



# SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)  
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution &  
Accredited by NAAC with "A" Grade)

Madagadipet, Puducherry - 605 107



## Department of Civil Engineering

09.04.2021

### Minutes of 2<sup>nd</sup> Board of Studies Meeting (UG)

The second Board of Studies meeting of Department of Civil Engineering was held on 9<sup>th</sup> April 2021 at 10:00 a.m in the Seminar hall, University Block, Sri Manakula Vinayagar Engineering College with Head of the Department in the Chair.

The following members were present for the BoS meeting,

SI.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	Mr. S. Sivaprasath Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet - 605107	Internal Member
11	Prof. M.A. Ishrath Jahan 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.Deepa Professor, 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. Confirmation of 1st BoS Meeting
2. To discuss and approve the revised Vision and Mission of the department.
3. To discuss and approve the Eligible Diploma Programmes for the Lateral entry students' admission into Second year under Autonomous Regulations R-2020 for the B.Tech – Civil Engineering programme.
4. To discuss and approve the B.Tech. Degree Professional Elective Courses for VI and VIII semesters under Pondicherry University Regulations 2013 for the B.Tech – Civil and the students admitted in the Academic Year 2017 – 21 (Final Year) and 2018-22 (Third Year)
5. Curriculum Structure of B.Tech – Civil Engineering
6. To discuss and approve the syllabi for V & VI Semester under R2019 Regulations for UG Programme: B.Tech. Civil Engineering in the Academic Year 2021-22 for the students admitted in the year 2019-20
7. To discuss and approve the B.Tech. Degree Professional Elective Courses for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)
8. To discuss and approve the B.Tech. Degree Open Elective Courses for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)
9. To discuss and approve the B.Tech. Degree Skill Development Course for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)
10. To discuss and approve the B.Tech. Degree Certification Course for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)
11. To discuss and approve about the recognized research supervisors in the department of Civil Engineering.
12. To discuss and approve the panel of examiners

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## 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 accepting to become the member of the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

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<b>Item:1</b>	<p>Chairman BoS, appraised the minutes of 1<sup>st</sup> BoS, its implementation and then it is confirmed with the approval for the incorporation of minor revisions needed as mentioned below.</p> <ol style="list-style-type: none"><li>1. In the First Semester, “Fundamentals of Civil and Mechanical Engineering” subject need to be removed and include preliminary study of any professional core subject (Building Materials or Building Technology).</li><li>2. The subject in fourth semester “Operational Research” need to be changed to fifth semester and the subject “Numerical Methods” in fifth semester to be in fourth semester</li><li>3. Instead of mentioning the subject “ E-Tabs Laboratory” in the fifth semester, it can be “Modeling and Analysis Laboratory”</li></ol> <p><b>The above corrections are approved by BoS members and the details are given in Annexure- I.</b></p>
<b>Item:2</b>	<p>The Vision and Mission of Civil Engineering department are revised, have been presented in the 2<sup>nd</sup> BoS meeting. It was approved by BoS members and given in <b>Annexure- II.</b></p>
<b>Item:3</b>	<p>The Eligible Diploma Programmes for the Lateral entry students’ admission into Second year B.Tech – Civil Engineering programme under Autonomous Regulations 2020 were discussed and approved by the BoS members.</p> <p>The Diploma programmes eligible for B.Tech Civil Engineering admission are,</p> <ul style="list-style-type: none"><li>○ Civil Engineering,</li><li>○ Civil and Rural Engineering,</li><li>○ Civil Engineering (Architecture),</li><li>○ Architectural Assistantship,</li><li>○ Civil Engineering (sandwich),</li><li>○ Architecture (Sandwich),</li><li>○ Environmental and Pollution Control Engineering,</li><li>○ Civil engineering (rural technology),</li><li>○ Architectural assistantship (sandwich)</li></ul>

Item:4	Discussed and approved the B.Tech. Degree Professional Elective Courses for VI and VIII semester under Pondicherry University Regulations 2013 for the B.Tech Civil and the students admitted in the Academic Year 2017 – 21 (Final Year) and 2018 - 22 (Third Year)
Item:5	The Curriculum Structure of B.Tech – Civil Engineering has been briefed on Regulation 2013, Regulation 2019 and Regulation 2020
Item:6	<p>The SMVEC Autonomous Regulation R-2019 curriculum for 1 to 8 semesters and syllabi for 5th and 6th semesters, for B.Tech – Civil Engineering were discussed and the following comments were given by BoS members.</p> <ul style="list-style-type: none"> <li>• Members suggested that the course outcomes need to have measurable words incorporating the blooms taxonomy such as remember, evaluate, apply etc., instead of general terms and it needed to be student centric</li> <li>• The course objectives can be written with a single caption such as “This course should enable the students to” for the course chosen</li> <li>• Members advised that in the course “Structural Analysis I”, unit V is obsolete and Kani’s method can be replaced with new methods of analyzing the structural elements</li> <li>• Members proposed that in the course “Revit Architecture” an inclusion of experiment containing modeling and designing of a complete structure with walkthrough need to be submitted by each student as a project</li> <li>• They also further discussed about the course Estimation costing and valuation laboratory, bar bending schedule need to be included as an additive exercise so that students can get knowledge on the field</li> <li>• In the course “Design of RC Elements” the second textbook has to be removed and replace with titled “Reinforced Concrete Design” by Unnikrishnan Pillai and Devdas Menon. Also Indian Standard code books of 825 Part I, II and III with SP 16 need to be included in reference books</li> <li>• For analytical papers, an option of incorporating usage of C programming language to solve some problems in any one of the five units can be added so that this will make the students to gain interest in solving with the help of computer knowledge</li> </ul> <p><b>The above corrections are incorporated and the Syllabi (Given in Annexure-III) are approved by the BoS members.</b></p>


