Department of Civil Engineering

Minutes of 5th BoS Meeting

Venue

R&D Lab, Mechanical Block

Sri Manakula Vinayagar Engineering College

Madagadipet, Puducherry – 605 107

Date & Time

24.09.2022 at 10.00 am

Department of Civil Engineering

24.09.2022

Minutes of 5th Board of Studies Meeting (UG)

The fifth Board of Studies meeting of Department of Civil Engineering was held on 24th September 2022 at 10:00 a.m in the R&D Lab, Mechanical Block, Sri Manakula Vinayagar Engineering College with Head of the Department in the Chair.

The following members were present for the BoS meeting,

Sl.No	Name of the Member with Designation and official Address	Members as per UGC norms
1	Dr. S.Sundararaman Professor and Head Department of Civil Engineering, SMVEC, Madagadipet – 605107	Chairman
2	Dr R Senthil Professor& HOD Civil, Division of Structural Engineering, Department of Civil Engineering, College of Engg., Guindy, Anna University, Chennai	Subject Expert (Pondicherry University Nominee)
3	Dr.R.Malathy Professor and Dean (Research) Dept. of Civil Engineering, Sona College of Technology, Salem	Subject Expert (Academic Council Nominee)
4	Dr A Rose Enid Teresa Professor and Head Rajalakshmi Engineering College, Chennai	Subject Expert (Academic Council Nominee)
5	Dr.B.Parthiban Assistant Manager – Structural Designer, Fujita Engineering India Pvt. Ltd., Chennai	Representative from Industry
6	Shri. G. Abdul Hakkim Design Engineer Emmarde Steel Private Limited, Puducherry	Alumni Member

7	Dr. S. Jayakumar Controller of Examinations Professor in Civil Engineering, SMVEC, Madagadipet – 605107	Internal Member
8	Ms.G . Yamuna Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet – 605107	Internal Member
9	Mr. K. Srinivasan Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet – 605107	Internal Member
10	Mrs. D.Sathiyasree Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet – 605107	Internal Member
11	Mrs. D.Jaichithra Associate Professor, Department of English, SMVEC, Madagadipet – 605107	Internal Member
12	Dr.T Sivaranjini Assistant Professor, Department of Physics, SMVEC, Madagadipet – 605107	Internal Member
13	Dr.S.Savithri Professor and Head, Department of Chemistry, SMVEC, Madagadipet – 605107	Internal Member
14	Mr.M.Devanathan Assistant Professor, Department of Mathematics, SMVEC, Madagadipet – 605107	Internal Member

Agenda of the Meeting

1. Review of 4th BoS Meeting
2. To discuss and approve the modifications/suggestions to be incorporated in the selected subject of VI Semester under Regulation 2020.
3. To appraise the members on the chosen Professional Elective Courses for VII semester under Regulation 2019 for the students admitted in the Academic Year 2019-20 (Final Year) and IV semester under Regulation 2020 for the students admitted in the Academic Year 2020-21 (Second Year)
4. To appraise the members on the chosen Open Elective Course for the VII semester under Regulation 2019 for the students admitted in the Academic Year 2019-20 (Final Year) and IV semester under Regulation 2020 for the students admitted in the Academic Year 2020-21 (Second Year)
5. To appraise the members on the chosen Skill Development Courses for the IV semester & II semester under Regulation 2020 for the students admitted in the Academic Year 2020-21 (Second Year) & 2021 – 22 (First Year)
6. To appraise the members on the chosen Certification Course for the IV semester & II semester under Regulation 2020 for the students admitted in the Academic Year 2020-21 (Second Year) & 2021 – 22 (First Year)
7. To discuss and approve the syllabi for VII & VIII Semester under Regulation 2020 for B.Tech. Civil Engineering
8. To discuss and approve the panel of examiners
9. To discuss & appraise about the Ph.D programme registration and the conduction of First Doctoral Committee meeting
10. Any other item with the permission of chair

Minutes of the Meeting

Dr. S. Sundararaman, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal members and thanked them for their presence in the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

BoS / 2021 / CIVIL / UG / 5.1

Chairman BoS, appraised the minutes of 4th BoS, its implementation and then it is confirmed with the approval for the incorporation of minor revisions needed as mentioned below.

S.No	Regulation	Semester	Course code with Name	Unit	Particulars
1	2020	V	U20CEP511 / Estimation Costing and Valuation Engineering	-	Members given the below suggestions for, the course "U20CEP511/ Estimation Costing and Valuation Engineering" I. In Experiment 2, instead of Estimation of Residential Building – I it can be mentioned as estimation of substructure. II. In Experiment 3, Estimation of Residential Building - II can be changed to estimation of super structure. III. To Include the estimate of underground water tank
2	2020	V	U20CEP509/ Sensors Applications in Civil Engineering Laboratory	-	Members suggested that in the course "U20CEP509/ Sensors Applications in Civil Engineering Laboratory", incorporation of wireless technology will be helpful to the students for understanding the recent advancement & it can be a study experiment rather than separate practical exercise.
3	2020	VI	U20CET614 / Design of Steel Structures	V	In, the Course "U20CET614 / Design of Steel Structures", the members suggested to change the syllabus of Unit V to Industrial Structure and Trusses. This is because the Unit I and Unit V deals with joints an connections and it is overlapping.
4	2020	V	U20CEE510/ Advanced Design of RCC Structures	V	Members suggested that the Professional Elective Course "U20CEE510/ Advanced Design of RCC Structures" Unit IV and V deals with bridges and Prestressed concrete structures which are a separate subjects and cannot be kept as separate units in this subject. Instead they asked to think on the topics such as Flat slab, shear wall design and corbel grid floor system.

The above corrections are approved by BoS members and the details are given in Annexure I.

BoS / 2021 / CIVIL / UG / 5.2	Discussed and approved the modifications incorporated in the course U20CET617 / Transportation Engineering of VI Semester under Regulation 2020. In this course Unit I, Unit II & Unit III includes Highway Engineering followed by Unit IV of Railway Engineering, Unit V of Airport & Harbour Engineering contents are combined to entire transportation engineering aspects. **The corrected and updated syllabi are approved by BoS members and the details are given in Annexure II.**
BoS / 2021 / CIVIL / UG / 5.3	Discussed and approved the B.Tech. Degree Professional Elective Courses "U19CEE71 Site Investigation Methods and Practices" have been chosen for VII semester under Regulation 2019 for the students admitted in the Academic Year 2019-20 (Final Year) and "U20CEE405 Alternative Building Materials and Technologies" have been chosen for IV semester under Regulation 2020 for the students admitted in the Academic Year 2020-21 (Second Year) **The list of professional elective courses and syllabi for the chosen course has been attached in Annexure III.**
BoS / 2021 / CIVIL / UG / 5.4	Discussed and approved the B.Tech. Degree Open Elective Course "U19CSO77 / Cloud Technology and its Applications" has been chosen for VII semester under R2019 for the B.Tech – Civil students admitted in the Academic Year 2019 – 20 (Final Year) and "U20ICO401 Sensors and Transducers" have been chosen for IV semester under Regulation 2020 for the students admitted in the Academic Year 2020-21 (Second Year) **The list of open elective courses and syllabi for the chosen course has been attached in Annexure IV.**
BoS / 2021 / CIVIL / UG / 5.5	Discussed and approved the B.Tech. Degree "Skill Development Courses 3: U20CES403/ Safety in Building Construction and Skill Development Courses 2: U20CES201/ MS Office – Word, Excel, Power point have been chosen for IV semester under R2020 for the B.Tech – Civil students admitted in the Academic Year 2020-21 (Second Year) and the students admitted in the Academic Year 2021-22 (First Year) **The list of Skill Development courses, chosen courses have been highlighted and attached in Annexure V.**

<table>
<tr><td>BoS / 2021 / CIVIL / UG / 5.6</td><td>Discussed and approved the B.Tech. Degree Certification Course “U20CEC456/ Internet of Things” has been chosen for IV semester for the students admitted in the Academic Year 2020-21 (Second Year) and “U20CEC274/Python Programming” has been chosen under Regulation 2020 for the students admitted in the Academic Year 2021-22 (First Year)

The list of Certification courses, chosen course has been highlighted and attached in Annexure VI.</td></tr>
<tr><td>BoS / 2021 / CIVIL / UG / 5.7</td><td>With respect to Regulation R-2020, the curriculum for 1 to 8 semesters and syllabi for 7th and 8th semesters, for B.Tech – Civil Engineering were discussed and the following comments are given by BoS members.

<table>
<tr><th>S.No</th><th>Regulation</th><th>Semester</th><th>Course code with Name</th><th>Unit</th><th>Particulars</th></tr>
<tr><td>1</td><td>2020</td><td>VII</td><td>Project Phase I U20CEW701 /</td><td>-</td><td>In Project Phase I, it would be better to include plan & design a building as per National Building code requirements.</td></tr>
</table>

The above corrections are incorporated in VII & VIII Semester and the syllabi are approved by BoS members. (Given in Annexure VII)</td></tr>
<tr><td>BoS / 2021 / CIVIL / UG / 5.8</td><td>The revised list of question paper setters and Evaluators (given in Annexure VIII) was presented and recommended by the BoS members to the Academic Council.</td></tr>
</table>

BoS / 2021 / CIVIL / UG / 5.9

Discussed and approved the Ph.D programme admission process. The board chairman appraised on the First Doctoral Committee meeting conducted for the research scholars (Part time external & Full time internal). The syllabus for mandatory course & advanced course were presented and approved by the BoS members.

The details of the PhD registered candidates and their internal & external members details are given below are presented before the BoS members.

S.No	Name of the Research Scholar	Enroll. No	Category	Research Topic	Name of the Supervisor
1	Mrs. K.Pushpa	220338	Part time External	Eco friendly concrete using recycled aggregate and Titanium Dioxide	Dr. S. Jayakumar Professor in Civil Engineering, SMVEC
2	Mrs. A. Sathiyapriya	220344	Full time Internal	Treatment of industrial pharmaceutical waste water by using natural coagulants	Dr.S.Sundararaman Head of the Department, Dept. of Civil, SMVEC

S. No	Name of the Research Scholar	Date of First DC Meeting	DC Member (Internal)	DC Member (External)	DC Member (External)
1	**Mrs. K.Pushpa** (Part time External)	10.09.2022	Dr.A.Thiagarajan Associate Professor Department of Mechanical Engineering, SMVEC	Dr. K.Srinivasamoorthy Professor Department of Earth Sciences Pondicherry University	Dr.N.Pannirselvam Associate Professor Department of Civil Engineering Kattankulathur Campus SRM Institute of Science & Technology
2	**Mrs. A. Sathiyapriya** (Full time Internal**)**	19.09.2022	Dr.J.Abbas Mohaideen Registrar Sri Manakula Vinaygar Engineering College Madagadipet.	Dr.V. Damodharan Associate Professor, Department of Civil Engineering, Annamalai University Chidambaram	Dr. P.Suresh Kumar Professor, Department of Civil Engineering, University college of Engineering, Panruti

The corrected and updated syllabi are approved by BoS members and the details are given in Annexure IX.

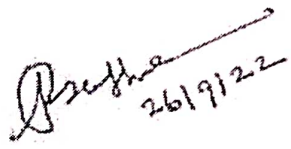
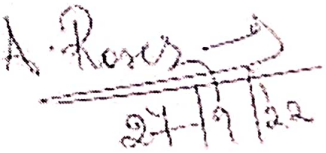
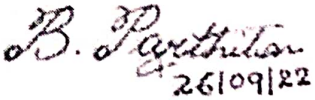
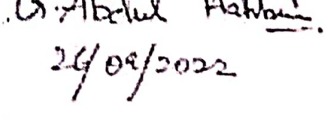
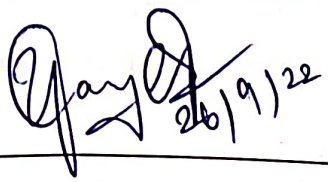
BoS / 2021 / CIVIL / UG / 5.10

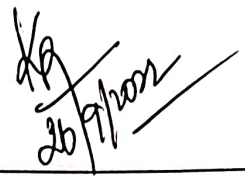
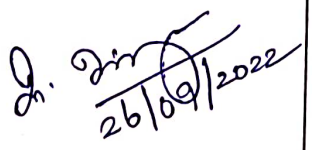
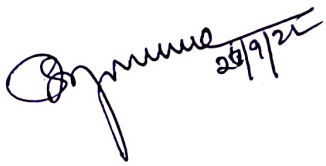
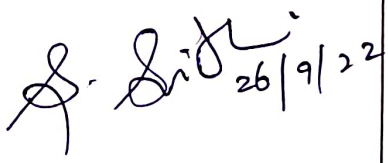
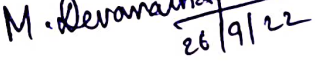
The Board of Studies Members discussed about the End Semester Examination which is scheduled on September 2022.

In Skill Development Course 2, the external experts suggested to replace Plane Table surveying with Contour and Leveling.

The corrected and updated syllabi are approved by BoS members and the details are given in Annexure X.

The meeting was concluded at 12:00 pm with vote of thanks by **Dr. S. Sundararaman**, Head of Department, and Department of Civil Engineering.

Sl.No	Name of the Member with Designation and official Address	Members as per UGC norms	Signature
1	Dr. S.Sundararaman Professor and Head Department of Civil Engineering, SMVEC, Madagadipet - 605107	Chairman	
2	Dr R Senthil Professor& HOD Civil, Division of Structural Engineering, Department of Civil Engineering, College of Engg., Guindy, Anna University, Chennai	Subject Expert (Pondicherry University Nominee)	
3	Dr.R.Malathy Professor and Dean (Research) Dept. of Civil Engineering, Sona College of Technology, Salem	Subject Expert (Academic Council Nominee)	
4	Dr A Rose Enid Teresa Professor and Head Rajalakshmi Engineering College, Chennai	Subject Expert (Academic Council Nominee)	
5	Dr.B.Parthiban Assistant Manager – Structural Designer, Fujita Engineering India Pvt. Ltd., Chennai	Representative from Industry	
6	Shri. G. Abdul Hakkim Design Engineer, Emmarde Steel Private Limited, Puducherry.	Alumni Member	
7	Dr. S. Jayakumar Controller of Examinations, Professor in Civil Engineering, SMVEC, Madagadipet - 605107	Internal Member	
8	Ms. G. Yamuna Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet - 605107	Internal Member	

9	Mr. K. Srinivasan Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet - 605107	Internal Member	
10	Mrs. D.Sathiyasree Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet - 605107	Internal Member	
11	Dr. D.Jaichithra Professor and Head, Department of English, SMVEC, Madagadipet - 605107	Internal Member	
12	Dr.T Sivaranjini Assistant Professor, Department of Physics, SMVEC, Madagadipet - 605107	Internal Member	
13	Dr.S.Savithri Professor and Head, Department of Chemistry, SMVEC, Madagadipet - 605107	Internal Member	
14	Mr.M.Devanathan Assistant Professor, Department of Mathematics, SMVEC, Madagadipet - 605107	Internal Member	

Dr.S.Sundararaman

HOD/Civil

Chairman –BoS (Civil)

Annexure I

U20CEP511	ESTIMATION COSTING AND VALUATION ENGINEERING	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

This course should enable the students to

- Understand the basics knowledge of estimation, costing and valuation of civil engineering works.
- Analyze the estimate gives an idea of time required for the completion of the work.
- Understand the standard schedule of rates of the current year.
- Provide the knowledge on various cost estimate for civil projects
- Analyze the rates and estimate the various construction works

Course Outcomes

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

CO1 - Measure and Estimate various elements in Civil Engineering works **(K2)**
CO2 - Prepare Detailed Estimate for a given building **(K3)**
CO3 - Rate analysis for different types of works **(K2)**
CO4 - Estimate the material quantities, prepare a bill of quantities and tender documents of project **(K2)**
CO5 - Prepare value estimates and report for a residential building. **(K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

LIST OF EXPERIMENTS

1. Introduction about Estimation, Costing and Valuation
2. To prepare a detailed and abstract estimate of Single roomed building for substructure (Load Bearing Structure)
    a. Earthwork Excavation for foundations
    b. P. C. C. (1:4:8) for foundations
    c. Brick Masonry in CM (1:5) for foundation and basement
    d. River sand filling for basement
    e. Plinth beam
3. To prepare a detailed and abstract estimate of Single roomed building for superstructure (Load Bearing Structure)
    a. Brick Masonry in CM (1:6) for superstructure
    b. R.C.C (1:2:4) for lintels, beams etc.
    c. R.C.C (1:2:4) for slabs
    d. Cement concrete (1:5:10) flooring
    e. Flooring with mosaic tiles
    f. Plastering with CM (1:6) for superstructure
    g. Plastering with CM (1:5) for ceiling
    h. White washing with two coats
    i. Color washing with two coats
    j. Supply and fixing of doors and windows
4. To prepare a detailed and abstract Estimate of Single storied Residential Building (Framed Structure)
5. Estimate of Septic tank with Soak pit
6. Estimate of Isolated column and Footing
7. Estimate of Box Culvert
8. Estimate of Underground Rectangular Water Tank
9. Estimation of Bar bending schedule
10. Analysis of Rates
11. Valuation

Reference Books

1. D.D Kohli and R.C Kohli, “A Text Book of Estimating and Costing (Civil)”, S. Chand and Company Ltd., 2013
2. V. N. Vazirani, S. P. Chandola, Civil Engineering Estimating, Costing & Valuation, Khanna Publishers, 1968
3. Rangwala, Estimation, Costing and Valuation, Charotar Publishing house Pvt Ltd, 17th Edition, 2017
4. S.P. Mahajan, Sanjay Mahajan, Quantity Surveying and Valuation book, Tech India Publication series, 2017
5. Govt of Tamil Nadu PWD – “Standard Schedule of Rates”, 2017-18

Web References

1. https://mis.wbprd.gov.in/Engineering/Document/BoxCulvertorMinorBridgeSampleEstimate.pdf
2. https://www.cphbooks.in/product/estimating-costing-and-valuation/
3. https://www.flipkart.com/estimating-costing-civil-engineering-theory-practice-including-specification-valuation

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	1	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEP509	SENSORS APPLICATIONS IN CIVIL ENGINEERING LABORATORY	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

This course should enable the students to

- Understand the different sensors
- Calibration of sensor
- Measurement of signal processing

Course Outcomes

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

CO1 – Identify the sensor **(K2)**

CO2 – Understand the errors in sensor **(K2)**

CO3 – Analyse the digital signal processing **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

LIST OF EXPERIMENTS

1. Instrumentation of typical civil engineering members/structures/structural elements
2. Use of different sensors, strain gauges, inclinometers,
3. Performance characteristics
4. Errors during the measurement process
5. Calibration of measuring sensors and instruments
6. Measurement, noise and signal processing
7. Analog Signal processing
8. Digital Signal Processing
9. Demonstration & use of sensor technologies
10. A comprehensive study of data transmission in wireless sensor network.

