soils, Allowable Maximum and Differential Settlement in Buildings, Design of CPRF System, conceptual Method of Design, Conceptual Method of Analysis, Distribution of Piles in the Rafts, Theoretical Methods of Analysis.

Circular and Annular Rafts – Introduction, Positioning of chimney Load on Annular Raft, Forces Acting on Annular Rafts, Pressures Under Dead Load and Moment, Methods of Analysis, Conventional Analysis of Annular Rafts, Analysis of Ring Beams Under circular Layout of Columns, Analysis of Ring Beam Transmitting Column Load to Annular Rafts, Detailing of Annular Raft Under Columns of a Circular Water Tank.

UNIT – V

Under-reamed Pile Foundations – Introduction, Safe Loads on Under-reamed Piles, Design of Under-reamed Pile Foundation for Load Bearing Walls of Buildings, Design of Grade Beams, Design of Under-reamed Piles Under Columns of Buildings, Use of Under-reamed Piles for Expansive Soils.

Design of cantilever and Basement Retaining Walls – Introduction, Earth Pressure and Rigid Walls, Calculation of Earth Pressure on Retaining Walls, Design of Rigid Walls, Design of Ordinary R.C. cantilever Walls, Design of cantilever Walls without Toe, Design of Basement Walls, Calculation of Earth Pressures in Clays, Design of Free Standing Basement Walls.

TEXT BOOKS

1. Design of Reinforced Concrete Foundations by P. C Varghese, PHI Learning Private Limited., New Delhi.

REFERENCES

1. Design of Reinforced Concrete Structures by N. Subramaniam- Oxford University.
2. Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata Mc Graw Hill.

I Semester	STRUCTURAL OPTIMIZATION (D25187A3)	L	T	P	C
		3	0	0	3

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

CO1	Apply theoretical principles in optimization
CO2	Formulation of optimization models
CO3	Solution methods in optimization
CO4	Methods of sensitivity analysis and post processing of results
CO5	Applications to a wide range of engineering problems
CO6	Design of beams and frames using dynamic programming technique.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	2	1	1	-	-	-	1	-
CO2	3	3	2	2	2	1	-	-	-	1	-
CO3	3	3	3	2	1	1	-	-	-	1	1
CO4	3	3	2	3	2	1	-	-	-	1	-
CO5	3	3	-	3	2	1	-	-	-	2	1
CO6	3	3	3	3	2	1	-	-	-	2	2
Course	**3**	**2.66**	**2.5**	**2.5**	**1.66**	**1**	**-**	**-**	**-**	**1.33**	**1.33**

CO-PSO Mapping

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1
CO6	1	1
Course	**1**	**1**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

UNIT: 1

Introduction: Need and scope for optimization – statements of optimization problems- Objective function and its surface design variables- constraints and constraint surface- Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)

UNIT: 2

Classical optimization techniques: Differential calculus method, multi variable optimization by method

of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms- introduction, characteristics of fully stressed design theoretical basis-examples

UNIT: 3

Non-Liner programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization- Constrained minimization- Cutting plane method- Zoutendjik's method- penalty function methods.

UNIT: 4

Linear programming: Definitions and theorems- Simplex method-Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame.

UNIT: 5

Introduction to quadratic programming: Geometric programming- and dynamic programming- Design of beams and frames using dynamic programming technique.

TEXT BOOKS

1. Engineering Optimization Theory and Applications – S. S. Rao, Wiley Eastern Limited, New Delhi

REFERENCES

1. Optimization Concepts and Application in Engineering- Belegundu A. D. and Chandrupatla T.R, Cambridge University Press

I Semester	BRIDGE ENGINEERING (D25187B0)	L	T	P	C
		3	0	0	3

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

CO1	Design theories for super structure and substructure of bridges
CO2	Design Culvert, R.C.C T Beam Bridge.
CO3	Understand the behavior of continuous bridges, box girder bridges.
CO4	Possess the knowledge to design prestressed concrete bridges.
CO5	Design Railway bridges, Plate girder bridges, different types of bearings, abutments, piers and various types of foundations for Bridges
CO6	Design Substructural Elements and Pipe Culvert

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	1	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-
CO5	2	2	3	1	-	-	-	-	-	-	-
CO6	2	2	3	1	-	-	-	-	-	-	-
Course	**2**	**2**	**2.5**	**1**	-	-	-	-	-	-	-

CO-PSO Mapping

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2
Course	**2**	**2**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Masonry arch Bridge design details- Rise, radius, and thickness of arch- Arch ring- Dimensioning of sub structures- Abutments pier and end connections.(Ref: IRC- SP-13)

UNIT: 2

Super Structure: Slab bridge- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Pigeaud's method- design of longitudinal girders- Guyon-Messonet method- Hendry Jaegar method- Courbon's theory. (Ref:

IRC-21), voided slabs, T-Beam bridges.

UNIT: 3

Plate girder bridges- Elements of plate girder and their design-web-flange- intermediate stiffener-vertical stiffeners- bearing stiffener-design problem

UNIT: 4

Prestressed Concrete and Composite bridges- Preliminary dimensions-flexural and torsional parameters- Courbon's Theory – Distribution coefficients by exact analysis- design of girder section-maximum and minimum prestressing forces- eccentricity- live load and dead load shear forces- cable zone in girder- check for stresses at various sections- check for diagonal tension- diaphragms and end block design- short term and long term deflections- Composite action of composite brides- shear connectors- composite or transformed section- design problem. (Ref: IRC: Section-VI)

UNIT: 5

Sub structure- Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers-Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment-culvert entrance structure- Hydraulic design and structural design of pipe culverts-reinforcements in pipes .(Ref: IRC: SP-13)

TEXT BOOKS

1. Design of Concrete Bridges- M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers
2. Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications

REFERENCES:

1. Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
3. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
4. IRC 21-2009 Standard Specifications and code of practice for Road Bridges Section III

I Semester	REPAIR AND REHABILITATION OF STRUCTURES (D25187B1)	L	T	P	C
		3	0	0	3

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

CO1	Recognize the mechanisms of degradation of concrete structures and design durable concrete structures using suitable repair materials, admixtures, and non-destructive evaluation techniques.
CO2	Conduct field monitoring and apply strengthening and stabilization techniques for beams, columns, and connections, including crack stabilization and stress reduction methods.
CO3	Design and suggest repair strategies for deteriorated concrete structures using bonded installation techniques such as externally bonded FRP, bolted plates, and near-surface mounted FRP.
CO4	Understand debonding mechanisms and strengthening applications for floors and other structural components to enhance load-carrying capacity.
CO5	Assess and improve concrete performance using fibre-reinforced, lightweight, no-fines, and fly ash concretes, focusing on properties, mix proportions, durability, and applications.
CO6	Evaluate high-performance concretes, including self-consolidating concrete, in terms of material selection, properties, and qualification tests to develop effective maintenance and rehabilitation strategies.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	-	1	1	-	-	-	-	1
CO2	2	3	3	2	2	1	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	1
CO4	2	2	3	2	2	1	-	-	-	-	1
CO5	3	2	2	-	1	-	-	-	-	-	2
CO6	3	3	3	2	1	-	-	-	-	-	2
Course	**2.7**	**2.5**	**2.7**	**2**	**1.4**	**1**	**-**	**-**	**-**	**-**	**1.3**

CO-PSO Mapping

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	2
CO5	3	1
CO6	3	2
Course	**3**	**2**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Materials for repair and rehabilitation -Admixtures- types of admixtures-purposes of using admixtures-chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods-Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods-Ultrasound pulse velocity methods- Pull out tests.