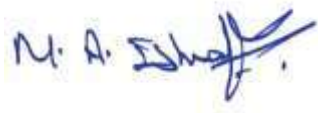



Item:7	<p>Discussed and approved the B.Tech. Degree Professional Elective Course “Alternative Building Materials and Technologies” has been chosen for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year).</p> <p><b>The list of professional elective courses and syllabi for the course Alternative Building Materials and Technologies has been attached in Annexure IV</b></p>								
Item:8	<p>Discussed and approved the B.Tech. Degree Open Elective Course “Sensors and Transducers” has been chosen for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)</p> <p><b>The list of Open elective courses and syllabi for the course Sensors and Transducers has been attached in Annexure V</b></p>								
Item:9	<p>Discussed and approved the B.Tech. Degree Skill Development Course “Experience with On-Site Construction Observation and Management” chosen for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)</p> <p><b>The list of Skill Development courses and syllabi for the course Experience with On-Site Construction Observation and Management has been attached in Annexure VI</b></p>								
Item:10	<p>Discussed and approved the B.Tech. Degree Certification Course “AutoCad for Civil” has been chosen for IV semester under R2019 for the B.Tech – Civil students admitted in the Year 2019 – 20 (Second Year)</p> <p><b>The list of Certification courses has been attached in Annexure VII</b></p>								
Item:11	<p>The following recognized research guides in the department were approved by the BoS members</p> <table border="1" data-bbox="421 1767 1339 2072"> <thead> <tr> <th data-bbox="421 1767 855 1821">Name of the Staff Member</th> <th data-bbox="855 1767 1339 1821">Designation</th> </tr> </thead> <tbody> <tr> <td data-bbox="421 1821 855 1874">Dr.Abbas Moideen</td> <td data-bbox="855 1821 1339 1874">Register</td> </tr> <tr> <td data-bbox="421 1874 855 1973">Dr. S. Jayakumar</td> <td data-bbox="855 1874 1339 1973">Controller of Examination and Professor in Civil Engineering</td> </tr> <tr> <td data-bbox="421 1973 855 2072">Dr. S.Sundararaman</td> <td data-bbox="855 1973 1339 2072">Professor and Head Department of Civil Engineering</td> </tr> </tbody> </table>	Name of the Staff Member	Designation	Dr.Abbas Moideen	Register	Dr. S. Jayakumar	Controller of Examination and Professor in Civil Engineering	Dr. S.Sundararaman	Professor and Head Department of Civil Engineering
Name of the Staff Member	Designation								
Dr.Abbas Moideen	Register								
Dr. S. Jayakumar	Controller of Examination and Professor in Civil Engineering								
Dr. S.Sundararaman	Professor and Head Department of Civil Engineering								

**Item:12**

The list of question paper setters and Evaluators (given in **Annexure-VIII**) was presented and recommended by the BoS members to the Academic Council.

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	 19/4/21
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)	 9/4/21
3	Dr.R.Malathy Professor and Dean (Research) Dept. of Civil Engineering, Sona College of Technology, Salem	Subject Expert (Academic Council Nominee)	 19/4/2021
4	Dr A Rose Enid Teresa Professor and Head Rajalakshmi Engineering College, Chennai	Subject Expert (Academic Council Nominee)	 17
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	Mr. S. Sivaprasath Assistant Professor, Department of Civil Engineering, SMVEC, Madagadipet - 605107	Internal Member	
11	Prof. M.A. Ishrath Jahan Associate Professor, Department of English, SMVEC, Madagadipet - 605107	Internal Member	
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Dr.S.Sundararaman  
HOD/Civil  
Chairman –BoS (Civil)



### Annexure – I

- (1. R2020 - “Fundamentals of Civil and Mechanical Engineering” subject need to be removed and include preliminary study of any professional core subject (Building Materials or Building Technology))