Reference Books

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press
3. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	-	-	-	1	-	-	-
CO2	3	2	1	1	-	1	-	-	-	-	-	1	-	-	-
CO3	3	2	1	1	-	1	-	-	-	-	2	1	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	2	1	-	-	-
CO5	3	2	1	1	-	-	-	-	-	-	2	1	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20CET614	DESIGN OF STEEL STRUCTURES	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

This course should enable the students to

- Gain knowledge on the limit state design of steel structures and the design of connections
- Be familiar with the design concepts of steel structural members subjected to tension.
- Understand the design concepts of the structural steel members subjected to compression.
- Be familiar with the design concepts of structural members subjected to bending.
- Be acquainted with the design of connections

Course Outcomes

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

CO1 – Design steel structural joints using bolts and welds. **(K5)**
CO2 – Design the structural members subjected to tension**. (K5)**
CO3 – Design single and compound compression members and the laced and battened columns. **(K5)**
CO4 – Design laterally supported and unsupported beams subjected to axial bending. **(K5)**
CO5 – Design the steel connection. **(K5)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT– I INTRODUCTION TO LIMIT STATE DESIGN (12 Hrs)

Properties of steel - Structural steel sections - types of connections, terminologies, failures in bolted and welded joints, Design of Joints – lap joint, single cover butt joint and double cover butt joint using bolts and welds under axial loading - Efficiency of joints.

UNIT – II DESIGN OF TENSION MEMBERS (12 Hrs)

Types of sections - Design of single and double angle tension member under Axial Loading using bolts and welds – Concept of shear lag –Design of tension Splices- Use of Lug Angles.

UNIT – III DESIGN OF COMPRESSION MEMBERS (12 Hrs)

Theory of columns - Modes of failures, Design of axially loaded compression members, design of Built- up columns, Design of Lacings and Battens, Design of Column Splices.

UNIT – IV DESIGN OF FLEXURAL MEMBERS (12 Hrs)

Modes of failures, Design of beam, design of laterally supported beam, design of laterally unsupported beam, design of built up beam – plate girder.

UNIT – V INDUSTRIAL STRUCTURES AND TRUSSES (12 Hrs)

Gantry girder (design procedure) - Design of purlins - Types of roof trusses for different spans- Estimation of dead, live and wind loads.

Text Books

1. N.Subramanian , "Design of Steel Structures" , Oxford University press, 2018.
2. S.K.Duggal, “Limit State Design of Steel Structures”, Tata McGrraw Hill Education Pvt. Ltd, 2019
3. Dayaratnam.P, “Design of Steel Structures”, Wheeler and Co Ltd., Allahabad, 2012
4. S.S.Bhavikatti, “Design of Steel Structures “, I.K. International Publishing House, 2019
5. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
6. IS 800 -2007, General Construction in Steel - Code of Practice.
7. SP 6-1 (1964): ISI Handbook for Structural Engineers -Part1 Structural Steel Sections [CED 7: Structural Engineering and structural sections]

Reference Books

1. Dr.Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Standard Publishers, 2012
2. Dr. V.L.Shah, S.S.Karve, "Limit State Design of Steel Structures", Structures Publications, 2012.
3. Punmia B.C, Ahok Kumar Jain and Arun Kumar Jain, “Comprehensive Design of Steel Structures”, Lakshmi publications (P) Ltd., New Delhi, 2015.
4. Arya, A.S. and Ajmani, J.L., “Design of Steel Structures”, Nem Chand and Bros, Roorkee, 2011.
5. Salmon and Johnson, “Steel Structures- Design and Behaviour”, Intext Educational Publishers, 1993

Web References

1. https://nptel.ac.in/courses/105105162/
2. https://nptel.ac.in/courses/105106113/
3. https://nptel.ac.in/courses/105106112/

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	1	3	3	3	3	3	1	3	3	3	3
CO2	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO3	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO4	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO5	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3

Correlation Level: 1- Low, 2 - Medium, 3 - High

U20CEE510 ADVANCED DESIGN OF RCC STRUCTURES

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the unified analysis of reinforced concrete structures
- Gain knowledge about the design of special reinforced concrete elements
- Understand the concept on yield line theory of slabs and to design flat slabs.
- Understand the design RCC slab culvert and bridge
- Analyze the prestressed concrete sections and design of beams.

Course Outcomes

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

CO1 - Analyze reinforced concrete structures **(K4)**
CO2 – Design special reinforced concrete elements **(K4)**
CO3 – Create an awareness on yield line theory of slabs and to design flat slabs. **(K2)**
CO4 - Design RCC slab culvert and bridge **(K5)**
CO5 - Analyze prestressed concrete sections and design of beams. **(K5)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION TO ANALYSIS OF REINFORCED CONCRETE STRUCTURES (9 Hrs)

Introduction to strut-tie model, equilibrium truss model, Bernoulli compatibility truss model, Mohr compatibility truss model, Introduction to nonlinear behavior of structures.

UNIT II DESIGN OF SPECIAL REINFORCED CONCRETE ELEMENTS (WSM) (9 Hrs)

Design of Deep Beams (using C programming), Checking for Local Failures, Detailing of Deep Beams, Design of shear walls, Design of Corbels, Design of Nibs, Design of pile cap. Reinforcement detailing for all design.

UNIT III FLAT SLABS (9 Hrs)

Elements of flat slabs, Codal procedure for design of flat slabs, Behavior of flat slab in shear, One way and two way shear, Equivalent Frame Method, Openings in flat slabs, Effect of pattern loading in flat slabs

UNIT IV YIELD LINE THEORY (9 Hrs)

Design of slabs of various shapes and having various support conditions using yield line analysis approach.

UNIT V DESIGN OF BEAM COLUMN JOINTS (9 Hrs)

Types of joints, Joints in multistoried buildings, Forces acting on joints, Design of joints for strength, Anchorage requirement in joints and detailing of reinforcement in joints.

Text Books

1. Varghese.P.C, “Advanced Reinforced Concrete Design”, Pretince-Hall India, 2005..
2. Unnikrishna Pillai.S and Devadas Menon, “Reinforced Concrete Design,” Tata MacGraw Hill Publishing Company Limited, Second Edition, New Delhi, 2010
3. Krishnaraju .N, Pranesh .R.N, “Design of Reinforced concrete IS: 456-2000”, New age International Publication (P) Ltd., New Delhi, 2003.

Reference Books

1. Krishnaraju .N, “Prestressed Concrete”, Tata McGraw-Hill Education, 2008, New Delhi.
2. Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”, Laxmi Publications, New Delhi, 2007..
3. Johnson Victor.D, “Essentials Of Bridge Engineering”, 6/E, Oxford & IBH Publishing Company Pvt. Ltd.,Fourth edition, 2007.
4. IS : 456-2000 - Plain and Reinforced Concrete - Code of Practice
5. SP – 16 - Design Aids for Reinforced Concrete
6. IS : 1343:2012 - Prestressed concrete-code of practice
7. IRC 6-2010 - Standard Specifications and Code of Practice for Road Bridges Section : Il Loads And Stresses

Web References

1. https://nptel.ac.in/courses/105/105/105105105/
2. https://nptel.ac.in/courses/105/105/105105104/
3. https://nptel.ac.in/courses/105/106/105106176/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	1	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	1	3	3	3	3
CO4	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO5	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

Annexure II

U20CET617	TRANSPORTATION ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the geometric design of highways
- Gain the knowledge about the pavement components and tests on highway materials.
- Understand the design principles of railway.
- Familiar with the basic elements and design principles of Railway track
- Understand the basic elements of Airport layout and also harbour

Course Outcomes

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

CO1 - Understand & Analyze the geometric design of highways **(K3)**
CO2 - Understand the various test procedures for highway materials and design theories **(K2)**
CO3 - Design the pavement **(K4)**
CO4 - Understand the railway elements**(K3)**
CO5 - Prepare airport layout and understand the various concepts and components of harbor **(K2)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I HIGHWAY GEOMETRY (10 Hrs)

Significance of highway planning –Factors influencing highway alignment -Classification of highways –Typical cross sections - Cross sectional elements - Sight Distances, Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD]- Gradients and its types, Design of Horizontal Alignments - Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves [Derivation of Formulae and Problems] Design of Vertical Alignments - Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves

UNIT II PAVEMENT COMPONENTS AND ANALYSIS (8 Hrs)

Pavement components - Types of pavements - Highway materials — Tests on aggregates and Tests on bitumen - Calculation of stresses – Single layer, Two layer theory, Westergaard's theory, Bradbury theory (Problems in stress calculation)

UNIT III PAVEMENT DESIGN AND MAINTENANCE (9 Hrs)

Pavement Design Factors in the design of flexible and rigid pavements- CBR methods - IRC recommendations on flexible pavement design (IRC37) and Rigid pavement (IRC58) (Problems in design of flexible pavement) - Highway drainage and its types - Pavement failures - Pavement evaluation –Benkelman beam deflection method

UNIT IV RAILWAY ENGINEERING (9 Hrs)

Permanent way and its elements – Functions, requirements and types of Rails, Sleepers and Ballast - Rail fixtures and fastenings - Gauge and its types -Coning of wheels - Defects in rails - Super elevation – Cant deficiency, negative cant (Problems) - Widening of gauge on curves (Problems) - Transition Curves and Shift (Problems) - Points and crossings – Turn outs - Design of turnouts (Problems) – Stations and Yards - classification of stations and yards

UNIT V AIRPORT AND HARBOUR ENGINEERING (9 Hrs)

Components of Airport - Airport organization – Types of airport - Runway orientation - Wind rose diagram (Problems), Basic runway length and corrections, Geometric design of Runway (Problems on Runway length) Runway Marking – Runway Lighting - Design of exit taxiway (Problems), Definition of Terms - Harbors, Ports, Docks, Littoral Drift, Satellite Ports - Requirements and Classification of Harbors - Dry and Wet Docks - Light Houses, Navigational Aids Coastal Structures- Piers, Breakwaters, Wharves, Jetties, Quays, Spring Fenders Coastal Shipping

Text Books

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2015.
2. S C Saxena and S P Arora, “A Textbook of Railway Engineering”, Dhanpat Rai Publication, 2010.
3. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010

Reference Books

1. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2019.
2. Rangwala, “Airport Engineering”, Charotar Publishing House, 2018.
3. S P Bindra, A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, 2018.
4. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Fifth Revision), IRC: 37-2018
5. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC: 58-2017

Web References

1. https://nptel.ac.in/courses/105101087/
2. https://nptel.ac.in/courses/105107123/
3. https://nptel.ac.in/courses/114106025/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	1	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	2	-	2	1	3	-	-	-	-	-	-	-	2	2	1
CO5	1	-	-	2	3	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

Annexure III

PROFESSIONAL ELECTIVE COURSE (R2019)

Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U19CEE71	Site Investigation Methods and Practices
2	U19CEE72	Urban Planning and Development
3	U19CEE73	Bridge Engineering
4	U19CEE74	Pollution Control and Monitoring
5	U19CEE75	Advanced Design of RCC Structures

U19CEE71 SITE INVESTIGATION METHODS AND PRACTICES

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the site investigation, its types and applications
- Gain the knowledge about the geological methods and its characterization
- Familiar with the logging methods, classification and its factors
- Understand the site exploration methods and its factors
- Understand the technical report preparation on site works

Course Outcomes

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

CO1 - Interpret the aerial photographs. **(K2)**
CO2 - Understand the various test procedures for geophysical methods. **(K2)**
CO3 - Prepare a log report. **(K2)**
CO4 - Familiarize with the exploration methods. **(K2)**
CO5 - Write technical report on site works. **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION (9 Hrs)

Objective(s) of site investigation - various stages in site investigation process - Planning and Desk Study - topographic maps, aerial photographs - interpretation of aerial photographs, applications in site investigation , Geological maps, minerals and mining records, soil planning maps, site reconnaissance and local enquiries.

UNIT II GEOLOGICAL METHODS (9 Hrs)

Geological methods - different stages, Geological exploration methods –Areal mapping, site mapping and construction mapping-Rock mass characterization- Discontinuities in rocks ,Rock core descriptors , Rock mass classification, RQD, Rock mass rating, Rock structure rating , Q-system- General principle distribution of physical field in subsurface – Electrical resistivity, Seismic refraction methods, their principle, methods of survey, correction to field data, Interpretation and limitations. Index and Mechanical properties of rocks, Laboratory and insitu tests.

UNIT III GEOPHYSICAL EXPLORATION (9 Hrs)

Trial pits, shafts, tunnels, auguring, and different types of drilling methods, their merits and demerits, Bore hole logging techniques (subsurface geophysical exploration) - Need for logging techniques, classification and different types logging methods.

UNIT IV SAMPLING METHODS (9 Hrs)

Soil Exploration methods, samples, sampling procedure, sample disturbances, samplers, Factors controlling spacing and depth of bore hole, Insitu tests, SPT, SCPT, Pressure meter tests, interpretation and application, Index properties , Laboratory testing.

UNIT V REPORT PREPARATION (9 Hrs)

Technical Report writing, report format, recommendations for earth work structures, highway excavations and drainage works, dams, check report site preparation, investigation during construction and operation.

Text Books

1. Francis Longstreth Thompson “Site planning in Practice: an Investigation of the Principles of Housing Estate Development” Palala Press, 2016.
2. Craig. C “Advances in site investigation practice” Thomas Telford Ltd, 1996
3. Joyce, M.D. ‘Site Investigation Practice; ESFN. SPON Publishers, 1982.

Reference Books

1. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2006.
2. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
3. Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.
4. Legget and Karrow, Hand book of Geology in Civil Engineering, McGraw Hill Publishers, 1983.
5. Hunt, R.E., Geotechnical Engineering Analysis and Evaluation, McGraw Hill Book Company, 1986.

Web References

1. https://nptel.ac.in/courses/105103182/
2. https://nptel.ac.in/courses/105104167/
3. http://www.digimat.in/nptel/courses/video/105103182/L15.html
4. https://nptel.ac.in/courses/105/108/105108075/
5. https://nptel.ac.in/courses/105/105/105105185/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	2	3	2	3	2	3	3	3	2	2
CO2	3	2	1	2	3	2	3	2	3	2	3	3	3	2	2
CO3	3	2	1	2	3	2	3	2	3	2	3	3	3	2	2
CO4	3	2	1	2	3	2	3	2	3	2	3	3	3	2	2
CO5	3	2	1	2	3	2	3	2	3	2	3	3	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

PROFESSIONAL ELECTIVE COURSES (R2020)

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U20CEE401	Engineering Geology
2	U20CEE402	Geographic Information System
3	U20CEE403	Building Services
4	U20CEE404	Renewable Energy Sources
5	U20CEE405	Alternative Building Materials and Technologies

U20CEE405 **ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

Gain knowledge on energy in building materials
Aware about different types of alternative building materials
Understand the Sustainable materials for construction
Learn about the alternative building technologies
Understand the concepts of equipment for construction and also planning control.

Course Outcomes

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

CO1 – Understand the various energies involved in the construction **(K2)**
CO2 – Understand the different types alternative materials**(K2)**
CO3 - Identify various eco-friendly materials **(K2)**
CO4 - Recognize suitable alternative building technologies **(K2)**
CO5 - Apply the cost concept involved in the planning of construction **(K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION (9 Hrs)

Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Environmental friendly and cost-effective building technologies, Requirements for buildings of different climatic regions.

UNIT II ALTERNATIVE BUILDNG MATERIALS (9 Hrs)

Characteristics of building blocks for walls - Stones and Laterite blocks - Bricks and hollow clay blocks - Concrete blocks - Stabilized mud blocks - Fal-G Blocks - Manufacture of stabilized blocks.

UNIT III SUSTAINABLE MATERIALS (9 Hrs)

Fibre reinforced concretes – Types: metal and synthetic - Properties and applications - Fibre reinforced plastics – Types: organic and synthetic - Properties and applications. Building materials from agro and industrial wastes - Types of agro wastes - Types of industrial and mine wastes - Properties and applications

UNIT IV ALTERNATIVE BUILDING TECHNOLOGIES (9 Hrs)

Alternatives for wall constructions, composite masonry, confined masonry, cavity walls, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique, 3D Printing Technology. Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs.

UNIT V MACHINES & PLANNING CONTROL (9 Hrs)

Machines for manufacture of concrete, Equipment for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Text Books

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International Publishers, 2017.
2. BT Ashwini Manjunath, “Alternative Building Materials and Technology”, Medtech Publisher, 2017.
3. Trevor M. Letcher and Janet L. Scott, “Materials for a Sustainable Future”, Royal Society of Chemistry, 2012

Reference Books

1. S Christian Johnson, “Concrete Technology”, Dipti Press, 2017.
2. G.C Sahu and Jayagopal Jena, “Building Materials and Construction”, McGraw hill Publication, 2015.
3. B C Punmia and Ashok kumar jain, “Building Construction”, Laxmi Publication, 2019.
4. M.S. Shetty, “Concrete Technology (Theory and Practice)”, S. Chand & Company Ltd., 2019.
5. S.K. Duggal, “Building Materials”, 5th edition, New age International Publication, 2020.

Web Reference

1. https://nptel.ac.in/courses/105/102/105102175/
2. https://nptel.ac.in/courses/105/102/105102195/
3. https://alison.com/course/sustainable-architecture-energy-efficiency-and-quality

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	3	3	2	-	2	1	3	3	2	2
CO2	2	-	-	-	3	2	3	2	-	2	1	3	3	3	2
CO3	3	-	-	-	3	3	3	3	-	2	1	3	3	3	2
CO4	3	-	-	-	3	3	3	3	3	3	1	3	3	3	2
CO5	3	-	-	2	2	3	3	3	3	3	1	3	3	2	2

Correlation Level: 1- Low, 2 - Medium, 3 - High

Annexure IV

OPEN ELECTIVE COURSES (R2019)

Open Elective – IV (Offered in Semester VII)				
1	U19EEO76	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
2	U19ECO75	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL
3	U19ECO76	Sensors for Industrial Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
4	U19CSO76	Artificial Intelligence	CSE	EEE, ICE, CIVIL, MECH
5	U19CSO77	Cloud Technology and its Applications	CSE	EEE, ICE, MECH, CIVIL, BME, Mechatronics
6	U19ITO76	Automation Techniques & Tools- DevOps	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, BME, Mechatronics
7	U19ITO77	Augmented and Virtual Reality	IT	EEE, ICE, MECH, CIVIL, BME
8	U19ICO75	Industrial Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, BME, Mechatronics.
9	U19MEO76	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
10	U19MEO77	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
11	U19MCO71	Building Automation	Mechatronics	MECH, CIVIL
12	U19MCO72	Automation in Manufacturing Systems	Mechatronics	MECH, CIVIL
13	U19CCO75	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
14	U19CCO76	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
15	U19ADO73	Data Science Application of NLP	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
16	U19ADO74	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME

		L	T	P	C	Hrs
U19CSO77	**CLOUD TECHNOLOGY AND ITS APPLICATIONS** (Common to EEE, ICE, MECH, CIVIL, BME, CCE, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To define the fundamental ideas behind Cloud Computing.
- To classify the basic ideas and principles in cloud information system.
- To relate cloud storage technologies and relevant distributed file systems.
- To explain the Cloud Applications.
- To define the Future of Cloud.