UNIT: 2

Strengthening and stabilization- Techniques- design considerations-Beam shear capacity strengthening-Shear Transfer strengthening-stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT: 3

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding- CDC debonding-plate end debonding- strengthening of floor of structures

UNIT: 4

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete-Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes

UNIT: 5

High performance concretes- Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes- Self Consolidating concrete-properties- qualifications.

TEXT BOOKS

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications

2. Repair and Rehabilitation of Concrete Structures – P.I. Modi, C.N. Patel, PHI Publications

3. Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors

4. Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company

2. Concrete Repair and Maintenance illustrated- Peter H Emmons

3. Concrete Chemical Theory and Applications- Santa Kumar A.R. , Indian Society for Construction Engineering and Technology, Madras

4. Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

I Semester	ADVANCED REINFORCED CONCRETE DESIGN (D25187B2)	L	T	P	C
		3	0	0	3

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

CO1	Analyze the limit state behavior of RC structures considering plastic hinge rotation, moment redistribution, IS code provisions, and loading patterns for fixed and continuous beams, and inelastic slab analysis.
CO2	Apply yield line theory using virtual work and equilibrium methods to determine ultimate load capacity of slabs with various geometries and boundary conditions.
CO3	Analyze ribbed slabs for moments, shears, ultimate moment of resistance, deflection, and reinforcement arrangement as per design requirements.
CO4	Evaluate flat slabs using direct design and equivalent frame methods, including moment distribution, shear transfer, and reinforcement detailing, while addressing method limitations.
CO5	Design reinforced concrete deep beams, corbels, and nibs using IS 456 provisions, including checks for local failures, force analysis, and reinforcement detailing.
CO6	Design slender and eccentrically loaded columns using additional moment method, prepare interaction diagrams, and provide appropriate reinforcement detailing.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	-	-	-	-	1	-	2
CO2	3	2	3	2	-	-	-	-	1	-	2
CO3	3	2	3	2	-	-	-	-	1	-	2
CO4	3	2	3	2	-	-	-	--	1	-	2
CO5	3	2	3	3	-	-	-	-	1	-	2
CO6	3	2	3	3	-	-	-	-	1	-	2
Course	**3**	**2**	**3**	**2.5**	**-**	**-**	**-**	**-**	**1**	**-**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	3
CO5	3	3
CO6	3	3
Course	**3**	**2.6**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Deflection of Reinforced Concrete Beams and Slabs: Introduction, Short-term deflection of beams and slabs, Deflection due to imposed loads, Short-term deflection of beams due to applied loads, Calculation of deflection by IS 456, Deflection of continuous beams by IS 456, Deflection of slabs. Estimation of Crack width in Reinforced Concrete Members: Introduction, Factors affecting crack

width in beams, Mechanisms of flexural cracking, Calculation of crack width, Simple empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking.

UNIT: 2

Redistribution of Moments in Reinforced Concrete Beams: Introduction, Redistribution of moments in fixed beam, Positions of points of contraflexure, Conditions for moment redistribution, Final shape of redistributed bending moment diagram, Moment redistribution for a two-span continuous beam, Advantages and disadvantages of moment redistribution, Modification of clear distance between bars in beams (for limiting crack width) with redistribution, Moment- curvature (M - ψ), Relation of reinforced concrete sections.

Approximation Analysis of Grid Floors: Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko's plate theory. Analysis of grid by stiffness matrix method, Analysis of grid floors by equating joint deflections, Comparison of methods of analysis, Detailing of steel in flat grids.

UNIT: 3

Design of Flat Slabs: Introduction, Proportioning of Flat Slabs, Determination of Bending moment and Shear Force, Direct Design method, Equivalent Frame method, Slab Reinforcement.

UNIT: 4

Chimneys : Introduction, Design factors, Stresses due to Self Weight and Wind load, Stress in horizontal reinforcement, Temperature Stresses, Combined effect of Self Weight, Wind load and Temperature, Temperature stresses in Hoop(Horizontal) Reinforcement.

UNIT: 5

Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading or classifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Fire resistance by structural detailing from tabulated data, Analytical determination of the ultimate bending moment, Capacity of reinforced concrete beams under fire, Other considerations.

TEXT BOOKS

1. Advanced Reinforced Concrete Design by P.C. Varghese Prentice Hall India Limited

REFERENCES:

1. Reinforced Concrete Structures by Robert Park & Thomas Paulay, Wiley Publications.
2. Design of Reinforced Concrete Strutures by N. Subrahmanyam, Oxford Publications
3. Advanced Reinforced Concrete Design by N. Krishna Raju, CBS Publishers and Distributers Pvt Ltd.

I Semester	FRACTURE MECHANICS (D25187B3)	L	T	P	C
		3	0	0	3

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

CO1	Predict material failure for any combination of applied stresses.
CO2	Estimate failure conditions of a structures
CO3	Determine the stress intensity factor for simple components of simple geometry
CO4	Predict the likelihood of failure of a structure containing a defect
CO5	Analyze fatigue crack propagation behavior using fatigue crack growth laws, threshold stress intensity factors, Paris law, and retardation effects.
CO6	Apply fracture mechanics principles to concrete structures by understanding strain softening behavior and Bazant's size effect law for predicting failure.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	2	-	-	-	-	1
CO2	3	3	2	2	2	2	-	-	-	-	1
CO3	3	2	3	2	2	2	1	-	-	-	1
CO4	3	2	2	3	2	2	1	-	-	-	1
CO5	2	2	2	3	2	2	2	1	-	-	1
CO6	3	3	3	3	2	2	2	1	-	-	2
Course	**2.83**	**2.33**	**2.33**	**2.5**	**2**	**2**	**1.5**	**1**	**-**	**-**	**1.16**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2
Course	**2**	**2**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Introduction: Fundamentals of elastic and plastic behaviour of materials- stresses in a plate with a hole – Stress Concentration factor-modes of failure- Brittle fracture and ductile fracture- history of fracture mechanics-Griffiths criteria for crack propagation cracks- Energy release rate, GI GII and GIII - Critical energy release rate GIc , GIIc and GIIIc – surface energy - R curves – compliance.