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
1	U20BST101	Engineering Mathematics - I Calculus and Linear Algebra	BS	2	2	0	3	25	75	100
2	U20BST108	Physics for Civil Engineering	BS	3	0	0	3	25	75	100
3	U20EST101	Programming in C	ES	3	0	0	3	25	75	100
4	U20EST119	Engineering Mechanics.	ES	2	2	0	3	25	75	100
5	U20CET101	Building materials	PC	3	0	0	3	25	75	100
<b>Practical</b>										
6	U20ESP102	Programming in C Laboratory	ES	0	0	2	1	50	50	100
7	U20CEP101	Civil Engineering Building Planning and Drafting	PC	0	0	2	1	50	50	100
8	U20CEP102	Civil Engineering Practice Laboratory	PC	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
9	U20CEC1XX	Certification Course – I**	EEC	0	0	4	-	100	-	100
<b>Mandatory Course</b>										
10	U20CEM101	Induction Program	MC	3 Weeks			-	-	-	-
							18	375	525	900

- (2. R2020 -Fourth semester “Operational Research” need to change to fifth semester and the subject “Numerical Methods” in fifth semester to be in fourth semester)

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
1	U19CET41	Numerical Methods	BS	2	2	0	3	25	75	100
2	U19CET42	Programming In Java	ES	3	0	0	3	25	75	100
3	U19CET43	Geotechnical Engineering - I	PC	2	2	0	3	25	75	100
4	U19CET44	Mechanics of Solids – II	PC	2	2	0	3	25	75	100
5	U19CEE4X	Professional Elective - I <sup>#</sup>	PE	3	0	0	3	25	75	100
6	U19XXO4X	Open Elective – I <sup>\$</sup>	OE	3	0	0	3	25	75	100
<b>Practical</b>										
7	U19CEP41	Programming In Java Laboratory	ES	0	0	2	1	50	50	100
8	U19CEP42	Concrete Engineering Laboratory	PC	0	0	2	1	50	50	100

9	U19CEP43	Strength of Materials Laboratory	PC	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
10	U19CEC4X	Certification Course – II**	EEC	0	0	4	-	100	-	100
11	U19CES41	Skill Development Course 3: General Proficiency - II	EEC	0	0	2	-	100	-	100
12	U19CES42	Skill Development Course 4 *	EEC	0	0	2	-	100	-	100
<b>Mandatory Course</b>										
13	U19CEM41	Indian Constitution	MC	2	0	0	-	100	-	100
							21	700	600	1300

<b>SEMESTER – V</b>										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
1	U19CET51	Operations Research	BS	2	2	0	3	25	75	100
2	U19CET52	Structural Analysis – I	PC	2	2	0	3	25	75	100
3	U19CET53	Geotechnical Engineering - II	PC	2	2	0	3	25	75	100
4	U19CET54	Environmental Engineering - I	PC	3	0	0	3	25	75	100
5	U19CEE5X	Professional Elective - II <sup>#</sup>	PE	3	0	0	3	25	75	100
6	U19XXO5X	Open Elective-II <sup>§</sup>	HS	3	0	0	3	25	75	100
<b>Practical</b>										
7	U19CEP51	Numerical Methods Laboratory	BS	0	0	2	1	50	50	100
8	U19CEP52	REVIT Architecture	PC	0	0	2	1	50	50	100
9	U19CEP53	Geotechnical Engineering Laboratory	PC	0	0	2	1	50	50	100
10	U19CEP54	Estimation Costing and Valuation Engineering	PC	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
11	U19CEC5X	Certification Course – III**	EEC	0	0	4	-	100	-	100
12	U19CES51	Skill Development Course 5: Foreign Language / IELTS - I	EEC	0	0	2	-	100	-	100
13	U19CES52	Skill Development Course 6: Presentation Skills using ICT	EEC	0	0	2	-	100	-	100
<b>Mandatory Course</b>										
14	U19CEM51	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							22	750	650	1400

(3. R2020 - Instead of mentioning the subject “ E-Tabs Laboratory” in the fifth semester, it can be “Modeling and Analysis Laboratory” )

SEMESTER – V										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
<b>Theory</b>										
1	U20BST551	Operations Research	BS	2	2	0	3	25	75	100
2	U20CET511	Structural Analysis – I	PC	2	2	0	3	25	75	100
3	U20CET512	Environmental Engineering-I	PC	3	0	0	3	25	75	100
4	U20CET513	Instrumentation And Sensor Technologies for Civil Engineering Applications	PC	3	0	0	3	25	75	100
5	U20CEE5XX	Professional Elective - II <sup>#</sup>	PE	3	0	0	3	25	75	100
6	U20XXO5XX	Open Elective-II <sup>§</sup>	HS	3	0	0	3	25	75	100
<b>Practical</b>										
7	U20CEP508	Modeling and Analysis Laboratory	PC	0	0	2	1	50	50	100
8	U20CEP509	Sensors Applications in Civil Engineering Laboratory	PC	0	0	2	1	50	50	100
9	U20CEP510	REVIT Architecture	PC	0	0	2	1	50	50	100
10	U20CEP511	Estimation Costing and Valuation Engineering	PC	0	0	2	1	50	50	100
<b>Employability Enhancement Course</b>										
11	U20CEC5XX	Certification Course – V**	EEC	0	0	4	-	100	-	100
12	U20CES504	Skill Development Course 4: Foreign Language/ IELTS - I	EEC	0	0	2	-	100	-	100
13	U20CES505	Skill Development Course 5: Presentation Skill using ICT	EEC	0	0	2	-	100	-	100
<b>Mandatory Course</b>										
14	U20CEM505	Indian Constitution	MC	2	0	0	-	100	-	100
							22	750	650	1400