Course Outcomes

After completion of the course, the students should be able to

CO1 - Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. **(K1)**

CO2 - Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacentres to build and deploy cloud applications that are resilient, elastic and cost-efficient. **(K3)**

CO3 - Illustrate the fundamental concepts of Cloud Applications. **(K4)**

CO4 - Explain the Applications of cloud. **(K3)**

CO5 - Advancing towards a Cloud. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Web Services Deliver from the Cloud – Communication-as-a-Service – Infrastructure-as-a-Service – Monitoring-as-a-Service – Platform-as-a-Service – Software-as-a-Service – Building Cloud Network.

UNIT II CLOUD INFORMATION SYSTEMS (9 Hrs)

Federation in the Cloud - Presence in the Cloud - Privacy and its Relation to Cloud-Based Information Systems – Security in the Cloud - Common Standards in the Cloud – End-User Access to the Cloud Computing.

UNIT III CLOUD INFRASTRUCTURE (9 Hrs)

Introduction– Evolving IT infrastructure – Evolving Software Applications –Service Oriented Architecture – Interoperability Standards for Data Center Management - Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment.

UNIT IV CLOUD APPLICATIONS (9 Hrs)

Software Utility Application Architecture - Characteristics of a SaaS - Software Utility Applications - Cost Versus Value - Software Application Services Framework - Common Enablers – Conceptual view to Reality – Business Profits - Implementing Database Systems for Multitenant Architecture - Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

UNIT V FUTURE OF CLOUD (9 Hrs)

Other Design Considerations - Design of a Web Services Metering Interface - Application Monitoring Implementation - A Design for an Update and Notification Policy - Transforming to Software as a Service - Application Transformation Program - Business Model Scenarios - Virtual Services for Organizations - The Future.

Text Books

1. Sandeep Bhowmik,"Cloud Computing",Cambridge University Press; First editiouun,2017.
2. Erl ,'Cloud Computing: Concepts, Technology & Architecture', Pearson Education India, 1st edition, 1 January 2014.
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

Reference Books

1. Sanjiva Shankar Dubey ,' Cloud Computing and Beyond', Dreamtech Press 2edition,2019.
2. John W. Rittinghouse and james F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
3. George Reese, "Cloud Application Architectures", O'reilly Publications, 2009.
4. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
5. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd.2006.

Web Resources

1. www.coltdatacentres.net/Cloud Technology.
2. www.zdnet.com.
3. https://www.cloudbakers.com/blog/what-is-a-cloud-application
4. https://www.cloudbakers.com/blog/what-is-a-cloud-application
5. https://blog.servermania.com/what-is-a-cloud-application/

COs/POs/PSOs Mapping

CO'S	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	1	-	2	1	3	1	2	3	2
2	1	1	2	1	1	3	1	-	2	1	3	1	3	3	2
3	2	2	1	1	-	3	1	1	2	1	3	1	3	3	3
4	1	1	1	1	2	2	1	-	2	1	3	1	2	2	2
5	2	1	1	1	1	3	1	-	2	1	3	1	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE COURSES (R2020)

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester IV)				
1	U20EEO401	Solar Photovoltaic Fundamental and applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
2	U20EEO402	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE, BME, IT, CSE, FT
3	U20ECO401	Engineering Computation with MATLAB	ECE	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS, Mechatronics
4	U20ECO402	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
5	U20CSO401	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U20CSO402	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U20ICO401	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL, CCE, AI&DS, FT
8	U20MEO401	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
9	U20MEO402	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
10	U20CCO401	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
11	U20CCO402	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics
12	U20ADO401	Knowledge Representation and Reasoning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
13	U20ADO402	Introduction to Data Science	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics

	SENSORS AND TRANSDUCERS	L	T	P	C	Hrs
U20ICO401	(Common to ECE, CSE, IT, MECH, CIVIL, CCE, AI&DS, FT)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- Get to know the methods of measurement, classification of transducers and to analyze error.
- Get exposed to different types of resistive transducers and their application areas
- To acquire knowledge on capacitive and inductive transducers.
- To gain knowledge on variety of transducers
- To introduce about advancements in sensor technology.

Course Outcomes

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

CO1 - Understand the concepts of classification of Transducers. **(K2)**
CO2 - Familiar with the working of resistance Transducer. **(K3)**
CO3 - Familiar with the principle and working of various Inductive and Capacitive transducer **(K1)**
CO4 - Able to design signal conditioning circuit for various transducers **(K3)**
CO5 - Able to identify or choose a transducer for a specific measurement application **(K4)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I CLASSIFICATION OF TRANSDUCERS (9 Hrs)

General concepts and terminology of measurement systems, transducer classification, general input-output configuration, static and dynamic characteristics of a measurement system, Statistical analysis of measurement data.

UNIT II RESISTANCE TRANSDUCERS (9 Hrs)

Resistive transducers: Potentiometers, metal and semiconductor strain gauges and signal conditioning circuits, strain gauge applications: Load and torque measurement, Digital displacement sensors.

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCERS (9 Hrs)

Transducers: – Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer – Variable reluctance transducers – Synchros – Microsyn – Principle of operation, construction details, characteristics of capacitive transducers – Different types & Signal Conditioning – Applications:- Capacitor microphone, Capacitive pressure sensor, Proximity sensor.

UNIT IV OTHER TRANSDUCERS (9 Hrs)

Piezoelectric transducers and their signal conditioning, Seismic transducer and its dynamic response, photoelectric transducers, Hall effect sensors, Magnetostrictive transducers. Eddy current transducers. Hall effect transducers – Optical sensors, IC sensor for temperature – signal conditioning circuits, Introduction to Fiber optic sensors – Temperature, pressure, flow and level measurement using fiber optic sensors

UNIT V SMART TRANSDUCER (9 Hrs)

Introduction to semiconductor sensor, materials, scaling issues and basics of micro fabrication. Smart sensors,Intelligent sensor, Mems Sensor, Nano-sensors, SQUID Sensors,- Environmental Monitoring sensors

Text Books

1. Doebelin E.O. and Manik D.N., “Measurement Systems”, 6th Edition, McGraw-Hill Education Pvt. Ltd., 2011.
2. Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design, Oxford University Press, Cambridge,2003
3. Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design Clarendon, Oxford2nd edition Jacob Fraden - 2010
4. DoeblinE..O. “Measurement System Applications and Design”, TMH, 5th Edition, 2004

Reference Books

1. Bela G. Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, 4th Edition, Vol.1 ISA/CRC Press, 2003.
2. Bela G. Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, 4th edition, Vol.2 ASME PTC ,2018
3. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010. E.A.
4. John P. Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education, 2000.

Web References

1. www.electrical4u.com
2. https://nptel.ac.in/courses/108108147/
3. https://www.youtube.com/watch?v=1uPTyjxZzyo

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	1	2	-	-	-	2	-	-	-	-
CO2	2	-	3	-	-	1	2	-	-	-	2	-	-	-	-
CO3	2	-	2	-	-	1	2	-	-	-	2	-	-	-	-
CO4	2	-	3	-	-	1	2	-	-	-	-	-	-	-	-
CO5	2	-	3	-	2	2	3	-	-	-	2	-	-	-	-

Correlation Level: 1- Low, 2 - Medium, 3 - High

Annexure V

EMPLOYABILITY ENHANCEMENT COURSES – (B).SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U20CES201	Skill Development Course 1 *
		1) MS Office – Word, Excel, Power Point
		2) Measurements and Conversion
		3) Traditional construction in modern age
2	U20CES302	Skill Development Course 2 *
		1) Basic Vasthu
		2) Plane Table surveying
		3) Auto level surveying
3	U20CES403	Skill Development Course 3 *
		1) Safety in building construction
		2) Air Quality Monitoring
		3) Experience with On-Site Construction Observation and Management
4	U20CES504	Skill Development Course 4 : Foreign Language/ IELTS - I
5	U20CES505	Skill Development Course 5 : Presentation Skills using ICT
6	U20CES606	Skill Development Course 6 : Foreign Language/ IELTS - II
7	U20CES607	Skill Development Course 7 : Technical Seminar
8	U20CES608	Skill Development Course 8 : NPTEL / MOOC – I
9	U20CES809	Skill Development Course 9 : NPTEL / MOOC - II

U20CES201	SKILL DEVELOPMENT COURSE 1 (Choose any one of the following course)	L	T	P	C	Hrs
		0	0	2	-	30

1. MS OFFICE – WORD, EXCEL, POWER POINT

Course Content:

This would involve training of students in how to use MS Office applications for office work. This would help in creating professional-quality documents; store, organize and analyze information; arithmetic operations and functions; and create dynamic slide presentations with animation, narration, images, and much more, digitally and effectively.

2. MEASUREMENTS AND CONVERSION

Course Content:

This would involve in training students with basic concepts of units and measurements. This would help the students to learn the concept of conversion factor encompassing metric unit weight or mass, measurement of length, metric unit for liquid measurements and area measurement. By learning measurement and conversion problem solving skills of students can be enhanced.

3. TRADITIONAL CONSTRUCTION IN MODERN AGE

Course Content:

This would help the students to understand the difference between traditional construction and modern construction by involving history of construction, replacement of traditional materials with modern materials and rise of modernism using salient features

U20CES403	SKILL DEVELOPMENT COURSE 3 (Choose any one of the following course)	L	T	P	C	Hrs
		0	0	2	-	30

1. SAFETY IN BUIDING CONSTRUCTION

Course Content:

This would involve training students for safety practices in building construction. The students would be given exercise to use the management tools that will allow structuring a safety plan suited to the project, complying with the local laws and regulations in force

2. AIR QUALITY MONITORING

Course Content:

This would help the students to understand the monitoring and measurement of air pollutants by studying about the air quality and preparation of action plan. Students would be given exposure to various sources of pollutants, measuring and assessing them; and how to manage it.

3. EXPERIENCE WITH ON-SITE CONSTRUCTION OBSERVATION AND MANAGEMENT

Course Content:

This would involve training of students with various drawings and specifications by understanding the construction progress and reports for materials and the concept of testing and inspections. In this students would be given exposure to on-site observations, verification of contractor performance, specialty reports for materials such as concrete and asphalt, pre-final and final inspections

Annexure VI

EMPLOYABILITY ENHANCEMENT COURSES –(A).CERTIFICATION COURSES

Sl. No.	Course Code	Course Title
1	U20CECX01	3ds Max
2	U20CECX02	Advance Structural Analysis of Building using ETABS
3	U20CECX13	AutoCAD for Civil
4	U20CECX22	Bridge Analysis
5	U20CECX56	Internet of Things
6	U20CECX57	Introduction to C Programming
7	U20CECX58	Introduction to C++ Programming
8	U20CECX59	IoT using Python
9	U20CECX73	Project Management
10	U20CECX74	Python Programming
11	U20CECX85	STAAD PRO V8i
12	U20CECX87	Total Station

CERTIFICATION COURSE

L	T	P	C	Hrs
0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40 - 50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Annexure VII

SEMESTER – VII

U20CET718	CONSTRUCTION MANAGEMENT	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the importance and basic functions of construction management
- Gain knowledge about various organization and planning system of construction
- Understand the scheduling and network analysis of project
- Impart the basic concepts of Contract and Tender
- Understand the M.I.S and labor, safety and related regulation

Course Outcomes

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

CO1 - Understand construction management importance **(K2)**
CO2 –Understand the various organization in the construction **(K2)**
CO3 –Become aware on scheduling and analysis **(K5)**
CO4 - Become aware on Contract and Tender **(K2)**
CO5 - Understand the M.I.S and labor, safety and related regulation **(K2)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I CONSTRUCTION PROJECT MANAGEMENT (9 Hrs)

Construction Project - Project Categories, Management objectives, functions - Project Development Process - Project Life Cycle - Project Team - Role of Project Manager - Management failure.

UNIT II ORGANIZATION AND PLANNING (9 Hrs)

Definition, Levels of Organization, Principles of Organization, process of organizing, Span of Control, Authority, Responsibility and Delegation – Forms of Organizations - merits and demerits of each.

UNIT III SCHEDULING AND NETWORK ANALYSIS (9 Hrs)

Scheduling: Definition, objectives, Importance of Planning, Scheduling and Controlling of Projects. Network Techniques in Construction Management - PERT, CPM, Time & cost optimization.

UNIT IV CONTRACTS (9 Hrs)

Contract and Types of Contract, Contract document, Specification, Condition of Contract, Tender and Tender documents – Arbitration - M. Book - Muster roll.

UNIT V M.I.S APPLICATIONS AND CONSTRUCTION (9 Hrs)

Labour Legislations - Safety in Construction: Objectives, Steps in Safety Programme, Safety Costs, Safety Codes, Occupational Safety and Hazards, Accidents - Causes of Accident

Text Books

1. Clifford J Schexnayder, Kraig Knutson, Construction Management Fundamentals, Tata McGraw-Hill, 2011.
2. Ps Gahlot, Bm Dhir, Construction Planning & Management, New Age International (P) Ltd., 2014
3. Srinath,L.S., “PERT and CPM Principles and Applications “, Affiliated East West Press, 2015

Reference Books

1. Ravindra.S.V., Krishnamurthy.K.G., Construction & Project Management, CBS Publishers, 2010.
2. Steven McCabe, “Quality Improvement Techniques in Construction.” Longman, 2016
3. Moder.J., C.Phillips and Davis, “Project Management with CPM”, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1995.
4. Shrivastava. U.K, Construction Planning & Management, Galgotia Publications Pvt. Ltd., 2014.
5. Chitkara.K.K., Construction Project Management Planning Scheduling and Controlling, Tata McGraw-Hill, 2014

Web References

1. https://nptel.ac.in/courses/105/104/105104161/
2. https://nptel.ac.in/courses/105/103/105103093/
3. https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ce20/ /

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	3	2	-	-	-	-	-	-	3	3	3
CO2	3	3	2	3	3	2	-	-	-	-	-	-	3	3	3
CO3	3	3	2	3	3	2	-	-	-	-	-	-	3	3	3
CO4	3	3	2	3	3	2	-	-	-	-	-	-	3	3	3
CO5	3	2	2	3	3	2	-	-	-	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CET719	HYDROLOGY AND WATER RESOURCE ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the hydrologic cycle, precipitation and its estimation.
- Understand the features of precipitation, rain gauge density, DAD curve, evaporation, transpiration and infiltration.
- Understand the occurrence, movement and augmentation of ground water through Darcy's law, recuperation test, pumping test and artificial recharge methods.
- Gain knowledge about runoff, estimation, modeling of runoff, and hydrograph.
- Gain knowledge about estimation, forecasting, control of flood, and concept of Muskingum method.

Course Outcomes

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

CO1- Understand the different forms of precipitation and also capable to analysis the missing precipitation data.**(K2)**

CO2 - Gain the knowledge in the various techniques and methods involved to quantify the total evaporation loss for water from the water bodies**(K3)**

CO3 - Understand the ground water concepts and identify the yield capacity of any given ground water sources **(K2)**

CO4 - Capable to solve and analyses the runoff problems **(K4)**

CO5 - Capable to solve and analyses the flood problems **(K4)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I PRECIPITATION AND SURFACE WATER HYDROLOGY (9 Hrs)

Hydrologic cycle, precipitation, stream flow, evaporation, transpiration and infiltration, types and measurement of precipitation, gauge networks, hyetographs, average depth of precipitation over the basin, mass rainfall curves, intensity duration curves – estimates of missing data and adjustment of records.

UNIT II EVAPO-TRANSPIRATION AND INFILTRATION (9 Hrs)

Evaporation, factors affecting, measurement and estimation of evaporation, transpiration, factors affecting and determination of transpiration, methods of estimating evapo-transpiration, factors affecting and measurement of infiltration, infiltration indices.

UNIT III GROUND WATER HYDROLOGY (9 Hrs)

Occurrence and movement of ground water - Permeability and Transmissibility - Darcy's Law – Ground water yield - Aquifers and their types - Infiltration wells and Infiltration galleries - Measurement of yield - Recuperation test - Pumping test – Steady flow analysis only - Artificial recharge – Methods.

UNIT IV RUNOFF (9 Hrs)

Runoff - Components of stream flow - Catchment characteristics - Factors affecting runoff - Estimation of runoff - Flow duration curve - Rainfall-runoff modeling - Hydrograph - Unit hydrograph - S-curve hydrograph - Synthetic hydrograph - Application.

UNIT V FLOOD ESTIMATION AND FORECASTING **(9 Hrs)**

Estimation of peak flood - Flood frequency studies - Methods of flood control - Flood routing thorough a reservoir - Channel flow routing - Muskingum method - Flood forecasting and warning.

Text Books

1. Santosh kumar Garg, Hydrology and Water Resources Engineering, Khanna Publishers, 2018.
2. Satyanarayana murthy.C., Water Resources Engineering Principles & Practice, New Age International (P) Ltd, 2019.
3. Subramanya.K, Engineering Hydrology, Tata McGraw-Hill, 2019.

Reference Books

1. Varshney, R.S., Engineering Hydroloy, Nem Chand & Bros., 2017.
2. Larry W Mays, Ven Te Chow, David R Maidment, Applied Hydrology, Tata McGraw-Hill, 2016.
3. Jayarami Reddi.P, Text Book of Hydrology, Lakshmi Publications, 2017.
4. Todd D.K., ”Groundwater Hydrology", John Wiley & Sons, Inc, New York, 2015.
5. Bear J., "Hydraulics of Groundwater", McGraw-Hill, New York, 2012.

Web References

1. https://nptel.ac.in/courses/105/101/105101002/
2. https://nptel.ac.in/courses/105/104/105104103/
3. https://nptel.ac.in/courses/105/108/105108130/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	-	-	-	-	-	-	1	3	1	2
CO2	2	3	1	2	2	-	-	-	-	-	-	1	3	1	-
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	3	-
CO4	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
CO5	3	3	2	2	3	-	-	-	-	-	-	1	1	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20HSP703 BUSINESS BASICS FOR ENTREPRENEUR

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

This course should enable the students to

- Develop a clear understanding on Business Plans and their significance.
- Be familiar with various forms of business appropriate for an individual entrepreneur
- Understand various ways of judging a successful opportunity for an entrepreneur
- Know the ways to formulate a successful Operation Plan
- Be aware of things to know to prepare effective financial and marketing plans

Course Outcomes

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

CO1 - Impact comprehensive knowledge of an entrepreneurial ecosystem**. (K6)**
CO2 - Understand the need and significance of Business Plan in the success of an Enterprise. **(K2)**
CO3 - Understand the ways to judge the economic and business viability of proposed venture. **(K2)**
CO4 - Utilize the elements of success of entrepreneurial ventures. **(K3)**
CO5 - Evaluate the effectiveness of different entrepreneurial strategies. **(K5)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I THE ENTREPRENEURIAL PERSPECTIVE (6 Hrs)

Entrepreneurship and Family Business Management, Entrepreneurship theory and practice, The Nature and Importance of Entrepreneurs, The Entrepreneurial and Intrapreneurial Mind, The Individual Entrepreneur, International Entrepreneurship Opportunities

UNIT II CREATING AND STARTING THE VENTURE (6 Hrs)

Creativity and the Business Idea, Legal Issues for the Entrepreneur, the Business Plan, the Marketing Plan, the Financial Plan, the Organizational Plan

UNIT III FINANCING THE VENTURE (6 Hrs)

Raising Finance, scaling up the venture, NDA'S and term sheet, Sources of the Capital, Informal Risk Capital and Venture Capital

Report Submission:

- Grooming Entrepreneurial Mind-set
- Interaction with Business Leaders/Bankers/Venture Capitalists
- Finding and evaluating an idea
- Develop a business plan
- Financing for a company start-up
- Setting up a company-legal entity
- Entrepreneurial development and employment creation
- Effects of creativity and innovation on the entrepreneurial performance of family business

Text Books

1. Friend, G., & Zehle, S. (2004). Guide to business planning. Profile Books Limited.
2. Lasher, W. (2010). The Perfect Business Plan Made Simple: The best guide to writing a plan that will secure financial backing for your business. Broadway Books.
3. Arjun Kakkar. (2009). Small Business Management: Concepts and Techniques for improving Decisions. Global India Publications.