UNIT: 2

Principles of Linear Elastic Fracture Mechanics: SOM vs Fracture Mechanics -stressed based Criteria for fracture- Stress Intensity Factors- KI K II and K III – Critical stress Intensity Factors, KIc KIIc and KIIc – crack tip plastic zone – Erwin's plastic zone correction –Critical crack length-Load carrying capacity of a cracked component- Design of components based on fracture mechanics.

UNIT: 3

Mixed mode crack propagation - Maximum tangential stress criterion – crack propagation angle - Material characterisation by Crack Tip Opening Displacements (CTOD)- Crack Mouth Opening Displacement (CMOD)- Critical crack tip opening displacement (CTODc) –critical Crack Mouth Opening Displacement (CMODc).

UNIT: 4

Fatigue Crack propagation - Fatigue load parameters Fatigue crack growth curve –Threshold stress intensity factor-Paris law- Retardation effects.

UNIT: 5

Applications of fracture Mechanics to concrete - reasons –strain softening behaviour –Bazant's sizeffect law.

TEXT BOOKS

1. Elementary engineering fracture mechanics – David Broek – Sijthoff & Noordhoff – Netherlands
2. Elements of Fracture Mechanics – Prasanth Kumar, Wiley Eastern Publications

REFERENCES

1 Fracture Mechanics: Fundamentals and applications – T. L. Andrason, PhD, CRC publications
2 Fracture Mechanics of Concrete: Applications of fracture mechanics to concrete, Rock, and other quasi-brittle materials - Surendra P. Shah, Stuart E. Swartz, Chengsheng Ouyang, John Wiley & Son publications.

I Semester	ADVANCED CONCRETE TECHNOLOGY LABORATORY (D2518703)	L	T	P	C
		0	1	2	2

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

CO1	Investigate the effect of water–cement ratio on the workability of different concrete mixes through laboratory testing
CO2	Evaluate the influence of water–cement ratio on the compressive strength of various concrete types.
CO3	Analyze the impact of varying coarse-to-fine aggregate ratios on concrete workability.
CO4	Assess the effect of coarse-to-fine aggregate ratios on the strength characteristics of concrete
CO5	Measure strains in structural elements using electrical resistance strain gauges and interpret the data.
CO6	Perform and interpret non-destructive and qualification tests on concrete, including Rebound Hammer test, UPV test, L-Box, J-Box, U-Box, and Slump tests, to assess quality and performance.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	3	-	-	1	1	-	2
CO2	3	3	2	3	3	-	-	1	1	-	2
CO3	3	3	2	2	3	-	-	1	1	-	2
CO4	3	3	2	2	3	-	-	1	1	-	2
CO5	3	3	2	3	3	-	-	2	1	-	2
CO6	3	3	2	3	3	2	-	2	1	-	2
Course	**3**	**3**	**2**	**2.7**	**3**	**2**	-	**1.3**	**1**	**-**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	3	2
Course	**2.1**	**2**

1. Slightly 2. Moderately 3. Substantially

List of Experiments

1. Study on Water / Cement Ratios Vs Workability of **different concretes with Admixtures**
2. Study on Water / Cement Ratios Vs Strength of **different concretes with different types of Cements.**
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non destructive testing- **Rebound Hammer test, UPV test**
7. Qualifications tests on Self compaction concrete- L Box , J Box , U box and Slump tests.
8. **Determination of Flexural Strength of Self Compacted Concrete.**

NOTE: A minimum of five experiments from the above set have to be conducted

I Semester	ADVANCED STRUCTURAL ENGINEERING LABORATORY (D2518704)	L	T	P	C
		0	1	2	2

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

CO1	Understand and differentiate the behavior of under-reinforced, over-reinforced, and balanced RCC sections in terms of deflection and cracking
CO2	Analyze the performance of RCC beams under combined bending and shear, and evaluate their modes of failure
CO3	Examine the structural behavior and load-carrying capacity of one-way and two-way RCC slabs under different support conditions
CO4	Determine the modulus of elasticity of concrete experimentally and relate it to theoretical values.
CO5	Develop practical skills in extraction, preparation, and testing of concrete core samples from pavements for strength and quality assessment
CO6	Apply knowledge of RCC behavior, slab and beam performance, and concrete material properties to evaluate structural safety, serviceability, and durability.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	-	-	1	1	-	1
CO2	3	3	2	2	2	1	-	1	1	-	1
CO3	3	2	3	2	1	1	-	1	1	1	1
CO4	3	2	-	3	2	-	-	-	1	-	2
CO5	2	2	-	3	2	2	1	1	2	1	2
CO6	3	3	3	3	2	2	1	2	2	2	3
Course	**2.83**	**2.33**	**2.5**	**2.5**	**1.66**	**1.5**	**1**	**1.66**	**2.5**	**1.33**	**1.66**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2
Course	**2**	**2**

1 Slightly 2. Moderately 3. Substantially

List of Experiments

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections
2. Study on Performance of RCC Beams designed for Bending and failing in Shear
3. Study on Performance of RCC Beams designed for Shear and failing in Bending
4. Study on Performance of RCC One way slabs
5. Study on Performance of RCC Two way slabs with simply supported edge conditions
6. Study on Performance of RCC Two way slabs with fixed edge conditions
7. **Calculation of Elastic Modulus of Concrete**
8. Extraction and Study of Concrete Core samples from pavements

NOTE: A minimum of five experiments from the above set have to be conducted as demonstration to entire class.

II Semester	FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING (D2528700)	L	T	P	C
		3	1	0	4

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

CO1	Develop finite element formulations of 1 degree of freedom problems and solve them
CO2	Understand any Finite Element software to perform stress, thermal and modal analysis
CO3	Compute the stiffness matrices of different elements and system
CO4	Interpret displacements, strains and stress resultants
CO5	Design CST & LST of Plane stress and strains
CO6	Find the shape function using Iso Parametric Evaluation

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	1	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	1	1	-	-	-	-	-	-	-
CO5	2	2	3	1	-	-	-	-	-	-	-
CO6	2	2	2	1	-	-	-	-	-	-	-
Course	**2**	**2**	**1.83**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CO-PSO Mapping

	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2
CO6	-	2
Course	**-**	**2**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation - variational approaches - weighted residual methods

UNIT: 2

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports- Galerkin's method for 1-D truss – Computation of stress in a truss element.

UNIT: 3

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading- Galerkin's method - 2-D Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame examples.