## Annexure - II



# SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

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Madagadipet, Puducherry - 605 107



## DEPARTMENT OF CIVIL ENGINEERING DEPARTMENT VISION AND MISSION

### DEPARTMENT VISION

We envision a world where the civil engineering department will be a home to an intellectual community with good quality education embedded with practical knowledge by inculcating research, strong social commitment and ethical values from its students, staffs and alumni.

### DEPARTMENT MISSION

#### M1: Quality Education

To fulfill the requirements of construction industry, Civil Engineering profession and rural community through dissemination of technical services.

#### M2: Practical Knowledge

To impart quality and real-time education to the students with the knowledge & skills needed for Civil Engineering practice

#### M3: Work Efficiency

To encourage research, development and consultancy through sustained interaction with industry & research organization.

#### M4: Societal issues

To develop graduates to compete at the global level to deal with modern issues.

#### M5: Moral & Ethical

To insist ethical values and professionalism among the students.

**Annexure III**  
**SEMESTER – V**  
**OPERATIONS RESEARCH**

<b>U19CET51</b>	(Common to CIVIL, AI & DS & MECHATRONICS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>60</b>

**Course Objectives**

*This course should enable the students to*

- Understand the role of operation research in decision making.
- Provide knowledge and training in using optimization techniques.
- Impart the various operation research models for effective problem solving.
- Understand the basics and the methods of solving game theory and network problems.
- Acquire knowledge in principles of Queuing Theory.

**Course Outcomes**

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

**CO1** - Understand the characteristics of different types of decision-making environments. **(K2)**

**CO2** - Solve Transportation Models and Assignment Models. **(K3)**

**CO3** - Design new simple models by using critical path method. **(K3)**

**CO4** - Understand the applications of game theory. **(K2)**

**CO5** - Apply Queuing theory and solve problems related to it. **(K3)**

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

**UNIT I LINEAR PROGRAMMING****(12Hrs)**

Stages of development of Operations Research – Applications of Operations Research – Limitations of Operations – Introduction to Linear Programming – Graphical Method – Simplex Method – Duality.

**UNIT II TRANSPORTATION PROBLEMS****(12Hrs)**

Basic feasible solution by different methods - Fixing optimal solutions- Stepping stone method- MODI method- Assignment problem – Formulation – Optimal solution.

**UNIT III NETWORKS MODELS****(12 Hrs)**

Shortest Path Problem – Floyd's Algorithm – Minimum Spanning Tree Problem - CPM/PERT – Crashing of a Project network.

**UNIT IV THEORY OF GAMES****(12 Hrs)**

Rectangular games – Minimax theorem – graphical solution of  $2 \times n$  or  $m \times 2$  games – game with mixed strategies.

**UNIT V QUEUING THEORY****(12 Hrs)**

Basic Waiting Line Models:  $(M/M/1):(GD/\alpha/\alpha)$  –  $(M/M/1):(GD/N/\alpha)$  –  $(M/M/C):(GD/\alpha/\alpha)$  –  $(M/M/C):(GD/N/\alpha)$ .

**Text Books**

1. Michael W. Carter, Camille C. Price, Ghaith Rabadi, "Operation Research – A Practical Introduction" Chapman and Hall/CRC; 2<sup>nd</sup> Edition 2018.
2. Jiongmin Yong, "Optimization Theory: A concise Introduction", World scientific publishing company, 2018.
3. John F. Shortle, James M. Thompson, Donald Gross, Carl M. Harris, "Fundamentals of Queuing Theory", 5<sup>th</sup> Edition, 2018.

**Reference Books**

1. A. Ravi Ravindran, "Operations Research Methodologies", Taylor and Francis, 2019.

2. Hasting, Kevin J. "Introduction to the Mathematics of Operations Research with Mathematics", Taylor and Francis, 2019.
3. A.M.Natarajan, P.Balasubramane and A.Tamilarasi, "Operations Research", Pearson. 2<sup>nd</sup> Edition, 2014.
4. J. K. Sharma, "Operations Research Theory and applications", Macmillan India Ltd, 5<sup>th</sup> Edition, 2013.
5. Hamdy A. Taha, "Operations Research: An Introduction", Pearson Publications, 10<sup>th</sup> Edition, 2020.