Reference Books

1. Alexander Osterwalder and Yves Pigneur – Business Model Generation.
2. Arthur R. DeThomas – Writing a Convincing Business Plan.
3. Ben Horowitz – The Hard Thing About Hard Things.
4. Guy Kawasaki – The Art of Start 2.0
5. Hal Shelton – The Secrets to Writing a Successful Business Plan.

Web References

1. https://www.waveapps.com/blog/entrepreneurship/importance-of-a-business-plan
2. https://www.entrepreneur.com/article/200516
3. https://smallbusinessbc.ca/article/how-to-use-viability-to-test-if-you-should-invest-in-your-business/
4. https://www.infoentrepreneurs.org/en/guides/strategic-planning/
5. http://www.marketingmo.com/strategic-planning/marketing-plans-budgets/
6. https://www.mbda.gov/page/loan-documentation

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	1	3	3	2	3	1	2	1	2	1
CO2	1	2	2	2	2	2	3	3	3	2	1	2	2	2	1
CO3	1	2	2	1	2	2	3	3	3	3	2	3	1	2	3
CO4	1	3	2	2	2	2	3	3	3	3	2	3	1	2	2
CO5	1	3	2	2	2	2	3	3	3	2	2	3	1	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEP715	IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

This course should enable the students to

- Understand the concepts of hydraulic design and to draw detailed drawings of hydraulic Structures.
- Introduce the design concepts of major units associated with water and sewage treatment

Course Outcomes

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

CO1 - Design and draw plan, elevation and sections of irrigation structures in detail.**(K3)**

CO2 - Design the sewage treatment plant units and draw the general arrangement **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

LIST OF EXERCISES

PART A

1) **TANK IRRIGATION STRUCTURES**

Detailed drawings of foundation details, plan and elevation

a) Tank surplus weirs
b) Tank sluices weirs

2) **CANAL TRANSMISSION STRUCTURES**

Detailed drawings of foundation details, plan and elevation

a) Canal head works and Canal regulator
b) Canal drops and Notch type

PART B

1) General layout of water and Waste treatment of plant.
2) Design and drawing of infiltration gallery.
3) Drawing of raw water - Intake towers - Manholes - Sewer lines
4) Design and drawing Slow sand filter - Rapid sand filter
5) Design and drawing of Trickling filters - Activated Sludge process
6) Design and drawing of Septic tanks and disposal arrangements

Reference Books

1. Peary, H.S., ROWE, D.R., Tchobanoglous, G., “Environmental Engineering”, McGraw- Hill Book Co., New Delhi, 1995.
2. Metcalf and Eddy, “Wastewater Engineering, Treatment and Reuse”, Tata McGraw-Hill, New Delhi, 2010.
3. Qasim,S.R., Motley, E.M and Zhu.G. “Water works Engineering – Planning, Design and Operation”, Prentice Hall, New Delhi, 2009.
4. Qasim, S. R. “Wastewater Treatment Plants, Planning, Design and Operation”, CRC Press, New York, 2010
5. Varshney, R.S., Engineering Hydroloy, Nem Chand & Bros., 2017

Web References

1. https://nptel.ac.in/courses/126/105/126105010/
2. https://nptel.ac.in/courses/105/105/105105110/
3. https://nptel.ac.in/courses/105/102/105102159/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	1	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	1	3	3	3	3
CO4	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3
CO5	3	3	3	2	1	3	3	3	3	3	1	3	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEP716 SIMULATION SOFTWARE LABORATORY (ANSYS)

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

This course should enable the students to

- To give exposure to software tools needed to analyse engineering problems
- Model the structures
- Analyze the structures
- Design the structures
- To expose the students to different applications of simulation and analysis tools

Course Outcomes:

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

CO1 - MATLAB to solve simple problems in vibration (**K4)**
CO2 - Analyze the structural components using software (**K5)**
CO3 – Analysis using link elements in Trusses, cables **(K5)**
CO4 - Vibration analysis of spring-mass systems (**K3)**
CO5 – Model analysis of beams (**K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

LIST OF EXPERIMENTS

A. Simulation

1. MAT LAB basics, dealing with matrices, Graphing-functions of one variable and two variables
2. Use of MATLAB to solve simple problems in vibration
3. Mechanism Simulation using multi body dynamic software

B. Analysis

1. Force and stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
   (i) Shear force and Bending Moment diagram of simply supported beam with Point Load
   (ii) Shear force and Bending Moment diagram of cantilever beam with end point load
3. Stress analysis of flat plates and simple shells.
4. Vibration analysis of spring-mass systems.
5. Model analysis of beams.
6. Fixed and Free Column Buckling Analysis

Web References

1.https://www.youtube.com/watch?v=xK1B61XfqQU
2. https://www.youtube.com/watch?v=VKRGtG_hpig

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	2	-	-	-	1	-	-	2	3	3	3
CO2	3	3	3	1	2	-	-	-	1	-	-	2	3	3	3
CO3	3	3	3	1	2	-	-	-	1	-	-	2	3	3	3
CO4	3	3	3	1	2	-	-	-	1	-	-	2	3	3	3
CO5	3	3	3	1	2	-	-	-	1	-	-	2	3	3	3

Correlation Level: 1- Low, 2 - Medium, 3 – High

U20CEP717 COMPREHENSIVE VIVA VOCE

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To assess the overall knowledge of the student in the relevant field of Engineering acquired over years of study in the undergraduate program. 4

Course Outcomes

CO 1 - The students will be able to attend the various Competitive examinations such as GATE, IES Examination etc. **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

Description

- Students' batch will be formed and each batch will prepare MCQ's question for concerned subjects.
- The student will be tested for his understanding of basic principles of the core Civil Engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective type from all the core subjects. The external university examination, which carries a total of 50 marks, will be a Viva Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

COs/POs/PSOs Mapping

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEW701	PROJECT PHASE - I	L	T	P	PW	C	Hrs
		0	0	0	4	2	60

Course Objectives

This course should enable the students to

- Encouraged to get hands on experience to work in various area of civil engineering.

Course Outcomes

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

CO1 - Perceive the problems and to find suitable solutions. **(K5)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

Description

The students to work in groups of not more than four members in each group need to plan and design a building as per National Building Code requirements. In addition, each group is required to do literature survey, formulate the problem & form a methodology for the field problems they proposed to carryout in Project Phase II. The student is required to do and form a methodology in arriving at the solution of the problem. Each project shall have an internal guide. The report of each group shall be submitted for evaluation. The evaluation is based on internal review committee and guide for 50 marks. The End Semester Examination for the project work shall consist of an evaluation of the project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner (25 marks) and an internal examiner (25 marks).

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEW702	INTERNSHIP/INPLANT TRAINING	L	T	P	C	Hrs
		0	0	0	2	3 to 4 Weeks

Course Objectives

This course should enable the students to

- Expose to the industrial environment
- Understand and sharpen the real time technical / managerial skills required in the civil engineering job.
- Expose on the current technological developments relevant to civil engineering domain.
- Communicate effectively on complex engineering activities
- Create conditions conducive to quest for knowledge and its applicability on the job.

Course Outcomes

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

CO1 - Be a source of highly motivated pre-professionals. **(K3)**
CO2 - Bring new perspectives to problem solving. **(K4)**
CO3 - Implement/Develop Technology solutions which will improve quality of life **(K4)**
CO4 - Develop an ability to communicate effectively (oral and written communication, report writing, presentation skills) **(K4)**
CO5 - Identify and to address their own educational needs in a changing world. **(K4)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

DESCRIPTION

Students may undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Mentor, Class advisor and Departmental Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	1	2	-	-	-	-	-	-	-	3	3	3
CO4	1	3	3	2	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEM707	PROFESSIONAL ETHICS	L	T	P	C	Hrs
		2	0	0	-	30

Course Objectives

This course should enable the students to

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Course Outcomes

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

CO - Apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities andrights in the society

UNIT I HUMAN VALUES (6 Hrs)

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Livingpeacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS (6 Hrs)

Senses of „Engineering Ethics" — Variety of moral issues — Types of inquiry — Moral dilemmas — Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles

- Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION (6 Hrs)

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS (6 Hrs)

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights –Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES (6 Hrs)

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development– Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Codeof Conduct — Corporate Social Responsibility

Reference Books

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –Concepts and Cases",Cengage Learning, 2009
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
6. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
7. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi2013.
8. World Community Service Centre, " Value Education", Vethathiri publications, Erode,2011

Web References

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

SEMESTER VIII

U20CET820	ARCHITECTURE AND TOWN PLANNING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Learn the history of Architecture and its development
- Understand the methods and materials used in ancient Architecture
- Understand interior planning and design
- Know the various planning ideologies in town planning
- Understand the concept of city, housing and landscape planning

Course Outcomes

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

CO1- Understand the history and architectural developments **(K2)**
CO2 - Comprehend the past, follows present, ascendance the future **(K2)**
CO3 - Design interior building services **(K3)**
CO4 - Understand and plan for site development **(K3)**
CO5 - Plan and design sustainable cities and town **(K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I ARCHITECTURE AND ITS DEVELOPMENT (9 Hrs)

Indian Indus valley, Vedic, Buddhist, Indo-Aryan, Dravidian and Mughal periods; European Egyptian, Greek, Roman, medieval and renaissance periods- construction and architectural styles; vernacular and traditional architecture. Architectural developments and impacts on society since industrial revolution; influence of modern art on architecture.

UNIT II SKILLS FOR AN ARCHITECTURAL UNDERSTANDING (9 Hrs)

Understanding the construction methods and materials through study of Egyptian, Greek, Roman, European, Indian Architectural History - Modern Architecture Thinking & Analytical Skills - Empathy - Philosophical Understanding from Idea to Form - Psychological and Social Understanding.

UNIT III BUILDING SERVICES (9 Hrs)

Water supply, sewerage and drainage systems; sanitary fittings and fixtures; plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings, intelligent buildings; elevators & escalators, their standards and uses; air-conditioning systems; firefighting systems, building safety and security systems

UNIT IV TOWN PLANNING (9 Hrs)

Objectives and Principles of Town Planning, Stages of Town Development (Indian), Levels of planning, Different types of plan, land use planning, Zoning – Principles, advantages, classification. Planning ideologies - Drainage and water supply in the selection of site for the development – Residential – Commercial – Industrial – Public – Transportation, Utility and services – Agriculture

UNIT V CITY, HOUSING AND LANDSCAPE PLANNING (9 Hrs)

Evolution of cities; principles of city planning; types of cities & new towns; planning regulations and building byelaws; eco-city concept; sustainable development. Concept of housing; neighbourhood concept; Principles of landscape design and site planning; environmental considerations in landscape planning.

Text Books

1. De Charia & Callender, Architecture, Mc. Graw Hill, (2012).
2. Vaishali S. Limaye, Rajani Deshmukh, Supriya.B, Architecture and Town Planning, Nirali Prakashan Publication, Edition 2016
3. Satish Chandra Agarwal, Architecture and Town Planning,
4. Dhanpat Rai & Co. Edition 2014.
5. Sajjan V.Wagh, Pravin R.Minde, Architecture and Town Planning, Tech –Max Publications, Pune, Edition 2016.
6. V.S.Limaye, A.D.Pawar, Architectural Planning And Design Of Buildings, Nirali Prakashan Publication, Edition 2016

Reference Books

1. Gallion, Urban pattern City planning and design, Charotar Publishing House, (2010).
2. Modak & Ambedkar, Town and Country Planning and Housing, (2001).
3. Arian Mostaedi, 'Sustainable Architecture: Low Tech Houses', CarlesBroto,2002

Web References

1. https://archive.nptel.ac.in/courses/124/107/124107158/
2. https://archive.nptel.ac.in/courses/124/105/124105016/
3. https://onlinecourses.swayam2.ac.in/cec20_ar01/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	1	2	-	-	-	3	3	1	2
CO2	-	-	-	1	1	2	1	1	1	-	-	2	3	1	-
CO3	2	2	2	1	2	2	1	1	-	-	1	2	2	3	-
CO4	1	1	1	1	2	1	2	2	1	-	-	2	2	2	3
CO5	3	2	2	-	2	1	2	1	-	-	1	3	1	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20HSP804 ENTREPRENEURSHIP MANAGEMENT

L	T	P	C	Hrs
0	0	2	1	35

Course Objectives

This course should enable the students to

- Develop an ability to identify the critical challenges hindering growth of entrepreneurs
- Understand the significance of Finance Skills, Branding, and Sales Skills for an Entrepreneur
- Be aware of various Government Schemes and Subsidies available for Entrepreneurs

Course Outcomes

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

CO1- Develop and demonstrate the business models. **(K2)**
CO2 - Practice cash management, brand building and enhancing turnover. **(K5)**
CO3 - Understand various schemes and subsidies that are offered by various Government agencies. **(K2)**
CO4 - Effectively tackle growth challenges of their venture. **(K5)**
CO5 - Manage and grow their business in terms of expansion and look for partnerships. **(K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I ENTRPRENEURIAL SKILLS 1 (6 Hrs)

Introduction to Business Model Generation , Developing Lean Business Model for the Business Idea, Developing Prototype and Evaluating assumptions in Business Model using prototype cheaply, Presentation of Business Model, Business Fair

UNIT II ENTREPRENEURIAL SKILLS 2 (6 Hrs)

Financial Skills – Cash Management – Problems of Poor Cash Management – Learning to be Frugal. Branding – Building a 'niche' follower for your product/service – Developing and Establishing a Brand, Sales skills – KPI of Success of Entrepreneurship – Ensuring Growth in Turnover

UNIT III ENTREPRENEURIAL OPPORTUNITIES (6 Hrs)

Awareness of Government Schemes and Subsidies for various Entrepreneurial Categories – Special Schemes for Women Entrepreneurs – Understanding the Procedure and Documentation Process for availing the Government Schemes – Venture Capital – Crowd funding – Angel Investors.

Report Submission:

1. How can I get first 100 customers to pay for my products/services?
2. Information technology as a resource
3. Marketing skill and promotion for entrepreneurs
4. Assessment of factors affecting performance of women entrepreneurs
5. Entrepreneurship as a tool for sustainable employment
6. Examination of problem facing small scale business
7. Survival strategies in small business
8. The role of insurance in minimizing business risk

Text Books

1. Storey, D. J., & Greene, F. J. (2010). Small business and entrepreneurship. Financial Times/Prentice Hall.
2. Scarborough, N. M. (2011). Essentials of entrepreneurship and small business management. Prentice Hall.
3. Gupta C.B., & Srinivasan N.P. (2020). Entrepreneurial Development. Sultan Chand and Sons

Reference Books

1. Brian Tracy – The Psychology of Selling.
2. Dale Carnegie – How to Win Friends & Influence People.
3. Robert Kiyosaki and Sharon Lechter – Rich Dad, Poor Dad.
4. Reid Hoffman – The Startup of You: Adapt to the Future, Invest in Yourself, and Transform Your Career.
5. Michael E. Gerber – The E-Myth Revisited.
6. Chris Guillebeau – The Art of Non-Conformity.
7. Eric Ries – The Lean Startup.
8. Kevin D. Johnson – The Entrepreneur Mind.

Web References

1. https://www.helpguide.org/articles/stress/stress-management.htm
2. https://bscdesigner.com/8-entrepreneurial-kpis.htm
3. https://www.inc.com/ilya-pozin/5-problems-most-entrepreneurs-face.html
4. https://www.inc.com/jessica-stillman/how-to-network-with-super-successful-people.html
5. https://www.entrepreneur.com/article/251603
6. https://seraf-investor.com/compass/article/understanding-crowdfunding

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	1	3	1	1	3	2	2	2	3	3
CO2	1	1	2	2	1	1	3	2	2	3	3	2	2	2	2
CO3	1	2	1	1	1	2	3	2	2	3	3	2	1	2	3
CO4	1	2	2	2	2	3	3	3	3	3	2	3	2	2	2
CO5	1	2	2	2	2	3	3	3	3	3	2	3	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEW803	PROJECT PHASE- II	L	T	P	PW	C	Hrs
		0	0	0	16	8	240

Course Objectives

This course should enable the students to

- Expose students to design problem related to various disciplines of civil engineering.

Course Outcomes

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

CO1 - Take up any challenging practical problems and find solution by formulating proper methodology. **(K5)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

DESCRIPTION

The students will be encouraged to handle the field problems independently in Project work phase II with the extension of the project work Phase-I started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal review committee for 40 marks. The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner (25 marks) , an internal examiner (25 marks) and Publication of paper / Prototypes / Patents , etc (10marks).

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20EES809

SKILL DEVELOPMENT COURSE 9

(NPTEL / MOOC - II)

Student should register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and Subject Experts. Students have to complete the relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course / marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation

Professional Elective – IV (Offered in Semester VII)

U20CEE716 SITE INVESTIGATION METHODS AND PRACTICES	L	T	P	C	Hrs
	3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the site investigation, its types and applications
- Gain the knowledge about the geological methods and its characterization
- Familiar with the logging methods, classification and its factors
- Understand the site exploration methods and its factors
- Understand the technical report preparation on site works

Course Outcomes

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

CO1 – Understand the methods of site investigation through various maps & records. **(K2)**
CO2 – Characterize the rocks & its test procedures. **(K2)**
CO3 – Classify the bore hole & prepare a log report for bore hole. **(K2)**
CO4 – Familiarize with the different insitu tests & sampling procedures. **(K2)**
CO5 – Write technical report for various site works. **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION (9 Hrs)

Objective(s) of site investigation - various stages in site investigation process - Planning and Desk Study - topographic maps, aerial photographs - interpretation of aerial photographs, applications in site investigation , Geological maps, minerals and mining records, soil planning maps, site reconnaissance and local enquiries.

UNIT II GEOLOGICAL METHODS (9 Hrs)

Geological methods - different stages, Geological exploration methods –Areal mapping, site mapping and construction mapping-Rock mass characterization- Discontinuities in rocks ,Rock core descriptors , Rock mass classification, RQD, Rock mass rating, Rock structure rating , Q-system- General principle distribution of physical field in subsurface – Electrical resistivity, Seismic refraction methods, their principle, methods of survey, correction to field data, Interpretation and limitations. Index and Mechanical properties of rocks, Laboratory and insitu tests.