UNIT: 4

Finite element formulation for plane stress, - plane strain and axi-symmetric problems- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems- comparison of CST and LST elements – convergence of solution- interpretation of stresses.

UNIT: 5

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation- patch test.

TEXT BOOKS

1. A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John

Wiley & Sons Publications

REFERENCES:

1 Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D. Belgunda, PHI publications.

2 Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New Age International (P) Limited.

II Semester	EARTHQUAKE RESISTANT DESIGN (D2528701)	L	T	P	C
		3	1	0	4

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

CO1	Interpret dynamic analysis result for design and analysis purposes
CO2	Apply Structural dynamics theory to Earthquake analysis response and design of structure
CO3	Apply Knowledge to create mathematical modeling
CO4	Understand qualitative and quantitative representations of Earth quake magnitude
CO5	Interpret dynamic analysis result for design and analysis purposes.
CO6	Create simple models for structures using knowledge of structural dynamic.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	2	3	2	2	-	1	-	-	1
CO2	3	2	2	1	2	2	-	-	1	-	-
CO3	2	2	2	3	2	2	-	-	1	-	-
CO4	3	1	2	3	2	2	-	1	2	1	-
CO5	1	1	2	3	2	2	-	1	2	-	-
CO6	2	1	2	3	1	2	-	-	-	-	-
Course	**2.16**	**1.33**	**2**	**2.66**	**1.83**	**2**	**-**	**1**	**1.5**	**1**	**1**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	3
CO2	2	3
CO3	2	2
CO4	2	3
CO5	2	3
CO6	2	2
Course	**2**	**2.66**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Engineering seismology – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects.

UNIT: 2

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames(MRF) – ductility of MRF – Infill wall – Non- structural elements

UNIT: 3

Calculation of EQ load – 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls

UNIT: 4

Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts- Base isolation – Adaptive systems – case studies

UNIT: 5

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

TEXT BOOKS:

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi.
2. Earthquake Resistant Design of Structures- S.K. Duggal, Oxford Publications

REFERENCE

1 Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

2 Earthquake Resistant Design and Risk Reduction- David Dowrick

3 IS 4326 -1998: Earthquake Resistant Design and Construction of Buildings

4 IS 1893 (Part 1 to 5)- 2002: General Provisions and Building

5 IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings

6 IS 13920-1997: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces

7 IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building

II Semester	STABILITY OF STRUCTURES (D2528702)	L	T	P	C
		3	1	0	4

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

CO1	Analyze different types of structural instabilities
CO2	Execute and work out the Elastic buckling using various methodologies.
CO3	Execute and work out the In-elastic buckling using various methodologies.
CO4	Examine the behaviour of beam columns and frames with and without side sway using classical and stiffness methods
CO5	To be well versed in the lateral buckling, torsional buckling, Flexural torsional buckling of various beams and non-circular sections.
CO6	Analyze the effect of cross-sectional properties (such as warping constant, torsional constant, and moment of inertia) on the lateral-torsional buckling behavior of beams

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	2	1	1	1	1	1	2
CO2	3	3	2	3	2	1	1	1	1	1	2
CO3	3	3	2	3	2	1	1	1	1	1	2
CO4	3	2	2	3	2	1	1	1	1	1	2
CO5	3	2	2	3	2	1	1	1	1	1	2
CO6	3	2	2	3	2	1	1	1	1	1	2
Course	**3**	**2.8**	**2**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	1	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	3	2
CO6	2	2
Course	**2**	**2**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Beam columns: Differential equation for beam columns – Beams column with concentrated loads – continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses

UNIT: 2

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode.

UNIT: 3

In-elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames

UNIT: 4

Torsional Buckling: Pure torsion of thin walled bars of open cross section – Non uniform torsion of thin walled bars of open cross section - Torsional buckling – Buckling of Torsion and Flexure

UNIT: 5

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending

TEXT BOOKS

1. Theory of Stability of Structures by Alexander ChaJes.
2. Theory of Elastic Stability by S. P. Timshenko & J.M. Gere-Mc Graw Hill Publications

REFERENCES:

1. Fundamentals of Structural Stability by George J Simitses & Dewey H. Hodges, Elsevier Publications

2. Elastic Stability of Structural Elements, N.G.R. Ayyangar Macmillan Publications

II Semester	ANALYSIS OF TALL STRUCTURES (D25287C0)	L	T	P	C
		3	0	0	3

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

CO1	Analysis the design principles and different types of loading
CO2	Exanmine the Various structural systems used for Tall structures.
CO3	Capable of Analyzing the tall structures
CO4	Design of structural elements for secondary effects
CO5	Execute stability analysis, overall buckling analysis of frames
CO6	Analysis for various secondary effects –such as Creep, Shrinkage and Temperature

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	-	-	-	-	-	-
CO2	3	3	2	2	2	1	-	-	-	-	-
CO3	3	2	3	2	1	1	1	-	-	-	1
CO4	3	2	3	3	2	-	-	-	-	-	-
CO5	3	2	3	3	2	2	2	1	-	-	1
CO6	3	3	3	3	2	2	2	1	-	-	2
Course	**3**	**2.33**	**2.66**	**2.5**	**1.66**	**1.5**	**1.8**	**1**	**-**	**-**	**1.33**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2
Course	**2**	**2**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Design Criteria Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete.

UNIT: 2

Gravity Loading – Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.

UNIT: 3

Behavior of Structural Systems- Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, In-filled frames, Shear walls, Coupled Shear walls, Wall–Frames, Tubular, Outrigger braced, Hybrid syst

UNIT: 4

Analysis and Design- Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral UNIT, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

UNIT: 5

Stability Analysis- Overall buckling analysis of frames, wall–frames, Approximate methods, Second-order effect of gravity loading, P–Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out of plumb effects, Effect of stiffness of members and foundation rotation in stability of structures.