### Web References

1. <https://www.researchgate.net/publication/313880623>
2. <https://nptel.ac.in/courses/117/103/117103017/>
3. <https://nptel.ac.in/courses/111/107111107128/>
4. <https://youtu.be/MrOwmSYqkiE>
5. <https://youtu.be/4U3B5lr-MqM>

### 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	1	-	-
CO2	3	2	1	1	-	1	-	-	-	-	-	1	1	-	-
CO3	3	2	1	1	-	1	-	-	-	-	2	1	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	2	1	1	-	-
CO5	3	2	1	1	-	-	-	-	-	-	2	1	1	-	-

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

<b>U19CET52</b>	<b>STRUCTURAL ANALYSIS - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>60</b>

**Course Objectives**

*This course should enable the students to*

- Analyze statically indeterminate beams by using Force method
- Analyze the pin jointed frame by using Force method
- Analyze statically indeterminate beams and frames by using Slope deflection method
- Analyze statically indeterminate beams and frames by using Moment distribution method
- Analyze the statically determinate and indeterminate structures of suspension bridges

**Course Outcomes**

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

**CO1** - Determine the degree of static indeterminacy to understand the concept of force method (**K4**)

**CO2** - Analyze the member forces, deflection for a pin jointed frames by using force method (**K3**)

**CO3** - Perform analysis of indeterminate beam and frame by slope deflection method (**K4**)

**CO4** - Perform analysis of indeterminate beam and frame by moment distribution method (**K4**)

**CO5** - Analyze the determinate and indeterminate structures of suspension bridges (**K3**)

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

**UNIT I FORCE METHOD (12 Hrs)**

Concept of degree of Static indeterminacy and Kinematic indeterminacy – Analysis of continuous beams..

**UNIT II REDUNDANT FRAME (12 Hrs)**

Structural member: Definition, degree of freedom, concept of free body diagrams, types of supports and reactions, types of loads, Analysis of trusses by Method of Joints.

**UNIT III SLOPE DEFLECTION METHOD (12 Hrs)**

Slope deflection equations – Equilibrium conditions – Analysis of continuous beams and rigid frames with and without sway – Support settlements – Symmetry portal frames.

**UNIT IV MOMENT DISTRIBUTION METHOD (12 Hrs)**

Stiffness and carry over factors – Distribution and carry over moments – Analysis of continuous beams and rigid frames with and without sway – Support settlements – Symmetry portal frames (Analyse the problem with C program)

**UNIT V SUSPENSION BRIDGES (12 Hrs)**

Analysis of Suspension bridges with statically determinate structures of two hinged stiffening girders and statically indeterminate structures of three hinged stiffening girders

**Text Books**

1. Vaidyanathan R and Perumal P, Structural Analysis, Vol. 1 & 2, Laxmi Publications Pvt. Ltd, New Delhi, 2016, 4<sup>th</sup> Edition
2. Bhavikatti,S.S, Structural Analysis, Vol. 1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi, 2010, 4<sup>th</sup> Edition
3. B.C.Punmia, Ashok Kumar Jain, Arun K. Jain, "Theory of Structures", Laxmi Publications Pvt. Ltd, 2017, 13<sup>th</sup> Edition
4. Arun Shyam,Karuna Basker, Structural Analysis, Medtech Publisher, 2019
5. Roy Sujit Kumar, Chakrabarty Subrata, Fundamentals of Structural Analysis: With Computer Analysis and Applications Paperback, S Chand & Company Publisher, 2003, 2<sup>nd</sup> Edition

**Reference Books**

1. Dr.R.P. Rethaliya, Structural Analysis-I, Atul Prakashan Publisher, 2020
2. Dr. Suresh R. Parekar, H.M. Somayya, Structural Analysis-I, Nirali Prakashan Publisher, 2014
3. Wang. C. K., Intermediate Structural Analysis, McGraw Hill Publishing Co., Tokyo, Fourth Edition, 2017.
4. Jindal, R. L., Indeterminate Structural Analysis, S. Chand and Company. New Delhi, 2000.
5. Thandavamoorthy, "Analysis of Structures", Oxford and IBH Publishers, New Delhi.2008

**Web References**

1. <https://nptel.ac.in/courses/105105166/>
2. [https://onlinecourses.nptel.ac.in/noc20\\_ce35/unit?unit=50&lesson=51](https://onlinecourses.nptel.ac.in/noc20_ce35/unit?unit=50&lesson=51)
3. <https://nptel.ac.in/courses/105101085/>

**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



<b>U19CET53</b>	<b>GEOTECHNICAL ENGINEERING-II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>60</b>

**Course Objectives**

*This course should enable the students to*

- Impart knowledge on common method of sub soil investigation and sampling Methods.
- Learn about the method of improving Bearing capacity of the soil.
- Gain knowledge about, investigate the soil condition and to design a suitable foundation.
- Gain knowledge about design procedure for shallow and deep foundation.
- Understand about the earth pressure on cohesion less and cohesive soil.