UNIT III GEOPHYSICAL EXPLORATION (9 Hrs)

Trial pits, shafts, tunnels, auguring, and different types of drilling methods, their merits and demerits, Bore hole logging techniques (subsurface geophysical exploration) - Need for logging techniques, classification and different types logging methods.

UNIT IV SAMPLING METHODS (9 Hrs)

Soil Exploration methods, samples, sampling procedure, sample disturbances, samplers, Factors controlling spacing and depth of bore hole, Insitu tests, SPT, SCPT, Pressure meter tests, interpretation and application, Index properties , Laboratory testing.

UNIT V REPORT PREPARATION (9 Hrs)

Technical Report writing, report format, recommendations for earth work structures, highway excavations and drainage works, dams, check report site preparation, investigation during construction and operation.

Text Books

1. Francis Longstreth Thompson “Site planning in Practice: an Investigation of the Principles of Housing Estate Development” Palala Press, 2016.
2. Craig. C “Advances in site investigation practice” Thomas Telford Ltd, 1996
3. Joyce, M.D. ‘Site Investigation Practice; ESFN. SPON Publishers, 1982.

Reference Books

1. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2006.
2. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
3. Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.
4. Legget and Karrow, Hand book of Geology in Civil Engineering, McGraw Hill Publishers, 1983.
5. Hunt, R.E., Geotechnical Engineering Analysis and Evaluation, McGraw Hill Book Company, 1986.

Web References

1. https://nptel.ac.in/courses/105103182/
2. https://nptel.ac.in/courses/105104167/
3. http://www.digimat.in/nptel/courses/video/105103182/L15.html
4. https://nptel.ac.in/courses/105/108/105108075/
5. https://nptel.ac.in/courses/105/105/105105185/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	-	-	-	-	-	-	3	3	2	2
CO2	2	-	-	-	1	-	-	-	-	-	-	3	3	2	2
CO3	2	1	-	-	1	-	-	-	-	-	-	2	3	2	2
CO4	1	1	-	2	1	-	-	-	-	-	-	2	3	2	2
CO5	-	-	2	-	-	2	-	-	-	-	-	3	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE717	URBAN PLANNING AND DEVELOPMENT	L	T	P	C	Hours
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Gain knowledge about urbanisation and suburbanisation
- Understand about principles of planning, goals and objectives.
- Evaluate various developmental plans in different zones
- Understand the implementation process of the urban projects and its design problems.
- Understand about the Standards and Regulations of urban system.

Course Outcomes

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

CO1 - Describe basic issues in urban planning. **(K2)**
CO2 - Formulate plans for urban and rural development. **(K2)**
CO3 - Plan and analyze socio economic aspects of urban and rural planning. **(K2)**
CO4 - Implement project formulation activities. **(K2)**
CO5 - Know about the legislation and regulations about the urban planning system. **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I BASIC ISSUES (9 Hrs)

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri - urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS (9Hrs)

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objective(s), Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION (9 Hrs)

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies

UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS (9 Hrs)

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM (9 Hrs)

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries

Text Books

1. Goel, S.L “Urban Development and Management”, Deep and Deep publications, New Delhi 2003
2. George Chadwick, “A Systems view of planning”, Pergamon press, Oxford 1978
3. Singh V.B, “Revitalised Urban Administration in India”, Kalpaz publication, Delhi, 2002

Reference Books

1. “Tamil Nadu Town and Country Planning Act 1971”, Government of Tamil Nadu, Chennai
2. Thooyavan, K.R., Human Settlements – “A Planning Guide to Beginners”, M.A Publications, Chennai, 2005

3. “CMDA, Second Master Plan for Chennai”, Chennai 2013
4. Edwin S.Mills and Charles M.Becker, “Studies in Urban development”, A World Bank publication, 2010
5. Catanese A J, “Urban Planning”, McGraw Hill publication January 2014.

Web References

1. https://nptel.ac.in/courses/124/107/124107007/
2. https://nptel.ac.in/courses/127/101/127101014/
3. https://www.youtube.com/watch?v=URLOGQhJWj0

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	-	-	-	-	2	2	2
CO2	3	2	3	3	-	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	3	3	-	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE718	BRIDGE ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Gain knowledge about the investigation of Bridges and loading standards.
- Understand the Bridge substructure.
- Understand the Bridge superstructure
- Understand the design concepts in bridges.
- Familiar about bridge maintenance and rehabilitation techniques adopted in bridge

Course Outcomes

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

CO1 - Gain knowledge on investigation and loading standards of bridge. **(K2)**
CO2 - Select the suitable types of foundation, design of abutment, wing walls and setting out piers and abutment. **(K2)**
CO3 - Compare and choose the right types of super structure. **(K2)**
CO4 - Design steel and concrete bridges. **(K3)**
CO5 - Choose the suitable maintenance and rehabilitation techniques of bridge. **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION (9 Hrs)

Introduction to bridges Investigations of minor and major bridge – Topography, catchment, hydrology, Geotechnical aspects, Construction Resources. Loading standard for road and railway bridges

UNIT II SUBSTRUCTURE (9 Hrs)

Choice of Foundation for piers and abutments –Types. Load on Foundation – Design of Well foundation, sinking process, tilt correction. Design of Pile Foundation. Design of wing wall and abutment. Setting out for piers and abutments for Major and Minor Bridges.

UNIT III SUPERSTRUCTURE (9 Hrs)

Choices of superstructure types Different types of superstructure (RCC and PSC); Longitudinal Analysis of Bridge.- Transverse Analysis of Bridge - Temperature Analysis - Distortional Analysis - Effects of Differential settlement of supports. Bearing and types.

UNIT IV DESIGN OF BRIDGE (9 Hrs)

Design of Bridges – IRC code – Pigeaud's method – Coulomb's method – design of Slab Bridge – T Beam Bridge. Design of Truss Bridges – Design of Plate girder bridges.

UNIT V MAINTENANCE (9 Hrs)

Maintenance-Inspection of bridges, Maintenance of substructure girders-Load testing on bridges-Temporary and movable bridges. Causes of bridge failure. Rehabilitation techniques for concrete bridges

Text Books

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 2010
2. M. K. Pant, Bridge Engineering, S.K Katariaand Sons, 2016
3. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 2017.

Reference Books

1. Victor.D.J, Essentials of Bridge Engineering, Oxford IBH Publishers 2013.
2. David Blockey, Bridges, Oxford University Press, 2013.
3. Phatak D.R., “Bridge Engineering”, Satya Prakashan, New Delhi, 1990.
4. Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013
5. Raina, V.K., Analysis, Design and Construction of Bridges, Tata McGraw Hill(2010)

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2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ce23/
3. https://nptel.ac.in/courses/105/105/105105165/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	-	-	-	-	-	-	1	3	1	2
CO2	2	3	1	2	2	-	-	-	-	-	-	1	3	1	-
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	3	-
CO4	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
CO5	3	3	2	2	3	-	-	-	-	-	-	1	1	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE719 POLLUTION CONTROL AND MONITORING

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the factors that must be satisfied for Water pollution control.
- Gain knowledge about air pollution, sources and its effects on human.
- Gain adequate knowledge about environmental, industrial noise and control legislation.
- Understand about the sources, collection and disposal method of solid waste.
- Understand the relationship between social, legislative and biological constraints in a modern developed society

Course Outcomes

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

CO1 - Describe the principles of the biological and chemical treatment processes that are required to ensure adequate quality and quantities of potable water.**(K2)**

CO2 - Analyze the sources, effect of air pollution, air quality monitoring and control system.**(K3)**

CO3 - Use advanced methods for monitoring and modeling for noise pollution and preventive temporal patterns for noise pollution.**(K3)**

CO4 - Understand the generation and preventive measures of solid waste.**(K2)**

CO5 - Analyze the method of sanitation for various field **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I WATER POLLUTION & CONTROL (9 Hrs)

Natural process-pollution due to industrial, agricultural and municipal wastes-limitations of disposal by dilution-BOD consideration in streams – Oxygen Sag Curve-Water pollution control legislation.

UNIT II AIR POLLUTION AND CONTROL (9 Hrs)

Pollution and their sources-effects of pollution on human health, vegetation and climate-prevention and control of particulate-industry and air-pollution surveys and sampling-Air quality monitoring- air pollution control legislation.

UNIT III NOISE POLLUTION AND CONTROL (9 Hrs)

Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution; fundamentals of sound generation, propagation etc; sound measurement; sound level meters – types, components, Measures for prevention and control of noise; environmental and industrial noise; noise control legislation.

UNIT IV SOLID WASTE MANAGEMENT (9 Hrs)

Source characteristics – quantities – collection methods and disposal techniques – sanitary landfill – incineration – and pyrolysis, composting, aerobic and anaerobic- economics of composting; recycling and reuse.

UNIT V ENVIRONMENTAL SANITATION (9 Hrs)

Relation of food to disease-principles of food sanitation-sanitation of kitchens, restaurants and other catering establishments-quality changes in milk-milk as carrier of infection-pasteurization of milk-HTST and LTLT processes – cattle shed sanitation. Orientation of buildings with respect to the direction of prevailing winds and solar movement. Air movement inside the buildings for a healthy residential environment.

Text Books

1. Noel de Nevers, “Air Pollution Control Engineering”, Waveland press,Inc 2017.
2. S. M. Khopkar “Environmental Pollution Monitoring and Control”,New age international(P)Limited 2004
3. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, “Air Pollution Control Engineering”, Tokyo, springer science + science media LLC,2004.

Reference Books

1. Vesilind (1997), Introducing to Environmental Engineering, PWS Publishing Company.
2. Gerard Kiley (1997), Environmental Engineering, Irwin McGraw-Hill.
3. Rao C.S. (1996), Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi.
4. Ahmed El-Nemr, 2010, Impact, Monitoring and Management of Environmental Pollution.
5. Marquita K. Hill,2010 Understanding Environmental Pollution

Web References

1. https://nptel.ac.in/courses/105102089/
2. http://www.ilocis.org/documents/chpt55e.htm
3. https://nptel.ac.in/courses/105/102/105102089/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	-	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	1	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO4	2	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE720 ADVANCED STRUCTURAL ANALYSIS

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Analyze the portal frames by using approximate method
- Analyze the indeterminate beams by Muller Breslau's theorem
- Analyze the trusses by using stiffness and flexibility method
- Gain the knowledge of space and cables structures by tension coefficient method
- Understand the concepts of developing finite elements and finite element packages.

Course Outcomes

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

CO1 - Understand the analysis of portal frames by Portal and Cantilever method (**K4)**
CO2 - Gain and draw influence lines for indeterminate beams by Muller Breslau's theorem **(K3)**
CO3 - Understand the pin jointed frames by Method of Joints **(K4)**
CO4 - Gain the knowledge about common feature in modern building construction, large roof spans in commercial and industrial buildings **(K2)**
CO5 - Understand FEM method is fast, accurate and innovative approach to solving your most challenging design problems **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I ANALYSIS OF MULTISTORIED FRAMES (9 Hrs)

Introduction – Substitute frame method - Portal Method – Cantilever Method – Analysis of frames

UNIT II ILD FOR INDETERMINATE STRUCTURES (9 Hrs)

Influence line diagram - Muller - Breslau's principle – I.L.D for Propped cantilever, Fixed beams, Continuous beams.

UNIT III ANALYSIS OF PIN JOINTED PLANE FRAMES (9 Hrs)

Analysis of pin jointed plane frames with two or three unknowns by Stiffness method - Lack of fit - Temperature stress

UNIT IV SPACE AND CABLE STRUCTURES (9 Hrs)

Analysis of Space trusses using method of tension coefficients – Beams curved in plan Suspension cables – Suspension bridges with two and three hinged stiffening girders

UNIT V INTRODUCTION TO FINITE ELEMENT METHOD (9 Hrs)

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements

Text Books

1. Vaidyanathan R and Perumal P, Structural Analysis, Vol. 2, Laxmi Publications Pvt. Ltd, New Delhi, 2017, 3rd Edition
2. Bhavikatti,S.S, Structural Analysis, Vol. 2, Vikas Publishing House Pvt. Ltd., New Delhi, 4th Edition, 2018
3. Pandit G.S, and Gupta S. P, "Structural Analysis a Matrix Approach", Tata McGraw Hill Publications, New Delhi, 2014

4. L.S. Negi and R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003.
5. Reddy.J.N., " Introduction to the Finite Element Method", Tata McGraw Hill, 2013

Reference Books

1. Gambhir. M.L., "Fundamentals of Structural Mechanics and Analysis"., PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Devdas Menon, Advanced structural analysis, Narosa,2009
3. C.S. Reddy, Basic Structural Analysis, Tata Mc-Graw hill, 2015
4. Wang C. K., “Intermediate Structural Analysis” Tata McGraw - Hill Education 2010.
5. Sujit Kumar Roy and Subrata Chakrabarty, “Fundamentals of Structural Analysis” S. Chand & Co., 2010

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2. http://www.digimat.in/nptel/courses/video/105101086/L01.html
3. https://nptel.ac.in/courses/105/106/105106176/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3	3	2	3	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	2	3	3	-	-	-	-	-	-	-	-	3	3	3
CO5	3	2	3	3	-	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

Professional Elective – V (Offered in Semester VIII)

U20CEE821	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the concept of degree of freedom
- Gain the knowledge about the multiple degree of freedom
- Familiar with the basic knowledge on Earthquake Engineering
- Know the basic response of structures to earthquake
- Study the design aspects on earthquake engineering

Course Outcomes

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

CO1 - Understand the concept of degree of freedom **(K3)**
CO2 - Grab the knowledge on Multiple degree of freedom **(K3)**
CO3 - Understand with the basic knowledge on Earthquake Engineering. **(K3)**
CO4 - Know the basic response of structures to earthquake **(K3)**
CO5 - Understand the design on Earthquake Engineering **(K4)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I SINGLE DEGREE OF FREEDOM (9 Hrs)

Definition of degree of freedom – Degree of freedom – idealization of structure as single degree of freedom system – Formulation of Equations of motion of SDOF system - D'Alembert's principles – effect of damping – free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces.

UNIT II MULTIPLE DEGREE OF FREEDOM (9 Hrs)

Formulation of equations of motion of multi degree of freedom (MDOF) system - Eigen values and Eigen vectors – Response to free and forced vibrations - damped and undamped MDOF system – Modal superposition methods.

UNIT III INTRODUCTION TO EARTHQUAKE ENGINEERING (9 Hrs)

Elements of Engineering Seismology – Definitions, introduction Seismic hazard, Earthquake phenomenon – Seismotectonic - Seismic Instrumentation- Characteristic of strong earthquake motion – Estimation of earthquake parameters.

UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE (9 Hrs)

Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces as per IS:1893 – 2002 - Response Spectra – Lessons learnt from past earthquakes.

UNIT V DESIGN METHODOLOGY (9 Hrs)

Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Lateral load analysis – Design and detailing as per IS:13920 – 1993.

Text Books

1. Chopra, A.K., “Dynamics of Structures: Theory and Applications to Earthquake Engineering”, Pearson, 5th Edition, 2017.
2. Clough R.W, and Penzien J, “Dynamics of Structures”, 2nd Edition, McGraw- Hill International Edition, 2003.
3. Mario Paz, “Structural Dynamics Theory and Computations”, 5th Edition, CBS Publishers, 2012.

Reference Books

1. Kappos, A., “Dynamic Loading and Design of Structures”, CRC Press, 2014
2. Craig, R.R., Kurdila, A.J., “Fundamentals of Structural Dynamics”, John Wiley and Sons, 2nd Edition, 2011.
3. Bollinger, G.A., “Blast Vibration Analysis”, Courier Dover Publications, 2018
4. Dr. K. Jagannadha Rao Er. Srinavas Vasam, “Structural Dynamics And Earthquake Engineering” S.K. Kataria Publisher, 2018
5. Gopinath R, “Structural Dynamics and Earthquake Engineering”, Yes Dee Publishing Pvt Ltd, 2021

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2. https://nptel.ac.in/courses/105/101/105101006/
3. https://nptel.ac.in/courses/105/104/105104189/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	3	-	-	-	-	3	3	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	2	2	3
CO4	-	2	2	-	-	2	2	2	-	-	-	-	3	2	3
CO5	-	3	3	2	3	2	2	2	1	1	1	1	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE822	HOUSING - PLANNING AND MANAGEMENT	L	T	P	C	Hours
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Train a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects.
- Study and understand the latest construction techniques applied to engineering Construction
- Become familiar with Building Byelaws
- Focuses on cost effective construction materials and methods.
- Emphasis is given on the principles of sustainable housing policies and programmes

Course Outcomes

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

CO 1 - Understand various strategies of housing planning in different level. **(K2)**
CO 2 - Get knowledge about various housing programs and schemes in governmental organization. **(K2)**
CO 3 - Formulate the housing Projects and design problems associated to implementation. **(K3)**
CO 4 - Undergo Performance Evaluation in various aspects. **(K2)**
CO 5 - Understand the concept of cost effective analysis of housing projects and to understand project appraisal techniques. **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION TO HOUSING (10 Hrs)

Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

UNIT II HOUSING PROGRAMMES (10 Hrs)

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods-Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS (9 Hrs)

Formulation of Housing Projects – Land Use and Soil suitability analysis - Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) – Housing Project Formulation.

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS (8 Hrs)

New Constructions Techniques – Cost Effective Modern Materials and methods of Construction- Green building concept - Building Centers – Concept, Functions and Performance Evaluation.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL (8 Hrs)

Evaluation of Housing Projects for sustainable principles – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy - Public Private Partnership Projects – Viability Gap Funding - Pricing of Housing Units.

Text Books

1. Meera Mehta and Dinesh Mehta, "Metropolitan Housing Markets", Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House, Bombay, 1997.
3. “Development Control Rules for Chennai Metropolitan Area, CMA”, Chennai, 2004.

Reference Books

1. Wiley- Blackwell, "Neufert Architects" Data, 4th Edition, Blackwell Publishing Ltd, 2012
2. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design", 8th Edition, Tata McGraw Hill Edition, 2011
3. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA 2010
4. “Development Control Rules for Chennai Metropolitan Area, CMA”, Chennai, 2004.
5. W Addington Willis, “Housing and Town Planning in Great Britain”, March 2019

Web References

1. https://nptel.ac.in/courses/124107001/
2. https://nptel.ac.in/courses/105106188/
3. https://www.youtube.com/watch?v=VI3Ef1Rytz8

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	2	-	-	-	-	-	-	3	2	2
CO2	3	2	3	3	2	2	-	-	-	-	-	-	3	2	2
CO3	3	2	3	3	2	2	-	-	-	-	-	-	3	2	2
CO4	3	2	3	3	2	2	-	-	-	-	-	-	3	2	2
CO5	3	2	3	3	2	2	-	-	-	-	-	-	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE823 **TALL STRUCTURES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the problems associated with large heights of structures with respect to loads (wind and earthquake and deflections of the structure).
- Understand the problems associated with large heights of structures with respect to loads (wind and earthquake and deflections of the structure).
- Understand the concept of shear wall and bracing structures in high rise building
- Understand the concept of lateral deformation of rigid frame buildings structures
- Know the parameters of designing tall buildings

Course Outcomes

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

CO1 - Explain the design aspects and the various innovative materials which can be used for the construction of tall buildings ***(K2)***

CO2 - Apply the knowledge of engineering fundamentals to characterize various types of loading which could be considered for the analysis of tall building. ***(K2)***

CO3 - Identify various structural systems, their behavior and performance under different loading conditions. ***(K2)***

CO4 - Analyze the structures as an integral unit for drift and twist ***(K2)***

CO5 - Design tall structures under different conditions like stability considerations, creep, shrinkage, and temperature and fire resistance. ***(K2)***

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I DESIGN CRITERIA AND MATERIALS **(9 Hrs)**

Design Philosophy - Modern concepts – Materials used - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self-Compacting Concrete, High strength steel, Composites

UNIT II LOADING **(9 Hrs)**

Gravity Loading – Dead load, Live load – Live load reduction techniques, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Dynamic Analysis, Combination of Loads

UNIT III BEHAVIOUR OF STRUCTURAL SYSTEMS **(9 Hrs)**

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 and Outrigger – Hybrid systems.