TEXT BOOKS

1. Bryan Stafford Smith and Alex Coull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 1991.
2. Structural Design of Multistoried Buildings U.H. Varyaani, South Aisna Publishers

REFERENCE:

1. Structural Analysis and Design of Tall Buildings Bungle S. Taranath, McGraw-Hill, 1988
2. High Tise Building Structures Woflgang Shcueller, John Wiley & Sons Inc
3. Art of the Skyscraper: The Genius of Fazulur R Khan- Ali Mir, Rizzoli International Publications

II Semester	ADVANCED STEEL DESIGN (D25287C1)	L	T	P	C
		3	0	0	3

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

CO1	Analyze combined shear and tension in both bearing-type and slip-critical bolted connections, including the effects of prying action.
CO2	Describe the concept of plastic hinges and state the fundamental conditions required for plastic analysis.
CO3	Analyze and design bolted framed, seat, and bracket connections under various loading conditions.
CO4	Design angular roof trusses, tubular trusses, and trusses for railway platforms to meet structural and functional requirements
CO5	Design compression and tension members for truss girder bridges as per relevant codes.
CO6	Analyze the design forces in bridge members such as compression and tension members under different loading conditions.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2	1	2	2	3	2	2
CO2	3	2	2	2	1	1	1	1	2	1	2
CO3	3	3	3	2	2	1	2	2	3	2	2
CO4	3	3	3	2	2	1	2	2	3	2	2
CO5	3	3	3	2	2	1	2	2	3	2	2
CO6	3	3	3	2	2	1	2	2	3	2	2
Course	**3**	**2.6**	**2.8**	**2**	**1.8**	**1**	**1.8**	**1.8**	**2.8**	**1.8**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	1	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	3	2
CO6	2	2
Course	**2**	**2**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT-I

Simple Connections – Riveted, Bolted Pinned And Welded Connections: Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT-II

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli - shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT-III

Eccentric And Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT-IV

Analysis And Design Of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT-V

Design Of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members;

wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

TEXT BOOKS

1.Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2.Design of steel structures by N. Subramanian, Oxford University Press
3.Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Publishes Journals Department.

REFERENCE

1.Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2.Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education, Edition 2012.
3.Indian Standard Code – IS – 800-2007.
4.Indian Standard Code – IS – 875 – Part III – 2015

II Semester	ANALYSYS OF OFFSHORE STRUCTURES(D25287C2)	L	T	P	C
		3	0	0	3

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

CO1	Explain the types and concepts of offshore structures, principles of flotation, fluid pressure, hydrostatic particulars, stability criteria, and motions of floating bodies.
CO2	Apply principles of mass and momentum conservation, Euler's equation, Bernoulli's equation, and linear wave theory to determine wave characteristics, particle kinematics, and wave energy.
CO3	Analyze wave forces on small bodies using Morison's equation, estimate forces on vertical cylinders, and assess current forces and marine growth effects.
CO4	Evaluate the effect of marine growth and current forces on offshore members, and refine wave force estimations for design considerations.
CO5	Analyze wave forces on large bodies using Froude–Krylov and diffraction theories for practical offshore design applications.
CO6	Perform static and dynamic analysis of fixed offshore structures to ensure structural safety and serviceability under marine environmental loads.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	1	-	2
CO2	3	3	2	2	-	-	-	-	1	-	2
CO3	3	3	3	2	2	-	-	-	1	-	2
CO4	3	3	3	3	2	-	-	-	1	-	2
CO5	3	3	3	3	2	-	-	-	1	-	2
CO6	3	3	3	3	3	-	-	-	1	-	2
Course	**3**	**2.8**	**2.66**	**2.66**	**1.5**	**-**	**-**	**-**	**1**	**-**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	3
CO5	3	3
CO6	3	3
Course	**3**	**2.66**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Introduction to different types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body.

UNIT: 2

Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy's theory, dispersion relationship, water particle kinematics, wave energy.

UNIT: 3

Wave force estimation- Wave force on small bodies-Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders.

UNIT: 4

Wave force on large bodies-Froude-krylov theory, Diffraction theory.

UNIT: 5

Static and dynamic analysis of fixed offshore structures.

TEXT BOOKS

1. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
2. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.

REFERENCES

1. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis,Inc., Plainfield, Illinois, USA.
2. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
   McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.

II Semester	STRUCTURAL HEALTH MONITORING (D25287C3)	L	T	P	C
		3	0	0	3

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

CO1	Diagnose the distress in the structure by understanding the causes and factors
CO2	Assess the health of structure using static field methods.
CO3	Assess the health of structure using dynamic field tests
CO4	Carryout repairs and rehabilitation measures of the structure
CO5	Understand about Piezo –electric materials and other smart materials
CO6	Understand electro –mechanical impedance (EMI) technique, adaptations of EMI technique

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	2	1	-	2	-	-	-	-	-
CO2	1	1	2	2	-	2	-	1	-	-	-
CO3	1	2	2	2	-	2	-	-	-	1	-
CO4	-	1	2	3	-	2	-	-	1	-	-
CO5	1	1	3	2	-	1	-	-	-	-	-
CO6	1	2	2	2	-	1	-	-	-	1	-
Course	**1**	**1.33**	**2.16**	**2.5**	**-**	**1.66**	**-**	**1**	**1**	**1**	**-**

CO - PSO Mapping

	PSO1	PSO2
CO1	-	-
CO2	1	1
CO3	1	2
CO4	1	-
CO5	-	-
CO6	-	-
Course	**1**	**1.5**

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT-I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance

UNIT-II

Structural Health Monitoring: Concept, Various Measures, Structural Safety in Alteration. Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT – III

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT-IV

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT-V

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), Piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

TEXT BOOKS

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods withApplications, Douglas E Adams, John Wiley and Sons, 2007.

REFERENCES

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc.

II Semester	THEORY OF PLATES AND SHELLS (D25287D0)	L	T	P	C
		3	0	0	3

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

CO1	Derive and solve the governing differential equations for rectangular plates under various loading and boundary conditions using Navier and Levy methods.
CO2	Analyze symmetrically loaded circular and annular plates subjected to different loading scenarios using classical plate theory.
CO3	Explain the fundamentals of shell structures including classification, geometric properties, and formulation of equilibrium equations for shells.
CO4	Apply membrane and bending theories to compute stress resultants in shells with single and double curvature.
CO5	Formulate and analyze cylindrical shells using the Donnell-Karman-Jenkins (DKJ) equation and Schorer's theory, and apply design principles using ASCE design coefficients.
CO6	Design and analyze shell roofs such as elliptic paraboloid, conoidal, and hyperbolic paraboloid shapes using membrane theory and beam theory concepts, including the role of diaphragms.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	-	1	-	-	-	-	-
CO2	3	3	2	2	-	1	-	-	-	-	-
CO3	2	3	1	1	-	1	-	-	-	-	-
CO4	3	3	2	2	-	1	-	-	-	-	-
CO5	3	3	3	2	1	1	-	-	-	-	-
CO6	3	3	3	2	2	1	-	-	-	-	-
Course	**2.83**	**3**	**2.16**	**1.83**	**1.5**	**1**	**-**	**-**	**-**	**-**	**-**

CO-PSO Mapping

	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	2	
CO4	-	-
CO5	-	-
CO6	-	2
Course	**2**	**2**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Derivation of governing differential equation for plate – in plane bending and transverse bending effects- Rectangular plates: Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy's type of solutions for various boundary condition.

UNIT: 2

Circular plates: Symmetrically loaded, circular plates under various loading conditions, Annular plates.

UNIT: 3

Introduction to Shells - Single and double curvature- Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of membrane theory and bending theory.