**Course Outcomes**

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

**CO1** - Analyze the method of soil exploration and sampling. **(K4)**

**CO2** - Get knowledge on bearing capacity and testing methods. **(K3)**

**CO3** - Select the type of foundation required for the soil at a place and able to design different types of foundation. **(K4)**

**CO4** - Determine the load carrying capacity of pile foundation. **(K5)**

**CO5** - Gain knowledge about retaining structures and Stability analysis. **(K4)**

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

**UNIT I SOIL EXPLORATION****(12 Hrs)**

Site investigation – soil exploration methods- samplers-sampling method- Hand augers and power drills- Wash boring - Spacing and depth of bore holes - Standard Penetration Test - Static Cone Penetration Test - Dynamic Cone Penetration Test- subsurface soundings-geo physical method - Preparation of soil investigation Report.

**UNIT II SHALLOW FOUNDATION****(12 Hrs)**

Classification of foundation- Types and selection criteria-- Methods to determine bearing capacity- Methods to increase BC-Terzaghi Analysis-Codal provision-Factors affecting bearing capacity -Settlement of foundations on granular and clay deposits- Seismic considerations in bearing capacity evaluation.

**UNIT III FOOTINGS AND RAFTS****(12 Hrs)**

Types of Isolated footing-Combined footing- Mat foundation-Codal provision– Contact pressure and settlement distribution -Proportioning of foundation–design of foundation.

**UNIT IV DEEP FOUNDATION****(12 Hrs)**

Pile foundations Introduction- classification-selection criteria- Individual and group pile carrying capacity- static and dynamic approach-pile load tests- under reamed piles-IS Codal provisions. Methods to increase pile carrying capacity – Deep compaction methods – Grouting.

**UNIT V RETAINING WALLS****(12 Hrs)**

Active and passive states –Definitions, Rankine’s theory – Cohesion less and cohesive soil – Earth pressure on retaining walls of simple configurations – Culmann’s Graphical method – Stability analysis of retaining walls – Codal provisions.

**Text Books**

1. Punmia B.C."Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 17th Edition, 2017.
2. Murthy, V.N.S.,“Text book of Soil Mechanics and Foundation engineering”, CBS Publishers Distribution Ltd., New Delhi. 2014.
3. Purushothama Raj. P.“Soil Mechanics and Foundation Engineering”, 2nd Edition, Pearson Education, India 2013
4. Varghese, P.C.”Foundation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2005

**Reference Books**

1. Venkatramaiah.C., "Geotechnical Engineering", New Age International Pvt. Ltd., New Delhi, 2017
2. Modi P N, "Soil Mechanics and Foundation Engineering", second Edition Standard Book House, New Delhi, 2017.
3. Coduto, D.P., "Geotechnical Engineering Principles and Practices", Prentice Hall of India Private Limited, New Delhi, 2002.
4. Michael A. Joyce "Site Investigation Practice", E. & F.N. Spon, 1982

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1. <https://nptel.ac.in/courses/105/101/105101083/>
2. <https://nptel.ac.in/courses/105105176/>
3. <https://nptel.ac.in/courses/105/105/105105039/>

**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	3	3	3	3	2	2	2	3	3	2
CO2	3	3	3	3	3	3	3	3	3	2	2	2	3	3	3
CO3	3	3	2	3	3	2	3	3	3	3	2	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3
CO5	3	3	3	3	2	2	3	3	3	3	2	2	3	3	2

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

<b>U19CET54</b>	<b>ENVIRONMENTAL ENGINEERING – I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

*This course should enable the students to*

- Understand the basics, importance, and methods of water supply.
- Gain knowledge on various sources and properties of water.
- Understand the various methods of conveyance of water.
- Learn the objectives and methods of water treatment and to study the features and function of different water treatment units.
- Learn the importance of rain water harvesting and water pollution.

**Course Outcomes**

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

**CO1** - Estimate the future population (**K2**)

**CO2** - Understand the different water sources and the characteristics of water and their analysis (**K2**)

**CO3** - Design the distribution network and Conveyance (**K4**)

**CO4** - Understands the various water treatment process (**K2**)

**CO5** - Construct to Water Management system (**K2**)

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

**UNIT I INTRODUCTION TO WATER SUPPLY****(9 Hrs)**

Environmental Engineering - Role of Environmental Engineer - Water supply - development of public water supply - need for protected water supplies - objectives of water supply systems - water supply scheme-quantity of water - estimating requirements - Design period – per capita consumption - fluctuations in dema pattern - population forecast – Arithmetic, Incremental, Geometric methods.

**UNIT II SOURCES, QUALITY AND STANDARDS OF WATER****(9 Hrs)**

Sources of water - surface and ground water sources – Quality of water - physical, chemical and biological aspects - analysis of water - water quality.

**UNIT III CONVEYANCE AND DISTRIBUTION SYSTEM****(9 Hrs)**

Intake structures - pipe materials - hydraulics of flow in pipes - laying, jointing, testing of pipes - pumping stations - selection of pumps - methods of distributing water - storage and distribution reservoirs - analysis of distribution system Hardy- cross method of balancing - equivalent pipes.