UNIT IV ANALYSIS **(9 Hrs)**

Modeling for approximate analysis, accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for drift and twist. Computerized 3D analysis.

UNIT V DESIGN PARAMETERS **(9 Hrs)**

Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance, Stability of Tall Structures - P∆ Effects, Buckling analysis Of Tall Buildings.

Text Books

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 2011.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, McGraw Hill, 2011.
3. Mark Sarkisian, “Designing Tall Buildings : Structure as Architecture”, Routledge, 2016
4. Wolfgang Schueller,"High-rise building Structures", John Wiley and Sons, New York 1977.

Reference Books

1. Coull, A. and Smith, Stafford, B. "Tall Buildings", Pergamon Press, London, 1997.
2. LinT.Y. and Burry D.Stotes, "Structural Concepts and Systems for Architects and Engineers", John Wiley, 1994.
3. Lynn S. Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1996.
4. Bungale S. Taranath, “Tall Building design: Steel Concrete, and Composite systems”
5. Kolousek V, Pimer M, Fischer O and Naprstek J, Wind effects on Civil Engineering Structures. Elsevier Publications.1984.

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2. https://www.elsevier.com/physical-sciences-and-engineering/engineering/journals/damping-technologies-for-tall-buildings-new-trends-in-comfort-and-safety

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3	-	-	-	-	2
CO2	3	3	2	-	2	-	-	3	-	-	-	-	2	2	2
CO3	-	2	2	1	2	-	-	-	-	-	-	-	3	-	3
CO4	-	3	3	-	3	2	-	2	-	-	1	1	3	3	2
CO5	-	3	3	-	2	2	2	2	1	-	1	1	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE824 INDUSTRIAL WASTE DISPOSAL AND TREATMENT

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Have a knowledge on the uses of water by industries
- Understand the process involved in industries and their waste water production
- Learn about the treatment of waste water.
- Learn about the treatment safe disposal of treated effluents.
- Study the impact due to Textiles Tanneries, Pulp and Paper, Metal finishing, Petroleum refining, chemical industries, Sugar and distilleries, Dairy, Iron and Steel.

Course Outcomes

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

CO1- An ability to use the recent techniques.**(K3)**
CO2 - Describe the importance of Pretreatment Methods **(K3)**
CO3 - Apply the various techniques for Treatment Methods of Industrial Wastes **(K3)**
CO4 - Describe the solve problems related to Industrial Waste Water management and Disposal **(K3)**
CO5 - Carry out Industry and power plants studies case studies **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I PRECIPITATION (9 Hrs)

Uses of water by Industry - Sources and types of wastewaters, quality criteria, effluent standards- Individual and common effluent treatment plants - Population equivalent, Effects of industrial wastes on streams, land, air and waste water treatment plants

UNIT II PRETREATMENT METHODS (9 Hrs)

Pretreatment Methods: Process modification – methods and materials changes – Reduce, reuse and recycle methods, housekeeping etc. to reduce waste discharge and strength of the waste and established methods for by products recovery within the plant operations.

UNIT III TREATMENT METHODS OF INDUSTRIAL WASTES (9 Hrs)

Equalization – Neutralization - Oil separation – Floatation – Precipitation –Adsorption - Aerobic and anaerobic biological treatment - High rate reactors. Chemical oxidation – Ozonation –Ion Exchange – Membrane technologies.

UNIT IV TREATMENT METHODS OF RESIDUALS (9 Hrs)

Residuals of Industrial waste treatment – Characteristics of sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge.

UNIT V CASE STUDIES (9 Hrs)

Industry and power plants - manufacturing process description - wastewater characteristics and waste treatment flow sheet for typical industries – Textiles – Tanneries – Pulp and Paper –Metal finishing – Petroleum refining – Chemical industries - Sugar and distilleries –Dairy –Iron and Steel- Fertilizers –Nuclear power plants.

Text Books

1. Eckenfelder. W.W., Industrial Water Pollution Control, McGraw Hill, 2017.
2. Arceivala.S.J. Wastewater Treatment for Pollution Control, Tata Mc.Graw Hill. 2018
3. Santosh kumar Garg, Industrial Waste Disposal and Treatment, Khanna Publishers, 2018.

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1. Nemerow,N.L., Theories and Practices of Industrial Wastes Treatment, Addisson and Wesley, 2015.
2. Gurnham,C.F., Principles of Industrial Waste Treatment, John Wiley, New York,2012.
3. Varshney, R.S., Industrial Waste Disposal and Treatment,, Nem Chand & Bros., 2017.
4. Jayarami Reddi.P, Text Book of Industrial Waste Disposal and Treatment, Lakshmi Publications, 2017.
5. Bear J., " Industrial Waste Disposal ", McGraw-Hill, New York, 2012

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3. https://nptel.ac.in/content/105/107/105106056/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	-	-	-	-	-	-	1	3	1	2
CO2	2	3	1	2	2	-	-	-	-	-	-	1	3	1	-
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	3	-
CO4	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
CO5	3	3	2	2	3	-	-	-	-	-	-	1	1	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE825 PREFABRICATED STRUCTURES

L	T	P	C	Hours
3	0	0	3	45

Course Objectives

This course should enable the students to

- Learn various distress and damages to concrete structures
- Assess the durability of concrete due to various non-destructive testing
- Suggest the suitable materials and techniques for repair
- Implement various rehabilitation and retrofitting techniques
- Select suitable demolition techniques for structures

Course Outcomes

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

CO1 - Gain knowledge of maintenance and various assessment techniques **(K2)**
CO2 - Understand the methods of non-destructive testing systems **(K2)**
CO3 - Understand the types and properties of repair material **(K2)**
CO4 - Understand the corrosion and damaged structures **(K2)**
CO5 - Gain knowledge of strengthening of structures **(K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION (9 Hrs)

Need for prefabrication – Principles – Materials – Modular coordination – Standarization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS (9 Hrs)

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

UNIT III DESIGN PRINCIPLES (9 Hrs)

Disuniting of structures – Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINT IN STRUCTURAL MEMBERS (9 Hrs)

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

UNIT V DESIGN FOR ABNORMAL LOADS (9 Hrs)

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. Poonam I. Modi and Chirag N. Patel, “Repair and Rehabilitation of concrete structures”, PHI Learning Pvt. Ltd., 2015
2. P.C.Varghese, “Maintenance, Repair & Rehabilitation & Minor Works of Buildings”, PHI Learning Pvt. Ltd., 2014
3. Riadh Al-Mahaidi, Robin Kalfat, “Rehabilitation of Concrete Structures with Fiber-Reinforced Polymer”, Matthew Deans, 2018

Reference Books

1. R.T.L. Allen, S.C. Edwards, and J.D.N. Shaw, “The Repair of Concrete Structures”, Blackie Academic & Professional, 2005
2. Walter F. Silva-Araya. Oladis T. De Rincon and Luis Pumarada O’Neill, “Repair and Rehabiliation of Reinforced Concrete Structures”, ASCE Publications, 1997.
3. Anibal Costa, Joao Miranda Guedes, Humberto Varum, “Structural Rehabilitation of Old buildings”, Springer, 2014
4. V.M. Malhotra,”Repair, Rehabiliation and Maintenance of Concrete Structures, and innovations in design and construction”, American Concrete Institute, 2000
5. Thomas Dyer, “Concrete Durability”, CRC Press, 2014

Web References

1. https://nptel.ac.in/courses/105/106/105106202/
2. https://onlinelibrary.wiley.com/doi/abs/10.1002/pse.140
3. https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470015902.a0021403.pub2

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	-	-	-	-	-	-	2	3	3
CO2	3	2	3	3	1	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	1	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	1	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	1	2	-	-	-	-	-	-	2	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

Professional Elective – VI (Offered in Semester VIII)

		L	T	P	C	Hours
U20CEE826	COASTAL AND OFFSHORE STRUCTURES	3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the various components in Harbour and offshore structures.
- Understand the planning and design principles of various components in Docks and harbours.
- Gain knowledge about types, forces, design concepts and foundation for offshore structures.
- Understand about the types of offshore structure.
- Understand about the design and installation of offshore pipelines.

Course Outcomes

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

CO 1 - Understand the classification of Harbours and details of different ports **(K2)**
CO 2 - Learn the terminology and fundamental concepts of planning **(K2)**
CO 3 - Students able to designing coastal and types of dock structures **(K3)**
CO 4 - Understand the types of offshore structures with different environmental conditions. **(K2)**
CO 5 - Learn the costal foundation and Submarine pipelines **(K2)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I GROWTH OF PORTS (9 Hrs)

History of Port – Classification of Harbours - Factors affecting the growth of Port. Requirement of a Harbour - General Planning - Site investigation. Description of selected Indian ports.

UNIT II HARBOUR PLANNING (TECHNICAL) (9 Hrs)

Harbour entrance - Navigational Channel – Depth of harbour – Turning basin – berthing area – Shipping terminal facilities – Essentials of passenger terminal, dry bulk cargo terminal, Liquid bulk cargo terminals and container terminals. Navigational aids – Light house.

UNIT III HARBOUR STRUCTURES (9 Hrs)

Break waters: Types – Selection – Forces and – Design principles of break waters. Berthing structures: Types – Loads – Selection and design principles of berthing structures –Selection and Design principles of Dock fenders and Mooring accessories. Types of dock structures, Dredging.

UNIT VI OFFSHORE STRUCTURE (9 Hrs)

Types of offshore structures – selection – function - Physical, environmental and geotechnical aspects of marine and offshore construction – Loads and responses of offshore structures.

UNIT V CONSTRUCTION OF OFFSHORE STRUCTURES (9 Hrs)

Foundations for offshore structures – Introduction to design and installation of offshore piled platforms, concrete offshore platforms, Moored floating structures and Submarine pipelines

Text Books

1. Narasimhan and S. kathiroli, Harbour and Coastal Engineering (Indian Scenario) Vol - I and Vol – II, NIOT- Chennai
2. Chakrabarti.,S.K., Hand Book of Offshore Engineering (Vols. 1 and 2)" Elsevier Publications
3. Offshore Structures, Marine Foundations and Sediment Processes (v. 2) (Handbook of Coastal and Ocean Engineering), Gulf Publishing Co, 1990

Reference Books

1. Gerwick, C., Construction of Marine and Offshore structures, CRC Press.
2. Alonzo Def. Quinn., Design and construction of Port and Marine structures, McGraw-Hill, 2007
3. Harbour Dock & Tunnel Engineering, R. Srinivasan, Charotar Publishing House pvt. Ltd.; 27th edition
4. C.M. Wang, Large Floating Structures: Technological Advances, Springer; 2015th edition, 2014
5. Angus Mather, Offshore Engineering, Witherby Seamanship International; Third Edition, 2011

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1. https://nptel.ac.in/courses/114/106/114106025/
2. https://nptel.ac.in/courses/114/106/114106011/
3. https://nptel.ac.in/courses/114/106/114106035/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	1	-	-	-	-	-	-	-	2	2	1
CO2	1	2	-	-	-	-	-	-	-	-	-	-	1	1	2
CO3	2	1	2	-	1	-	-	-	-	-	-	-	3	3	2
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	2	1
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE827	PAVEMENT ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the various stresses in the pavement
- Gain knowledge about the design of flexible pavement
- Familiar with the design of flexible pavement
- Understand the basic distresses in the pavement
- Gain knowledge on basic elements of soil stabilization

Course Outcomes

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

CO1- Design the stresses and deflection of the pavement **(K3)**
CO2 - Design the flexible pavement **(K4)**
CO3 - Design the rigid pavement **(K4)**
CO4 - Understand the pavement evaluation methods **(K3)**
CO5 - Understand the various soil stabilization techniques **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I PAVEMENT AND STRESS DISTRIBUTION (9 Hrs)

Introduction – Pavement as layered structure – Pavement types (rigid and flexible) - Stress and deflections in pavements under repeated loading

UNIT II DESIGN OF FLEXIBLE PAVEMENTS (9 Hrs)

Flexible pavement design - Factors influencing design of flexible pavement - Empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads

UNIT III DESIGN OF RIGID PAVEMENTS (9 Hrs)

Cement concrete pavements - Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India

UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE (9 Hrs)

Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index - Pavement maintenance

UNIT V STABILIZATION OF PAVEMENTS (9 Hrs)

Stabilization for highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads

Text Books

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2015.
2. Kadiyali L R, “Highway Engineering”, Khanna Book Publishing Co Pvt Ltd, 2019.
3. Thom Nicholas, “Principles of Pavement Engineering”. ICE Publishing, 2008

Reference Books

1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Fifth Revision), IRC: 37-2018
2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC: 58-2017
3. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2019.
4. Yoder, E.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2011
5. Huang, “Pavement Analysis and Design”, Pearson Education, 2008.

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1. https://nptel.ac.in/courses/105101087/
2. https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-28.pdf
3. https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-29.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	1	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	2	-	2	1	3	-	-	-	-	-	-	-	2	2	1
CO5	1	-	-	2	3	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE828 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Learn various distress and damages to concrete structures
- Assess the durability of concrete due to various non-destructive testing
- Suggest the suitable materials and techniques for repair
- Implement various rehabilitation and retrofitting techniques
- Select suitable demolition techniques for structures

Course Outcomes

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

CO1 - Gain knowledge of maintenance and various assessment techniques **(K2)**
CO2 - Understand the methods of non-destructive testing systems **(K2)**
CO3 - Understand the types and properties of repair material **(K2)**
CO4 - Understand the corrosion and damaged structures **(K2)**
CO5 - Gain knowledge of strengthening of structures **(K3)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I MAINTENANCE AND REPAIR STRATEGIES (9 Hrs)

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II DAMAGE DIAGNOSIS AND ASSESSMENT (9 Hrs)

Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement.

UNIT III REPAIR TECHNIQUES (9 Hrs)

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks.

UNIT IV CORROSION OF STEEL IN CONCRETE (9 Hrs)

Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns)

UNIT V STRENGTHENING OF CONCRETE STRUCTURES (9 Hrs)

Introduction – Plate bonding method - RC Jacketing of column and beams with reinforced concrete – FRP methods – Strengthening of RC members in flexure, shear, confinement using FRP

Text Books

1. Poonam I. Modi and Chirag N. Patel, “Repair and Rehabilitation of concrete structures”, PHI Learning Pvt. Ltd., 2015
2. P.C.Varghese, “Maintenance, Repair & Rehabilitation & Minor Works of Buildings”, PHI Learning Pvt. Ltd., 2014
3. Riadh Al-Mahaidi, Robin Kalfat, “Rehabilitation of Concrete Structures with Fiber-Reinforced Polymer”, Matthew Deans, 2018

Reference Books

1. R.T.L. Allen, S.C. Edwards, and J.D.N. Shaw, “The Repair of Concrete Structures”, Blackie Academic & Professional, 2005
2. Walter F. Silva-Araya. Oladis T. De Rincon and Luis Pumarada O’Neill, “Repair and Rehabiliation of Reinforced Concrete Structures”, ASCE Publications, 1997.
3. Anibal Costa, Joao Miranda Guedes, Humberto Varum, “Structural Rehabilitation of Old buildings”, Springer, 2014
4. V.M. Malhotra,”Repair, Rehabiliation and Maintenance of Concrete Structures, and innovations in design and construction”, American Concrete Institute, 2000
5. Thomas Dyer, “Concrete Durability”, CRC Press, 2014

Web References

1. https://nptel.ac.in/courses/105/106/105106202/
2. https://onlinelibrary.wiley.com/doi/abs/10.1002/pse.140
3. https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470015902.a0021403.pub2

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	2	1	-	-	-	-	-	-	2	3	2
CO5	3	2	3	3	2	-	-	-	-	-	-	-	2	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE828 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Gain knowledge on the various environmental protection laws and acts in India
- Decide appropriate technologies to quantify the impact.
- Gain knowledge on the various mitigation measures for air, water and land quality
- Understand about the steps in performing socio economic impact assessment
- Gain knowledge about the impacts of economic profile of the community

Course Outcomes

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

CO 1-Understand the concept of Environmental protection laws-**(K2)**
CO 2-Understand about EIA methodologies-**(K2)**
CO 3-Analyze the various mitigation measures- **(K4)**
CO 4-Understand the concept of socio economic impact assessment –**(K2)**
CO 5-Assess the concept about economic profile of the community**-(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I LAWS AND ACTS (9 Hrs)

Historical perspective of environmental protection laws and acts in India - Definition of EI, EIA, EIS - Industrial policy statement of the Government of India. Legal and Regulatory aspects in India - Types and Limitations of EIA - Minimum National Standards – Bureau of Indian Standards – WHO standards.

UNIT II METHODOLOGIES (9 Hrs)

EIA methodologies – Appropriate Methodologies, Quantification, - Cost benefit analysis - Risk assessment, Test Model format - Preliminary assessment

UNIT III AIR QUALITY IMPACT (9 Hrs)

Background - Typical considerations and factors, air quality impact of industry, transport systems, mitigation methods. Water quality impact: Water quality criteria and standards, Field Surveys waterquality- impacts by developmental projects –Land and soil quality impacts- Soil fertility and remediation. Noise impact: Noise and sound, the effects of noise on people, noise scales and rating methods, estimating transportation noise impact.

UNIT IV ENERGY IMPACT (9 Hrs)

Energy impact considerations, data sources, energy conservation data, EIA of hydro, thermal and nuclear power plants, Vegetation and Wild life impact: Biological concepts and terms, impact on flora and fauna, mitigating measures, alternatives - Types, steps in performing socio economic impact assessment, analysis of public services and facilities, impacts, social impacts

UNIT V SUMMARIZATION OF ENVIRONMENTAL IMPACTS (9 Hrs)

Environmental Management plan, Public involvement - impacts of economic profile of the community, Exchange of information - comparison of alternatives-Training

Text Books

1. Trivedi.P.R, Trivedi, P.R, Environmental Impact Assessment, APH Publishing, 2011.
2. S.R. Khandeshwar N.S. Raman, A.R. Gajbhiye “Environmental Impact Assessment” 2010
3. Larry Canter “Environmental Impact Assessment” McGraw Hill publications.1995
4. Rau Whooten “Environmental Impact Analysis Handbook” McGraw Hill publications. 1980
5. R K Jain “Environmental Impact Analysis – A Decision Making Tool”

Reference Books

1. Canter, L.W (1996) Environmental Impact Assessment, Mc Graw Hill.
2. Petts, J (1999) Handbook of Environmental Impact Assessment Vol.I and II, Blackwell Science, London.
3. Kuala Lampur(1983) “Environmental assessment of development projects”, United Nations Asia and Pacific Development Centre.
4. John, G. Rau and David C. Wooten (1980), Environmental Impact Analysis Hand Book, McGraw Hill Book Co.
5. Judith Petts “Handbook of Environment Impact Assessment” McGraw Hill publications.