UNIT: 4

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT: 5

Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

TEXT BOOKS

1. Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw-Hill book company, INC, New York.

2. Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications

Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd

REFERENCES:

1. Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press

2. A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.

3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill, New York

II Semester	PRECAST AND PREFABRICATED STRUCTURES (D25287D1)	L	T	P	C
		3	0	0	3

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

CO1	Explain the need, principles, types, and economy of prefabrication, along with modular coordination, standardization, and material selection.
CO2	Design and analyze prefabricated beams, columns, frames, and panels considering handling, erection stresses, and structural behaviour.
CO3	Design joints for structural connections ensuring strength, stiffness, and load transfer in precast construction.
CO4	Select and detail joints for waterproofing, non-structural fastenings, and thermal/structural expansion in precast elements.
CO5	Plan production setups, select manufacturing methods, manage precast element storage, and apply appropriate hoisting and erection techniques.
CO6	Design and detail precast structural units for various applications while incorporating provisions for resisting abnormal effects and avoiding progressive collapse.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	1	-	-	-	1	1	2
CO2	3	3	3	2	2	-	-	-	1	1	2
CO3	3	3	3	2	2	-	-	-	1	1	2
CO4	3	2	3	1	2	-	-	-	1	1	2
CO5	3	2	3	1	2	-	-	-	1	2	2
CO6	3	2	3	2	2	1	-	-	1	2	2
Course	**3**	**2.5**	**2.67**	**1.5**	**1.83**	**1**	**-**	**-**	**1**	**1.33**	**2**

CO-PSO Mapping

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	3	2
CO5	3	2
CO6	3	2
Course	**3**	**2.33**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT -I

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

UNIT -II

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT -III

Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

UNIT -IV

Production Technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT -V

Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TEXT BOOKS

1. Precast Concrete Structures- Kim S Elliott, CRC Press CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994
3. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

REFERENCES

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.

II Semester	EARTH RETAINING STRUCTURES (D25287D2)	L	T	P	C
		3	0	0	3

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

CO1	Understand the basics of Earth Dams, Retaining Structures, Slopes and Cuts
CO2	Apply the basics of lateral earth pressure theories.
CO3	Apply geotechnical engineering principles for the design of earth dams, retaining structures, slopes and cuts.
CO4	Analyze the stability of earth dams, slopes, cuts, and retaining structures
CO5	Aware of Current guidelines regarding the design of earth retaining structures
CO6	Design Retaining structures considering both external and internal stability aspect

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	1	1	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-
CO3	3	2	3	-	1	1	1	-	1	-	2
CO4	3	2	2	-	-	2	1	-	1	-	1
CO5	-	-	3	2	-	2	-	-	-	-	-
CO6	-	-	-	3	1	-	-	-	-	-	-
Course	**3**	**2**	**2.5**	**1.5**	**1**	**1.5**	**1**	**-**	**1**	**-**	**1.5**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	1
CO4	1	-
CO5	1	-
CO6	2	1
Course	**1.67**	**1**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

UNIT: 1

Earth pressures – Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.

UNIT: 2

Retaining walls – different types - Type of Failures of Retaining Walls – Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

UNIT: 3

Sheet Pile Structures – Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Rowe's moment reduction method – Location of anchors and Design of Anchorage system.

UNIT: 4

Soil reinforcement – Reinforced earth - Different components – their functions – Design principles of reinforced earth retaining walls.

UNIT: 5

Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – TVA method and Cummins' methods.

TEXT BOOKS

1. Principles of Foundation Engineering 7e by Braja Das, Cengage Learning
2. Foundation analysis and design by Bowles, J.E. – McGraw Hill

REFERENCES

1. Soil Mechanics in Engineering Practice – Terzaghi, K and Ralph, B. Peck 2e. – John Wiley & Sons.,
2. Analysis and Design of Foundations and Retaining Structures, Samsher Prakash, Gopal Ranjan and Swami Saran, Saritha Prakashan, New Delhi
3. NPTEL course materials on Geo-synthetics and Earth Retaining Structures

II Semester	INDUSTRIAL STRUCTURES (D25287D3)	L	T	P	C
		3	0	0	3

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

CO1	Plan the functional requirements of structural systems for various industries
CO2	Get an idea about the materials used and design of industrial structural elements.
CO3	Realize the basic concepts and design of power plant structures.
CO4	Design power transmission structures.
CO5	Possess the ability to understand the design concepts of Chimneys, Bunkers and Silos
CO6	Design of heavy load structure foundations

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	1	1	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-
CO3	3	2	3	-	1	1	1	-	1	-	2
CO4	3	2	2	-	-	2	1	-	1	-	1
CO5	3	-	3	2	-	2	-	-	-	-	-
CO6	-	-	-	3	1	-	-	-	-	-	-
Course	**3**	**2**	**2**	**2.5**	**1**	**1.5**	**1**	**-**	**1**	**-**	**1.5**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	3
CO2	2	2
CO3	2	1
CO4	1	3
CO5	1	1
CO6	2	1
Course	**1.66**	**1.88**

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT: 1

Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations

UNIT: 2

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations.

UNIT: 3

Design of Folded plates- Design considerations- analysis of folded plates- analysis of multibay folded plates- design of diaphragm beam

UNIT: 4

Power plant structures- Bunkers and silos- chimney and cooling towers-Nuclear containment structures

UNIT: 5

Power transmission structures- transmission line towers- tower foundations- testing towers

TEXT BOOKS

1. Advanced Reinforced Concrete design by N. Krishnam Raju, CBS Publications & Distributions
2. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
3. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

REFERENCES:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings
3. Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd

II Semester	COMPUTER AIDED DESIGN LABORATORY (D2528703)	L	T	P	C
		0	1	2	2

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

CO1	Develop and implement computer programs for the analysis of beams subjected to various loading conditions.
CO2	Analyze and design reinforced concrete multistoried buildings in compliance with relevant codes of practice.
CO3	Perform structural analysis of plane and space trusses using appropriate computational methods.
CO4	Analyze plane and space frames considering different loading and support conditions.
CO5	Determine mode shapes and natural frequencies of tall buildings using lumped mass (stick model) approximation
CO6	Integrate programming techniques with structural analysis and design principles for efficient modelling of complex structures.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	3	-	-	1	1	-	2
CO2	3	3	3	2	2	2	-	1	1	2	2
CO3	3	3	2	2	3	-	-	1	1	-	2
CO4	3	3	2	2	3	-	-	1	1	-	2
CO5	3	3	2	3	3	-	-	1	1	-	2
CO6	3	3	3	3	3	1	-	2	1	2	3
Course	**3**	**3**	**2.33**	**2.33**	**2.83**	**1.5**	**-**	**1.77**	**1**	**2**	**2.17**

CO-PSO Mapping

	PSO1	PSO2
CO1	1	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	3	2
CO6	2	2
Course	**2**	**2**

1. Slightly 2. Moderately 3. Substantially

List of Experiments

Analysis and Design using STAAD Pro / STAAD FOUNDATION / ETABS / ANSYS

1. Programming for beams subject to different loading
2. Analysis and Design of reinforced concrete multistoried building
3. Analysis of plane and space truss
4. Analysis of plane and space frame
5. Determination of mode shapes and frequencies of tall buildings using lumped mass (stick model) approximation

NOTE: A minimum of Four from the above set have to be conducted.