**UNIT IV WATER TREATMENT SYSTEM****(9 Hrs)**

Definition of unit process and unit operations - objectives of water treatment - methods and sequence of treatment of water - typical flow sheet treating hard groundwater turbid surface water - aeration , coagulation, flocculation filtration and disinfection - principles functions of design - sedimentation - flocculation- filter units - miscellaneous methods -iron and manganese removal - deflouridation and demineralization.

**UNIT V WATER MANAGEMENT****(9 Hrs)**

Sustainable Development-Rain Water harvesting-Methods-Water Pollution- Causes and effects- Role of regulatory bodies and Local bodies-CPCB-TWAD Board- CMWSSB etc-Water Act 1974-Case Studies related to Effective Water Management.

**Text Books**

1. Garg, S.K., - Environmental Engineering I, Khanna Publishers, New Delhi, 2016
2. Modi, P.N., - Environmental Engineering I , Standard Book House, Delhi, 2016
3. Duggal K.N., - Elements of Environmental Engineering S.Chand and Co. Ltd., New Delhi, 2019

**Reference Books**

1. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2015.
2. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987.
3. Gray N.F, Water Technology, Elsevier India Pvt. Ltd., New Delhi, 2016.
4. Birdie, G.S. and Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, 2016.
5. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2016.

**Web References**

1. [https://onlinecourses.nptel.ac.in/noc20\\_ce23/announcements](https://onlinecourses.nptel.ac.in/noc20_ce23/announcements).
2. [https://swayam.gov.in/nd1\\_noc20\\_ce23/preview](https://swayam.gov.in/nd1_noc20_ce23/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	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	2	2	3	3	3	3	2	3	2	2	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

U19CEP51

**NUMERICAL METHODS LABORATORY**

L	T	P	C	Hrs
0	0	2	1	30

**Course Objectives**

*This course should enable the students to*

- Learn the techniques of non – linear equation.
- Understand the techniques of solving simultaneous equations.
- Introduce the numerical techniques of integration.
- Understand the applications of Simpsons rule.
- Study about the numerical solution of Laplace equation.

**Course Outcomes**

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

**CO1** – Find out the root of the Algebraic and Transcendental equations. **(K3)**

**CO2** – Solve the simultaneous equations. **(K3)**

**CO3** – Know the iterative Interpolation formula of integration. **(K3)**

**CO4** – Implement Simpsons Rule formula. **(K3)**

**CO5** – Solve the Laplace equation using Numerical methods. **(K3)**

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

**LIST OF EXPERIMENTS**

1. Roots of non – linear equation using bisection method.
2. Roots of non – linear equation using Newton’s method.
3. Find the largest Eigen value of a matrix by power - method.
4. Solve the system of linear equations using Gauss - Elimination method.
5. Solve the system of linear equations using Gauss - Jordan method.
6. Solve the system of linear equations using Gauss - Seidal iteration method.
7. Find the area by using trapezoidal rule.
8. Find the area by using Simpson’s 1/3 rule.
9. Find the area by using Simpson’s 3/8 rule
10. Find the numerical solution of heat equation.

**Reference Books**

1. C. Xavier, “C Language And Numerical Methods”, New Age International, 2007.
2. P. Siva Ramakrishna Das, “Numerical Analysis”, Kindle Edition, 2016.
3. Timo Heister, Leo G. Rebholz, FeiXue, “Numerical Analysis an Introduction”, Publisher De Gruyter, 2019.
4. K. Sankara Rao, “Numerical Methods for Scientists and Engineers”, 3<sup>rd</sup> Edition, PHI Learning Pvt. Ltd, New Delhi, 2018.
5. Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers" McGraw – Hill Higher Education, 2010.

**Web Resources**

1. <http://nptel.ac.in/courses/111107063>
2. <http://nptel.ac.in/courses/122102009>
3. <http://nptel.ac.in/courses/111/107/111107105>
4. <http://www.math.iitb.ac.in/~baskar/book.pdf>
5. <https://www.math.ust.hk/~machas/numerical-methods.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	2	1	1	-	1	-	-	-	-	-	1	-	-	1
CO2	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
CO3	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
CO4	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1

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

<b>U19CEP52</b>	<b>REVIT ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

### Course Objectives

*The course should enable the students to:*

- Get exposed to the usage of software
- Learn the concepts of planning and orientations.
- Create a full 3D Elements like walls, doors, windows, components, floors, ceilings, roofs, stairs.
- Create a full 3D architectural project model
- Learn the concept of walkthrough in Revit Architecture.