Web References

1. http://environmentclearance.nic.in
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ge22/
3. http://www.gpcet.ac.in/wp-content/uploads/2017/03/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	-	-	-	-	-	-	1	3	1	2
CO2	2	3	1	2	2	-	-	-	-	-	-	1	3	1	-
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	3	-
CO4	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
CO5	3	3	2	2	3	-	-	-	-	-	-	1	1	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20CEE830 PRE- STRESSED CONCRETE STRUCTURES

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the need for pre-stressing in a structure.
- Explain the methods, types and advantages of pre-stressing to the students.
- Aware of Design of compression and Tension Members
- Understand about methods and analysis of Composite Beams and Continuous Beams.
- Describe the principles of pre tensioned and post tensioned concrete bridge decks.

Course Outcomes

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

CO 1 - Understand the behaviour of pre-stressed concrete members and able to analyze the pre-stressed Concrete beams. **(K2)**
CO 2 - Design the pre-stressed concrete members for flexure and shear as per the relevant design code (IS 1343). **(K3)**
CO 3 - Design compression and tension members**(K3)**
CO 4 - Analyze and design of composite beams and continuous beams. **(K4)**
CO 5 - Choose the right pre-stressed bridge type suitable for construction process**(K5)**
KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I INTRODUCTION (9 Hrs)

Basic concepts – Advantages and disadvantages - Materials of pre-stressing - Loss in pre-stress - Analysis of sections – Stress concept – Strength concept – Load balancing concept -Deflection of Pre-stressed Concrete members – Beam Deflection (Using C Programming)

UNIT II DESIGN OF SHEAR AND FLEXURAL MEMBERS (9 Hrs)

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams - Design for shear based on I.S. 1343 Code.

UNIT III DESIGN OF COMPRESSION AND TENSION MEMBERS (9 Hrs)

Design of compression members and tension members. Circular pre-stressing - Water tanks - Pipes - Analysis and design - IS Codal provisions.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS (9 Hrs)

Composite beams - Analysis and design. Partial pre-stressing - non-pre-stressed reinforcements. Analysis of Continuous beams - Cable layout - Linear transformation - Concordant cables.

UNIT V PRE-STRESSED CONCRETE BRIDGES (9 Hrs)

General aspects - Pretension pre-stressed bridge decks - Post tensioned pre-stressed bridge decks - Advantages over R.C. bridges

Text Books

1. Krishna Raju N., Pre-stressed concrete, Tata McGraw Hill Company, New Delhi 2012
2. Lin T.Y. and Ned.H.Burns, "Design of pre-stressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013
3. Dr. Y.R.M. Rao, J. P. Annie, P. Easwari, Pre-stressed Concrete Analysis and Design, G S Enterprises, 2017.

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1. Ramaswamy G.S., Modern pre-stressed concrete design, Arnold Heinimen, New Delhi, 2012
2. David A.Sheppard, William R. and Philips, Plant Cast precast and pre-stressed concrete - A design guide, McGraw Hill, New Delhi 2011.
3. Praveen Nagaraja, Pre-stressed Concrete Design, Kindersley India, 2013
4. Dayaratnam.P., "Pre-stressed Concrete Structures", Oxford and IBH, 2013
5. IS1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012

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3. https://nptel.ac.in/courses/105/106/105106117

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	2	-	-	1	1	-	1	-	-	-
CO2	3	2	3	-	-	1	-	-	1	1	-	1	1	1	1
CO3	3	2	3	-	-	1	-	-	1	1	-	1	1	-	2
CO4	2	2	3	-	-	1	-	-	1	1	-	1	-	1	-
CO5	2	2	3	-	-	1	-	-	1	1	-	1	-	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

Annexure VIII

DEPARTMENT OF CIVIL ENGINEERING

DETAILS OF EXAMINERS FOR QUESTION PAPER SETTER AND EVALUATORS

Sl. No	Name of the Examiner	Specialization	Year of Experience	Designation, Department and Institution in which currently working	Contact number and mail id
1.	Dr.S.Prakash Chandar	Construction Engineering and Management	11	Assistant Professor, Senior Grade Department of Civil Engineering, SRM Institute of Science and Technology, Chennai	9962042224 prakashs@srmist.edu.in
2.	Dr.S.Karuppasamy	Remote Sensing and GIS	17	Associate Professor, Department of Civil Engineering, SRM Institute of Science and Technology, Chennai	9791695481 karuppas@srmist.edu.in
3.	Dr. M. Uma Maguesvari	Structural Engineering	13	Associate Professor, Department of Civil Engineering, Rajalakshmi Engineering College, Chennai	9443444595 umamaguesvari@gmail.com
4.	Dr. S. Syed Ibrahim	Structural Engineering	7	Assistant Professor, Department of Civil Engineering, Sree Dattha Institute of Engineering and ScienceSheriguda, Hyderabad	8247443197 syed_ibms@yahoo.co.in
5.	Dr. R. Venkata Krishnaiah	Construction Engineering & Management	26	Professor, Department of Civil Engineering, Bharath Institute of Higher Education and Research, Chennai	9840261276 venkatapec@gmail.com
6.	Dr. K. Rex	Structural	11	Professor and Head, Department of Civil	9381026207

		Engineering		Engineering, Agni College of Technology, Chennai	rex_lk@rediffmail.com
7.	Mr. B. Krishnamoorthy	Construction Engineering & Management	20	Associate Professor, Department of Civil Engineering, Sreenivasa Institute of Technology and Management science, Andhra Pradesh	9486202395 krishapec2010@gmail.com
8.	Dr. Jailakshmi Menon	Water Resources Engineering	13	Associate Professor, Department of Civil Engineering, Saveetha Engineering College, Chennai	9940066459 jailakshmiunni@gmail.com
9.	Mr. V.Tamilselvan	Structural Engineering	8	Assistant Professor, Department of Civil Engineering, Aditya College of Engineering, Kakinada, Andra Pradesh	848930017 civiltamilstructural@gmail.com
10.	Dr. K. Thulasirajan	Structural Engineering	8	Associate Professor, Department of Civil Engineering, Annamacharya Institute of Technology, Andra Pradesh	9486851632 kthulasirajan@gmail.com
11.	Dr. A. K. Kaliluthin	Structural Engineering	13	Associate Professor, Department of Civil Engineering, Crescent Institute of Science & Technology, Chennai	9486075577 kalil@crescent.education
12.	Mr.P.Selvaprasanth	Construction Engineering & Management	6	Assistant Professor, Department of Civil Engineering, SNS College of Technology, Coimbatore	9976679657 selvatamil50@gmail.com
13.	Dr. P. V. Premalatha	Structural Engineering	16	Principal, Department of Civil Engineering, Oxford Engineering College, Pirattiyur, Trichy	9944579386 pvpremalatha@yahoo.co.in
14.	Dr. Srinivasa Rao Naraganti	Structural Engineering	17	Associate Professor, Department of Civil Engineering, J.B Institute of Engineering and Technology, Hyderabad	6281776979 srininarajbiet@gmail.com
15.	Mrs. J.P. Annie Sweetlin Jebarani	Structural Engineering	22	Associate Professor, Department of Civil Engineering, Velammal College of Engineering and Technology, Viraganoor, Madurai	9443497176 jpas@vcet.ac.in
16.	Dr. P.T. Ravichandran	Geotechnical	27	Professor, Department of Civil	9840798450

		Engineering		Engineering, SRM Institute of Science and Technology, Chennai	ptrsrm6@gmail.com
17.	Mr.V.Nageshwaren	Environmental Engineering	11	Assistant Professor, Department of Civil Engineering, University College of engineering, Tindivanam	9486078639 nageshwaranv@gmail.com
18.	Dr. Mohan	Structural Engineering	35	Professor, Department of Civil Engineering, Bharath Institute of Higher Education and Research, Chennai	9444642646 mohansjm@yahoo.com
19.	Dr. Zealakshmi	Structural Engineering	12	Professor and Head, Department of Civil Engineering, Christ College of Engineering and Technology, Puducherry	8056375521 laxzea1978@gmail.com
20.	Dr. R.Sakthivel	Concrete Technology	10	Assistant Professor, Department of Civil Engineering, Hindusthan College of Engineering and Technology, Coimbatore	9944332228 srisakthi2010@gmail.com
21.	Dr.R.Anuradha	Structural Engineering	15	Professor, Department of Civil Engineering, SNS College of Technology, Coimbatore	9843263653 anuradhastalin@gmail.com
22.	Dr.S.Pradeepkumar	Environmental Engineering	5	Assistant Professor, Department of Civil Engineering, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad.	9843672986 structuralpradeep@gmail.com
23.	Dr. B. Sri Muruganandam	Environmental Engineering	15	Associate Professor, Department of Civil Engineering, Vellore Institute of Technology, Vellore	9791177668 bsrimuruganandam@vit.ac.in
24.	Mr.R.Karthiravan	Environmental Engineering	15	Assistant Professor, Department of Civil Engineering, Arunai College of Engineering, Tiruvannamalai	9994250111 Kathiravan_99@yahoo.com
25.	Dr. A. Krishnamoorthy	Construction Engineering & Management	10	Professor, Department of Civil Engineering, Adhiparasakthi engineering college, Melmaruvathur, Tamil Nadu	9994140410 krish_moor2006@yahoo.com
26.	Dr.Karthikeyan	Construction	25	Professor, Department of Civil	9994271151

		Engineering & Management		Engineering, Dhanalakshmi Srinivass Engineering College, Perambalur, Tamil Nadu	mkartik2009@gmail.com
27.	Mr. J.Gopikrishna	Transport & Water Resources	6	Assistant Professor, Department of Civil Engineering, Knowledge Institute of Technology, Salem	9965203643 gopikrishnag2@gmail.com
28.	Dr. N.Pannirselvam	Structural Engineering	13	Associate Professor, Department of Civil Engineering, SRM Institute of Science and Technology, Chennai	9976379998 pannirsn@srmist.edu.in
29.	Mr.M.Shyamkumar	Structural Engineering	10	Assistant Professor, Department of Civil Engineering, Layola Engineering college, Chennai	9940047244 shyamcoumar@gmail.com
30.	Dr.R.M.Narayanan	GIS & Remote Sensing	21	Professor, Department of Civil Engineering, Dr.M.G.R Educational and Research Institute, Chennai	9884336912 narayanan.rm@drmgrdu.ac.in
31.	Dr.C.M Vivek Vardhan	Environmental Engineering	12	Associate Professor, Department of Civil Engineering, Malla Reddy Engineering College (Autonomous), Maisammaguda, Hyderabad	9985963959 vivekvardhan2@gmail.com
32.	Mr. R. K. Paramaguru	Concrete Technology	10	Associate Professor, Department of Civil Engineering, Saraswathy college of engineering and technology, Thindivanam	9790635529 rkparamaguru62@gmail.com
33.	Dr. S.Kandasamy	Concrete Technology	7	Assistant Professor, Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai	8190965230 skandasamyisha@gmail.com,
34.	Dr. P.Subashree	Structural Engineering	12.5	Assistant Professor, Department of Civil Engineering, Hindusthan College of Engineering and Technology, Coimbatore	6379559740 subasri03@gmail.com
35.	Dr. V. Subathra Devi	Concrete	16	Associate Professor, Department of Civil	9791076767

		Technology		Engineering, Saveetha Engineering College, Chennai	subidevi@gmail.com
36.	Dr.N.Senthil Kumar	Transport & Water Resources	7	Assistant Professor, Department of Civil Engineering, Vellore Institute of Technology, Vellore	9003378135 n.senthilkumar@vit.ac.in
37.	Dr G.Prabhakaran	Environmental Engineering	22	Professor, Department of Civil Engineering, Siddharth institute of Engineering and Technology, Puttur, Andra Pradesh	9047088680 gprabhadhana@gmail.com
38.	Mr.T.D.Ramadasan	Transport & Water Resources	12	Assistant Professor, Department of Civil Engineering, Adhiparasakthi engineering college, Melmaruvathur Tamil Nadu	9894652150 tdrdasan@gmail.com
39.	Dr.J.Rex	Structural Engineering	11	Associate Professor, Department of Civil Engineering, Malla Reddy Engineering College (Autonomous), Hydrabad.	9994348591 rexdindigul@gmail.com
40.	Dr.N.Ilavarasan	Geotechnical Engineering	16	Assistant Professor, Department of Civil Engineering, University College of Engineering, BIT Campus, Anna University, Tiruchirappalli.	9865082422 k13071981k@gmail.com
41.	Dr. P. Sivarajan	Water and Wastewater Management	19	Associate Professor, Department of Civil Engineering, Annamalai University, Annamalainagar - 608002 Tamil Nadu	9443669336 sivarajan.au@gmail.com
42.	Dr. G. Senthilkumar	Environmental Engineering	21	Associate Professor, Department of Civil Engineering, Annamalai University, Annamalainagar - 608002 Tamil Nadu	9842354814 cdm.gsk@gmail.com
43.	Dr. V. Damodharan	Environmental Engineering	20	Associate Professor, Department of Civil Engineering, Annamalai University, Annamalainagar - 608002 Tamil Nadu	damucivil75@gmail.com 9443665709

44.	Mr.S.Sudalai	Environmental Engineering	12	Associate Professor, Centre for Pollution Control and Environmental Engineering, School of Engineering and Technology, Pondicherry University. Puducherry	9894788723 ssudalai.cpe@gmail.com
45.	Mr.S.Pradeepkumar	Structural Engineering	10	Assistant Professor, Department of Civil Engineering, Knowledge Institute of Technology, Salem, Tamil Nadu	9787077997 pradeep2sk@gmail.com
46.	Dr. T.Subbulakshmi	Structural Engineering	8	Assistant Professor, Department of Civil Engineering, CK College of Engineering and Technology, Cuddalore.	9677443918 subbulakshmicivil88@gmail.com
47.	Dr.S.Natarajan	Structural Engineering	13	Associate Professor, Department of Civil Engineering, Madha Engineering College, Chennai.	9080096539 Sera.natraj1@gmail.com

Annexure IX

(COMMON TO ALL ENGINEERING & TECHNOLOGY STREAMS

AND

SCIENCE & HUMANITIES)

COURSE CODE	COURSE TITLE	L	T	P	C
PHD21RMT101	RESEARCH METHODOLOGY	3	1	0	4

Course Category: Foundation Course

a. Preamble:

Today research is of immense importance in every field of life. Hence students need sound initiation in the world of research. Thus, this syllabus is prepared to equip students with the basics of research methodology and also provide them acquaintance with the main ingredients of collection of data, analysis of data, quantitative methods, optimization IPR and report writing.

b. Prerequisite Courses:

This course has no prerequisites

c. Related Courses:

Research and Publication Ethics.

d. Course educational objectives:

To impart knowledge and skills required for research:

- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Be able to read and interpret statistical information
- Know the basics of different evolutionary algorithms.
- Patent drafting and filing patents.

e. Course Outcomes:

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

CO Nos.	Course Outcomes	Knowledge level (Basedon revised Bloom's Taxonomy)
CO1	Formulate the research problem through fundamentals of research and literature review.	K3
CO2	Identify and apply research design principles and make use of data collection and analysis techniques.	K3
CO3	Apply quantitative methods to solve research problem.	K3
CO4	Analyze the optimization techniques in solving the real problem.	K3
CO5	Interpret the research problem into registering IPR and filing patents.	K2

f. Course Content

UNIT I – INTRODUCTION AND RESEARCH FORMULATION L-9 + T-2

Introduction to Research: Definitions and Characteristics of Research, Motivation and Objectives, Research Methods *vs.* Methodology. Types of Research: Descriptive *vs*. Analytical, Applied *vs*. Fundamental, Quantitative *vs*. Qualitative, Conceptual *vs*. Empirical, Concept of Applied and Basic Research Process, Criteria of Good Research.

Defining and Formulating the Research Problem: Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

Literature Review: Objectives of Review of Literature, Importance of Literature Review in Defining a Problem, Primary and Secondary Sources, Reviews, Treatise, Monographs, Patents, Web as a Source, searching in the Web, Critical Literature Review, Identifying Gap Areas from Literature Review and Research Database, Development of Working Hypothesis.

UNIT II – RESEARCH DESIGN, DATA COLLECTION AND ANALYSIS L-9 + T-4

Research Design: Basic Principles, Need of Research Design, Features of Good Design, Different Research Designs, Experimental Designs, Research Databases, Development of Models, Developing a Research Plan, Exploration, Description, Diagnosis, and Experimentation.

Data Collection and Analysis: Primary and Secondary Data, Methods of Data Collection, Sampling Methods, Data Processing and Analysis Strategies and Tools, Data Analysis with Statistical Packages (Sigma STAT, SPSS for Student's t-test), Testing of Hypothesis (Student's t-test), ANOVA Technique.

UNIT III – QUANTITATIVE METHODS FOR PROBLEM SOLVING L-9 + T-3

Basic Statistical Distributions and their Applications (No Derivations): Binomial, Poisson, Normal and their Applications in Research Studies. Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression Analysis, Fundamentals of Time Series Analysis and Spectral Analysis.

UNIT IV – OPTIMIZATION TECHNIQUES IN SOFT COMPUTING L-9 + T-4

Optimization Definition, Need and Application, Formulation of Optimization Problems. Introduction to Evolutionary Algorithms, Fundamentals of Genetic Algorithms, Particle Swarm Optimization, Simulated Annealing, Introduction to Neural Networks, Neural Network Based Optimization, Introduction to Fuzzy Sets and Fuzzy Logic, Optimization of Fuzzy Logic.

UNIT V – IPR AND REPORT WRITING L-9 + T-2

IPR: Intellectual Property Rights and Patent Law, Commercialization, Copy Right, Royalty, Trade Related aspects of Intellectual Property Rights (TRIPS).

Report Writing: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Oral Presentation, Design of Research Paper, Citation, Plagiarism, Basic Knowledge of funding agencies, Proposal Submission for Funding Agencies.