REFERENCE:

1. Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

II Semester	STRUCTURAL DESIGN LABORATORY (D2528704)	L	T	P	C
		0	1	2	2

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

CO1	Analyze wind loads, pressure distribution and their influence on stability and serviceability of tall buildings using code provisions and software
CO2	Analyze prestressing effects, loss calculations and load distribution for safe bridge design.
CO3	Study stress resultants, buckling and deformation behaviour of cylindrical shells under different loading conditions.
CO4	Evaluate structural behaviour, load transfer and foundation interaction for piers/abutments under service and extreme loads.
CO5	Carry out modal, response spectrum and time history analyses to assess seismic and dynamic performance.
CO6	Use modern tools, interpret results, recommend design/safety measures and communicate findings professionally.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	1	1	1	1	2
CO2	3	3	3	2	2	1	1	1	1	2	2
CO3	3	2	2	3	2	1	1	1	1	1	2
CO4	3	3	3	3	2	2	1	2	2	2	3
CO5	3	3	2	3	3	1	1	1	2	1	2
CO6	3	3	3	3	2	2	1	2	2	2	3
Course	**3**	**2.83**	**2.5**	**2.67**	**2.17**	**1.33**	**1**	**1.33**	**1.5**	**1.5**	**2.33**

CO-PSO Mapping

	PSO1	PSO2
CO1	2	3
CO2	2	3
CO3	2	3
CO4	2	3
CO5	2	3
CO6	2	3
Course	**2**	**3**

1. Slightly 2. Moderately 3. Substantially

List of Experiments

Analysis and Design using STAAD Pro. / STAAD FOUNDATION / ETABS / ANSYS

1. Wind analysis on tall structure
2. Analysis of pre stressed concrete bridge girder
3. Analysis of Cylindrical shell
4. Analysis of Bridge Pier and Abutment
5. Dynamic Analysis of Multistory structure

NOTE: A minimum of Four from the above set have to be conducted.

REFERENCE:

Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

II Semester	SEMINAR - II (D2528705)	L	T	P	C
		0	0	2	1

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

CO1	Identify emerging research topics, technical problems, or recent advancements in the field of specialization.
CO2	Conduct an in-depth literature review to analyze and summarize existing work in the chosen area
CO3	Develop critical thinking and the ability to compare, interpret, and evaluate technical information.
CO4	Prepare a well-structured seminar report following proper technical writing, referencing, and formatting standards.
CO5	Deliver effective oral presentations using appropriate communication tools and techniques.
CO6	Demonstrate self-learning, professional ethics, and confidence in addressing queries during discussions.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	-	-	1	1	1	2
CO2	2	3	2	2	2	-	-	1	2	1	3
CO3	3	3	2	3	2	-	1	2	2	2	2
CO4	2	2	2	2	2	-	-	1	3	2	2
CO5	2	2	1	1	2	-	-	2	3	2	2
CO6	2	2	2	1	1	-	3	2	2	2	3
Course	**2.33**	**2.5**	**1.83**	**1.83**	**1.83**	**-**	**2**	**1.5**	**2.16**	**1.66**	**2.33**

CO-PSO Mapping

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-
Course	**-**	**-**

1. Slightly 2. Moderately 3. Substantially

III Semester	RESEARCH METHODOLOGY & IPR (D2538700)	L	T	P	C
	SWAYAM 12 WEEK MOOC COURSE	3	0	0	3

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

CO1	Identify and formulate a valid research problem and apply appropriate investigation methods.
CO2	Conduct effective literature review while adhering to plagiarism norms and research ethics.
CO3	Prepare technical reports, research papers, and proposals with effective presentation skills.
CO4	Explain the fundamentals of intellectual property rights and patenting procedures.
CO5	Analyze patent rights, technology transfer, and use of patent databases.
CO6	Evaluate recent developments and applications of IPR in emerging and traditional knowledge domains.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	-	3	-	-	-	-	-	-	2
CO2	2	2	-	2	1	-	3	-	-	-	2
CO3	1	-	-	-	-	-	-	2	3	-	2
CO4	2	2	-	-	-	-	-	-	-	2	1
CO5	2	2	2	-	2	-	-	-	-	3	1
CO6	2	2	-	2	-	-	2	-	-	-	3
Course	**1.66**	**1.66**	**2**	**1.13**	**1.5**	**-**	**2.5**	**2**	**3**	**2.5**	**1.66**

CO-PSO Mapping

	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-
CO6	-	-
Course	-	-

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus

UNIT I

Meaning of research problem, Sources of research problem. Criteria:-Characteristics of a good research

problem. Errors in selecting a research problem, Scope and objectives of research problem. Approaches

of investigation of solutions for research problem, data collection, Analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, Analysis Plagiarism and Research Ethics

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT VI

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: "An Introduction For Science & Engineering Students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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END SEMISTER EXAMINATIONS

MODEL QUESTION PAPERS

M.TECH (STRUCTURAL ENGINEERING)

&

B.TECH (CIVIL ENGINEERING)

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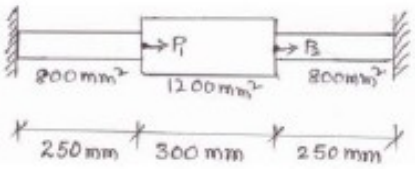
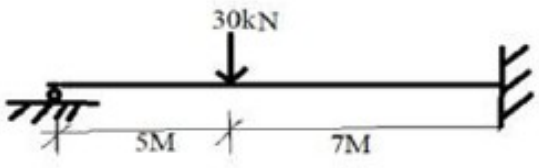
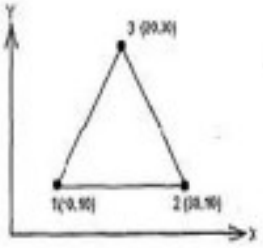
Course Code:D2528700 **DR25** HTNO

D.N.R COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
I M.Tech., II Semester Regular Examinations (Model Paper)
Subject Name: Finite Element Methods in Structural Engineering