Total: 60 Hours

g. Learning Resources

i. Reference Books:

1. Jeannette Lawrence, Introduction to Neural Networks: Design, Theory, and Applications, California Scientific Software, sixth edition, 1994.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, An introduction to Research Methodology, RBSA Publishers, U.K., 2002.
3. Fink, A., Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 5th edition, 2009.
4. Dr P M Bulakh, Dr P. S. Patki and Dr A S Chodhary, Research Methodology, Expert Trading Corporation Dahisar West, Mumbai, 2010.
5. Paolo Brandimarte, Quantitative Methods: An Introduction for Business Management, John Wiley & Sons, 2011.
6. Douglas C. Montgomery and George C. Runger. Applied Statistics and Probability for Engineers, 5th edition, John Wiley and Sons, Inc., New York, 2011.
7. Panneerselvam, R. Research Methodology, PHI Publications, Second edition, 2014.
8. Priya Rai, R.K. Sharma, P.K. Jain and Akash Singh, Transforming Dimension of IPR Challenges for New Age Libraries, National Law University Delhi Press, 2015.
9. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley publications, 4th Edition, 2016.
10. C.R. Kothari and Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International (P) Ltd., Publishers, Fourth Multi Colour Edition, 2020.
11. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical statistics, Sultan Chand & Sons, New Delhi, 12th Revised Edition, 2020.
12. Lawrence M. Leemis, Mathematical Statistics, Ascended Ideas, UK, 2020.
13. Sukanta Nayak, Fundamentals of Optimization Techniques with Algorithms, Academic Press,2020.
14. Singiresu S. Rao, Engineering Optimization: Theory and Practice, New Age International Publishers, 5th edition 2020.

ii. Online resources:

1. https://www.soas.ac.uk/cedep-demos/000_P506_RM_3736-Demo/module/pdfs/p506_unit_01.pdf
2. https://repository.up.ac.za/bitstream/handle/2263/27704/01chapter1.pdf?sequence=2&isAllowed=y
3. http://egyankosh.ac.in/bitstream/123456789/41939/1/Unit-4.pdf
4. https://www.formpl.us/blog/data-collection-method
5. https://www.questionpro.com/blog/data-collection/
6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4485510/
7. https://www.questionpro.com/blog/quantitative-research/
8. https://hls.harvard.edu/content/uploads/2011/12/quantitative_methods.pdf
9. https://libguides.usc.edu/writingguide/quantitative
10. https://mech.iitm.ac.in/nspch52.pdf
11. https://www.kdd.org/kdd2016/topics/view/optimization-techniques
12. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3217699/
13. https://iare.ac.in/sites/default/files/M.Tech-RM%20%26%20IPR%20%28ECE%29%20PPTS.pdf

(COMMON TO ALL ENGINEERING & TECHNOLOGY STREAMS

AND

SCIENCE& HUMANITIES)

COURSE CODE	COURSE TITLE	L	T	P	C
PHD21RPT102	RESEARCH AND PUBLICATION ETHICS	2	1	1	4

Course Category: Foundation Course

a. Preamble:

Today research is of immense importance in every field of life. Hence students need sound initiation in the world of research. The ethical pursuit of research in humanities, social sciences and other scientific disciplines is essential to the achievement of robust goals and research outcomes within the academe and it promotes systemic contributions in the field of advanced learning and knowledge generation.

b. Prerequisite Courses:

The course is primarily open to all Ph.D. scholars.

c. Related Courses:

Research Methodology

d. Course educational objectives:

To impart knowledge and skills required for research:

- Provide students with the fundamental knowledge of basics of philosophy of science and ethics, research integrity, publication ethics.
- Hands-on sessions are designed to identify research misconduct and predatory publications.
- Indexing and citation databases, open access publications, research metrics (citations, index, Impact Factor etc.).

e. Course Outcomes:

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

CO Nos.	Course Outcomes	Knowledge level (Based on revised Bloom's Taxonomy)
CO1	Apply theories and methods in ethics, research ethics and scientific conduct.	K3
CO2	Understand the philosophy of science and ethics, research integrity and publication ethics.	K2
CO3	Identify software tools in open access publishing to check publisher copyright, predatory publications and journal suggestions.	K3
CO4	Acquire skills of presenting arguments and results of ethical inquiries and understand the usage of plagiarism tools.	K3
CO5	Utilize the indexing, citation databases and research	K2

	metrics (citations, h-index, impact Factor, etc.).	

f. Course Content

Unit I: PHILOSOPHY, ETHICS AND SCIENTIFIC CONDUCT L-8 + T-0

Philosophy, Ethics (3 Hrs.): Introduction to philosophy: definition, nature and scope, concept, branches - **Ethics**: definition, moral philosophy, nature of moral judgments and reactions.

Scientific Conduct (5 Hrs.): Ethics with respect to science and research - Intellectual honesty and research integrity - Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP) - Redundant Publications: duplicate and overlapping publications, salami slicing - Selective reporting and misrepresentation of data.

Unit II: PUBLICATION ETHICS L-7 + T-0

Publication ethics: definition, introduction and importance - Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. - Conflicts of interest - Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types - Violation of publication ethics, authorship and contributor ship - Identification of publication misconduct, complaints and appeals - Predatory publisher and journals.

Unit III: OPEN ACCESS PUBLISHING L-0 + T-4

Open access publications and initiatives - SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies - Software tool to identify predatory publications developed by SPPU - Journal finger / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester, etc.

Unit IV: PUBLICATION MISCONDUCT L-0 + T-2+P-2

Group Discussion (2 Hrs.): a) Subject specific ethical issues, FFP, authorship b) Conflicts of interest c) Complaints and appeals: examples and fraud from India and abroad.

Software tools (2 Hrs.): Use of plagiarism software like Turnitin, Urkund and other open source software tools.

Unit V: DATABASES AND RESEARCH METRICS L-0 + T-4+P-3

Databases (4 Hrs): Indexing databases, Citation databases: Web of Science, Scopus, etc.

Research Metrics (3 Hrs.): Impact Factor of journal as per Journal Citations Report, SNIP, SJR, IPP, and Cite Score - Metrics: h-index, g index, i10 Index, altmetrics.

***Units 1and 2 are** to be covered via Theory mode and Units **3, 4 and 5** are to be covered via Tutorial practice mode.

Total: 30 Hours

g. Learning Resources

i. Reference Books:

1. Sidney Hook, Miro Todorovich, Paul Kurtz, The Ethics of Teaching and Scientific Research. Weldon Beckner ,1978.
2. Barbara H. Stanley; Joan E. Sieber; Gary B. Melton, Research Ethics: A Psychological Approach, University of Nebraska Press, 1996.
3. Anderson B.H, Dursaton and Poole M, Thesis and assignment writing, Wiley Eastern, 1997.
4. Paul Oliver, The Student's Guide to Research Ethics, Open University Press, 2003.
5. Adil E. Shamoo, David B. Resnik, Responsible Conduct of Research, Oxford University Press,2003.
6. Bird, A, Philosophy of Science. Routledge, 2006.
7. Nicholas H. Steneck. Introduction to the Responsible Conduct of Research. Office of ResearchIntegrity. 2007.
8. Graziano, A., M., and Raulin, M.,L, Research Methods – A Process of Inquiry, Sixth Edition, Pearson, 2007.
9. Bijorn Gustavii, How to write and illustrate scientific papers, Cambridge University Press.2008.
10. Bordens K.S. and Abbott, B.b, Research Design and Methods, Mc Graw Hill, 2008.
11. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. On Being Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press. 2009.
12. Jeffrey A. Gliner; George A. Morgan Lawrence Erlbaum Associates, Research Methods in Applied Settings: An Integrated Approach to Design and Analysis, Routledge,2009.
13. Resnik, D. B. What is ethics in research & why is it Important. National Institute of Environmental Health Sciences, 2011.
14. Joel Lefkowitz, Ethics and Values in Industrial-Organizational Psychology, Routledge ,2017.
15. P. Chaddah, Ethics in Competitive Research: Do not get scooped; do not get plagiarized, 2018.
16. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance. 2019.
17. Kambadur Muralidhar, Amit Ghosh Ashok Kumar Singhvi, Ethics in Science Education, Research and Governance. Indian National Science Academy, 2019.

ii. Online resources:

1. https://www.enago.co.kr/academy/wp-content/uploads/2018/05/Research_Ethics.pub_V2.pdf
2. https://www.frontiersin.org/about/policies-and-publication-ethics
3. https://www.researchgate.net/publication/340807930_RESEARCH_AND_PUBLICATION_ETHICS
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5508450/
5. https://www.iieta.org/Journals/IJSDP/Publication%20Ethics%20and%20Malpractice%20Statement
6. http://ignca.gov.in/short-term-certification-course/research-and-publication-ethics/

COURSE CODE	COURSE TITLE	L	T	P	C
	SUSTAINABLE CONSTRUCTION				

Course Objectives:

- To familiarize the concepts of sustainable construction
- To learn about sustainable construction planning
- To explore the concept of Green Construction
- To know how to select sustainable materials
- To gain basic knowledge about Green Building Codes and Carbon accounting

Course Outcomes:

CO1: To identify the various concepts of sustainable construction
CO2: Apply sustainability to project planning
CO3: Green Construction Concepts
CO4: Choose appropriate sustainable materials
CO5: Green Building Codes and specifications, Carbon accounting

UNIT I

Sustainability and Sustainable Development. Definitions and Prospective on sustainability, Theory and background to sustainable construction planning. The Three E's. Environment, Economics, and Ethics. Ecology ofsustainable developments.

UNIT II

Sustainable Construction Planning. Major Environmental challenges, Global Warming. Building energy system. Strategies, Energy conservation in buildings. Energy Efficientprojects. HVAC Systems. Water Conservation in buildings. Rain water harvesting and management, Water Cyclestrategies.

UNIT III

Introduction, Green construction, Site selection for Green Construction, Design Considerations, Objectives of Green building movement. Green construction materials andresources.

UNIT IV

Material Selection Strategies. Eco-friendly Materials, Recyclable and Reusable Materials.Embodied Energy in Materials.

UNIT V

Introduction. Green building Codes and Standards, International Construction Codes, Carbonaccounting, Green building Specifications.

References

1. Green Building Design and Delivery, 2nd Edition, John Wiley, Hoboken -New Jersey.
2. Energy Efficient Buildings in India. Ed. Mujumdar Mili. TERI PRESS.
3. Energy efficient buildings in India. Case Studies by Teri. Video Cassettes, ds.
4. Climate Responsive Architecture. Krishna Arvind.
5. Energy Management Handbook, Steve Doty and Wayne C. Turner, 8th edition.

COURSE CODE	COURSE TITLE	L	T	P	C
	ADVANCED CONCRETE TECHNOLOGY				

Course Objectives:

- To know about the types of cement and its testing method
- To explore about fresh concrete and its properties
- To study the properties of hardened concrete
- To know about types of admixtures and its applications
- To orient about types of special concrete

Course Outcomes:

CO1: Study of types of cement and its testing
CO2: Fresh concrete and its properties
CO3: Properties of hardened concrete
CO4: Types of admixtures and its applications
CO5: Introduction to special Concrete

UNIT I CONSTITUENTS OF CONCRETE

Types of Cement and their composition. Tests on various properties of aggregates.

UNIT II PROPERTIES OF FRESH CONCRETE

Mixing and matching. Workability, factors effecting workability, Measurements of workability, Various tests and procedures. Segregation and bleeding, Vibration of concrete. Types of vibrators and their influence on composition. Analysis of fresh concrete.

UNIT III PROPERTIES OF HARDENED CONCRETE

Strength of concrete. Water Cement ratio. Gel space ratio. Effective water in the max. short term and long term properties of concrete. Tests and procedure. Influence of various parameters on strength of concrete. Relationship between various mechanical strengths of concrete. Curing of concrete. Methods of curing. Maturity concept. Influence of temperature on strength of concrete. Stress-Strain curves for concrete. Durability of concrete.

UNIT IV ADMIXTURES USED IN CONCRETE

Classification of admixtures. Chemical and mineral admixtures. Influence of various admixtures on properties of concrete. Application, concept of ready mixed concrete. Fly ash concrete. Properties and proportion of Fly ash, Applications.

UNIT V SPECIAL CONCRETES

High strength concrete, Ferro Cement, Light weigh concrete, High density concrete. Recycled aggregate

concrete. Their specialties and applications, need for the reinforced Concrete (FRC) Mechanism of FRC. Types of fibres, fibre shotcrete.

References

1. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.
2. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010.
3. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
4. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.
5. Job Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi,2015.
6. Mehta P.K. and Paulo J.M.M. Concrete – Micro Structure - properties and Material.

COURSE CODE	COURSE TITLE	L	T	P	C
	ADVANCED WASTEWATER TREATMENT				

Course Category: Advanced Course

Prerequisite Courses: Environmental Engineering –II, Wastewater Engineering

Course Objectives

- T**o** understand how the wastewater collection system influences the treatment system.
- To apply existing theories to design different types of Biological treatment systems
- To identify critical parameters and unit process in wastewater system
- To understand the microbial, chemical and physical processes involved in advanced wastewater treatment systems.
- To understand the main concepts of sustainability related to the wastewater system.

Course Outcomes

CO1: Understand the concept and working principles of wastewater treatment plant

CO2: Gain knowledge about the secondary treatment processes in wastewater treatment system

CO3: Gain knowledge about the role of unit operation in treatment system

CO4: Understand the basic knowledge in advanced technologies used in waste water system

CO5: Understand the concept of sludge disposal and reuse technologies

UNIT I WASTEWATER TREATMENT PLANT UNITS

Screen chamber, Grit chamber with proportional flow weir, sedimentation tank - Trickling filters, Rotating Biological contactor, activated sludge process & variations, aerated lagoons, waste stabilization ponds, Natural treatment systems - Disinfected disposal options - reclamation and reuse - Flow charts, layout, hydraulic profile - Recent advances.

UNIT II OBJECTIVES OF BIOLOGICAL TREATMENT

Overview of biological Treatment - aerobic and anaerobic treatment- Combined aerobic processes - Microbial metabolism - Bacterial growth -Factors affecting growth - attached and suspended growth - Determination of Kinetics coefficients for organics removal - Biodegradability assessment - selection of process.

UNIT III UNIT PROCESSES

Role of unit processes in waste water treatment, coagulation – Chemical precipitation for improved plant performance. UASB, up flow filters, Fluidised beds - Septic tank and disposal - Nutrient removal systems - Layout and Hydraulic profile - Recent advances.

UNIT IV TECHNOLOGIES USED IN ADVANCED TREATMENT

Classification of technologies- Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration Absorption – Ion Exchange – Advanced oxidation process.

UNIT V DESIGN OF SLUDGE MANAGEMENT FACILITIES

Sludge thickening, sludge digestion, Biogas generation, sludge dewatering (mechanical and gravity) - upgrading existing plants - ultimate residue disposal - Recent Advances.

Text Books

1. Water Supply and Sanitary Engineering G.S. Bridie & J.S. Brides, Dhanpat Rai & Sons 1993.
2. A Treatise on Rural, Municipal, and industrial water management KVSG Murali Krishna.
3. Environmental sanitation (Social and Preventive medicine) Dr. P.V. Rama Raju & KVSG Mural Krishna.
4. Waste Water engineering, treatment and reuse by Metealf and eddy, fifth edition, Tata McGraw Hill.

Reference Book

1. METCALF & EDDY, INC. 'Wastewater Engineering', Treatment and Reuse. Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003
2. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999

Web References

1. http://gcpcenvis.nic.in/Books/Advanced_Wastewater_Treatment_Technologies.pdf
2. https://organicabiotech.com/advanced-wastewater-management-technologies-for-reduction-of-pollutants-in-wastewater/
3. https://www.epa.gov/sites/default/files/2019-02/documents/emerging-tech-wastewater-treatment-management.pdf

COURSE CODE	COURSE TITLE	L	T	P	C
	INDUSTRIAL WASTE WATER TREATMENT				

Course Category: Advanced Course

Prerequisite Courses: Industrial Wastewater Management**,** Unit Operations and Processes in Water and Wastewater Treatment

Course Objectives:

- Learn the theories of Quantity and Quality of Industrial effluent
- To impart knowledge on sampling Technologies
- To impart knowledge on composition treatment and effective disposal of Industrial effluents
- An outlook on industrial effluent treatment processes with reference to specific industries(1)
- An outlook on industrial effluent treatment processes with reference to specific industries(2)

Course Outcomes:

CO1: Understand the concept of Quantity and Quality of Industrial effluent
CO2: Gain knowledge about the basic theories of sampling method in industrial waste water
CO3: Gain knowledge about the disposal method and management of industrial waste water
CO4: Understand the basic knowledge about the process and treatment of industry type-1
CO5: Understand the basic knowledge about the process and treatment of industry type-2

UNIT I INDUSTRIAL WATER QUANTITY AND QUALITY SCENARIO IN INDIA

Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests -Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters- Prevention and Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis. Use of Municipal wastewater in Industries

UNIT II BASIC THEORIES AND INDUSTRIAL WASTE SURVEY

Basic theories of Industrial Wastewater Management: Industrial waste survey -Measurement of industrial wastewater Flow-generation rates –Industrial wastewater sampling and preservation of samples for analysis – Grab, Composite and integrated samples. - Bio monitoring Waste management Approach, Waste Audit, Volume and strength reduction, Material and process modifications, Recycle, reuse and byproduct recovery, Zero effluent discharge

UNIT III INDUSTRIAL WASTEWATER DISPOSAL MANAGEMENT

Industrial wastewater disposal management: Discharges into Streams, Lakes and oceans and associated problems, Land treatment -Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges-Recirculation of Industrial Wastes-Effluent Disposal Method- Zero effluent discharge systems- Residuals of industrial wastewater treatment- Quantification and characteristics of Sludge - Thickening, digestion, conditioning, dewatering and disposal of sludge - Management of RO rejects.

UNIT IV PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES-1

Process and Treatment of specific Industries-1: Definition- classifications of industries, Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants- Case studies

UNIT V PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES-2

Process and Treatment of specific Industries-2: Definition Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plants- case studies

Text Books

1. M. N. Rao and A. K. Dutta, "Wastewater Treatment", Oxford & IBH, New Delhi.
2. K.V. S. G. Murali Krishna, "Industrial Water and Wastewater Management".

Reference Books

1. A. D. Patwardhan, Industrial Wastewater treatment, PHI Learning, Delhi
2. Metcalf and Eddy Inc., Wastewater Engineering, Tata McGraw Hill co., NewDelhi.
3. G. L. Karia & R.A. Christian Wastewater Treatment-Concepts and Design Approach, Prentice Hall of India.

Web References

1. https://www.un-ihe.org/online-course-industrial-effluent-treatment
2. https://www.neeri.res.in/divisions/details/rd-division-waste-water-technology-division#googtrans(en|en)
3. http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php
4. http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php

Annexure X

EMPLOYABILITY ENHANCEMENT COURSES – (B). SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U20CES201	Skill Development Course 1 *
		1) MS Office – Word, Excel, Power Point
		2) Measurements and Conversion
		3) Traditional construction in modern age
2	U20CES302	Skill Development Course 2 *
		1) Basic Vasthu
		2) Contour and Leveling
		3) Auto level surveying
3	U20CES403	Skill Development Course 3 *
		1) Safety in building construction
		2) Air Quality Monitoring
		3) Experience with On-Site Construction Observation and Management
4	U20CES504	Skill Development Course 4 : Foreign Language/ IELTS - I
5	U20CES505	Skill Development Course 5 : Presentation Skills using ICT
6	U20CES606	Skill Development Course 6 : Foreign Language/ IELTS - II
7	U20CES607	Skill Development Course 7 : Technical Seminar
8	U20CES608	Skill Development Course 8 : NPTEL / MOOC – I
9	U20CES809	Skill Development Course 9 : NPTEL / MOOC - II

**** Any one course to be selected from the list***