Time: 3 Hrs Max. Marks: 60

S.no		Answer All Questions, One from each Unit Case Study is Compulsory	CO	TL	Marks
1.		**Unit-I**			**12 M**
	a)	What do you mean by essential and natural boundary conditions?	CO1	L2	(6M)
	b)	Explain the principle of the minimum potential energy method with an example.	CO1	L2	(6M)
		OR			
	a)	Explain the following: i) variational approach ii) weighted residual methods.	CO1	L2	(6M)
	b)	Using the Rayleigh-Ritz method find the approximate displacement of the uniform bar (EA constant) fixed at one end and subjected to a static point load at the other end. The bar is also subjected to a linearly varying axial load	CO1	L3	(6M)
		Unit-II			**12 M**
2.	a)	Determine the stresses for the given assembly as shown in fig. P1=200 kN, P2=400 kN, E=70 kN/mm2 	CO2	L3	(6M)
	b)	For the beam shown in figure below, determine the nodal displacements. Given E = 200 GPa and I = 8000 cm4 	CO2	L3	(6M)
		OR			
	a)	Derive the stiffness matrix for a plane truss element.	CO2	L4	(6M)
	b)	What are the properties of the stiffness matrix in a truss element?	CO2	L2	(6M)
3.		**Unit-III**			**12 M**
	a)	Solve for deflections and reactions in a rigid plane frame subjected to concentrated and distributed loads using FEM principles.	CO3	L3	(6M)
	b)	A propped cantilever beam of length 10 m carries a concentrated load of 20kN at the centre of span. EI=48x105N-m2. Determine deflection under the load and shear force and bending moment at mid span.	CO3	L3	(6M)
		OR			
	a)	Discuss the process of assembling the global stiffness matrix for a beam structure	CO3	L2	(6M)
	b)	Explain the application of Galerkin's method in the context of beam elements.	CO3	L2	(6M)

4.		**Unit-IV**			**12 M**
	a)	Compare and contrast Constant Strain Triangle (CST) and Linear Strain Triangle (LST) elements in FEM	CO4	L3	(6M)
	b)	What considerations are taken into account when treating body and surface forces in finite element analysis?	CO4	L2	(6M)
		OR			
	a)	Derive the stiffness matrix for a CST element considering plane stress conditions.	CO4	L4	(6M)
	b)	Analyze an axi-symmetric problem using FEM and interpret the resulting stress distribution	CO4	L4	(6M)
5.		**Unit-V**			**12 M**
	a)	Define with neat sketch, Iso-parametric, super-parametric, and sub-parametric elements	CO5	L2	(6M)
	b)	Explain the patch test.	CO5	L2	(6M)
		OR			
	a)	A plate of dimensions 15cm x 6cm x 1cm is subjected to an axial pull of 15kN. Assuming a typical element is of dimensions as shown in figure. Find shape functions at point (15, 20). Determine the strain displacement matrix and constitutive matrix. E=200GPa, μ=0.3 	CO5	L3	(12M)
		* * *			

H.T.No: | | | | | | | | | | | DR24 Course Code: **BT24CE3102**

D.N.R. COLLEGE OF ENGINEERING &TECHNOLOGY
(AUTONOMOUS)
III B.Tech I Semester Regular Examinations
Engineering Hydrology
Civil Engineering
(CE)

Time: 3hours Max.Marks:70

1. Answer all the questions form Section – A. Each question carries 2 Marks.
2. Answer any one question from each unit in section – B. Each question carries 10 Marks.

S. No.		PART – A (Answer All Questions	20 Marks		
			BTL	CO	M
1	a	Define Hydrology and mention its applications.	L2	CO1	2
	b	List the types of precipitation with examples.	L2	CO1	2
	c	What is a Unit Hydrograph?	L2	CO2	2
	d	List factors affecting infiltration.	L2	CO2	2
	e	Define Kennedy''s theory in canal design.	L2	CO3	2
	f	What are the causes of water logging?	L2	CO3	2
	g	Define reservoir yield and reservoir losses.	L2	CO4	2
	h	What is river training? List any two structures used.	L2	CO4	2
	i	Define Duty, Delta, and Base period.	L2	CO5	2
	j	What is Irrigation Efficiency? List types.	L2	CO5	2
		PART – B (All Questions Carry Equal Marks)	**50 Marks**		
		UNIT-1			
2.	a).	Explain the hydrological cycle with a neat diagram.	L2	CO1	5
	b).	Describe any two methods of measuring rainfall.	L2	CO1	5
		OR			
3.	a).	What is meant by consistency of rainfall data? Explain the double mass curve method.	L3	CO1	5
	b).	List the factors affecting infiltration. Explain the working of any one type of infiltrometer.	L2	CO1	5
		UNIT-2			
4.	a).	Explain the factors affecting runoff.	L2	CO2	5
	b).	The ordinates of 3hr Unit Hydrograph are given below. Derive the ordinates of 6hr Unit Hydrograph.	L3	CO2	5
		Time / CO1 / 3 / 6 / 9 / 12 / 15 / 18 / 21 / 24 / 27 / 30			
		Ordinates of 3 hr U.H / CO1 / 10 / 25 / 20 / 16 / 12 / 9 / 7 / 5 / 3 / 0			
		OR			
5.	a).	What is a Unit Hydrograph? State its assumptions and uses.	L2	CO2	5

	b).	Explain how an S-hydrograph is derived and mention its applications.	L3	CO2	5
		UNIT-3			
6.	a).	Design an irrigation channel to carry a discharge of 6 cumecs. Assume N=0.0225, m=1, bed slope = 0.25 m/km. Use Kennedy''s theory.	L2	CO3	5
	b).	Classify irrigation canals and explain the importance of canal alignment.	L3	CO3	5
		OR			
7.	a).	List and explain the modes of failure in a gravity dam.	L3	CO4	5
	b).	Explain the forces acting on a gravity dam with a neat sketch.	L3	CO4	5
		UNIT-4			
8.	a).	Explain the procedure for determining reservoir capacity using the mass curve and demand curve method.	L3	CO5	5
	b).	Evaluate different types of reservoir losses and suggest suitable control measures for evaporation and sedimentation.	L3	CO5	5
		OR			
9.	a).	Explain the various types of developments and investigations required for reservoir planning.	L2	CO5	5
	b).	Describe the different storage zones in a reservoir and their significance	L2	CO5	5
		UNIT-5			
10.	a).	Define Duty, Delta, and Base period. Derive the relationship among them.	L3	CO6	5
	b).	What are the factors affecting duty? Explain methods of improving duty and the procedure for determining evapotranspiration.	L3	CO6	5
		OR			
11.	a).	Differentiate between direct and indirect irrigation systems with suitable examples.	L3	CO6	5
	b).	Compare surface and sprinkler irrigation methods in terms of suitability for crops and soil conditions.	L3	CO6	5

…… THE END ……..