### Course Outcomes

*At the end of Course students will be able to*

**CO1** - Describe building information modeling methodology and its benefits. **(K3)**

**CO2** - Use different parts of the Revit Architecture user interface and work with different types of architectural elements and families. **(K3)**

**CO3** - Use the different views listed in the Project Browser, control the visibility and graphical **(K3)**

**CO4** - Representation of objects in architecture model, and work with elevation, section, and 3D views. **(K4)**

**CO5** - Set up a project and transfer standards between projects, add and modify levels in project model, create and modify grids. **(K4)**

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

### List of Experiments

1. Introduction
2. Core concepts
3. Touring the Revit Workspace
4. Starting a Project in Revit
5. Levels, Grids, and Columns
6. Using walls
7. Doors and Windows
8. How to use components
9. Use of columns and their types
10. Use of stairs and their types
11. Railing in Revit
12. Ramps
13. Floors
14. Roof
15. Text
16. Camera
17. Walk through
18. 3D modeling of Residential building

### Reference Books

1. Shah.M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Build Environment", Tata McGraw Hill Publishers Limited, 2019.
2. Dr. N. Kumaraswamy, A. KameswaraRao, Charotar Publishing- Building planning and Drawing,2017
3. Marimuthu V.M., Murugesan R. and Padmini S., "Civil Engineering Drawing-I", Pratheeba Publishers, 2018.

### Web References

1. [https://www.google.com/search?q=revit+architecture+tutorial&rlz=1C1CHBD\\_enIN877IN877&andq=REVIT+ARCHITECTURE+&tandaqs=chrome.1.69i57j0I7.13121j0j8&andsourceid=chromeandie=UTF-8](https://www.google.com/search?q=revit+architecture+tutorial&rlz=1C1CHBD_enIN877IN877&andq=REVIT+ARCHITECTURE+&tandaqs=chrome.1.69i57j0I7.13121j0j8&andsourceid=chromeandie=UTF-8)
2. <https://www.youtube.com/watch?v=cJz20pnOGrw>

3. <https://www.pdfdrive.com/revit-architecture-d18827665.html>

### 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	1	2	1	3	1	-	-	2	3	-	3	3	2	3
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CO3	3	1	2	1	3	1	-	-	2	3	-	3	3	2	3
CO4	3	1	2	1	3	1	-	-	2	3	-	3	3	2	3
CO5	3	1	2	1	3	1	-	-	2	3	-	3	3	2	3

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



<b>U19CEP53</b>	<b>GEOTECHNICAL ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

### Course Objectives

*This course should enable the students to*

- Develop the skill for conducting experiment in different types of soil.
- Determine the index and engineering properties and to characterize the soil based on their properties.
- Determine the field density and compaction characteristic of the soil.

### Course Outcomes

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

**CO1** - Classify the soil and assess the engineering Properties, based on index properties (**K2**)

**CO2** - Understand the concept of in-situ density and compaction characteristic of soil sample (**K3**)

**CO3** - Understand about the techniques and method to determine the index properties and Engineering Properties of soil sample(**K5**)

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

### LIST OF EXPERIMENTS

#### DETERMINATION OF INDEX PROPERTIES

1. Determination of Grain size distribution (Sieve Analysis, Hydrometer Analysis)
2. Determination of Specific gravity of soil grains (Pycnometer, Density bottle)
3. Determination of Atterberg limits Test
  - Liquid limit,
  - Plastic limit
  - shrinkage limit Test
4. Determination of swell index Test

#### DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

5. Determination of Field density test (Core cutter and sand replacement methods)
6. Determination of moisture - Density relationship using Standard Proctor Test

#### DETERMINATION OF ENGINEERING PROPERTIES

7. Determination of Permeability (Constant Head, Falling Head methods)
8. Determination of Direct shear test on Cohesion less soil
9. Determination of Unconfined compression test on cohesive soil
10. Determination of Triaxial compression test on cohesive soil
11. Demonstration of one dimensional consolidation Test
12. Demonstration of Standard Penetration Test (SPT)

### Reference Books

1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 17th Edition, (2017).
2. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Cooperative Society, Anna University, Chennai, 2010.

3. Indian Standards on Soil Engineering, Part 1 Laboratory Testing of Soils for Civil Engineering Purposes —SP 3 (Part 1): 1987II, Bureau of Indian Standards, New Delhi, 1987.
4. Varghese, P.C."Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005

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1. <https://nptel.ac.in/courses/105103097/>
2. <https://nptel.ac.in/courses/105/101/105101160/>
3. <https://nptel.ac.in/courses/105/101/105101201/>

### 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	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	3	3	3	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3

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

<b>U19CEP54</b>	<b>ESTIMATION COSTING AND VALUATION LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

**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. Estimation on Residential Building – I
3. Estimation on Residential Building - II
4. Estimation on Septic tank with Soak pit
5. Estimation on Isolated Footing with column
6. Estimation on Box Culvert
7. Estimation on Earthwork with embankment
8. Estimation on Bituminous road
9. Analysis of Rates
10. Valuation
11. Estimation of bar bending schedule

**Text Books**

1. B. N. Dutta, "Estimating and Costing in Civil Engineering", CBS Publishers and Distributors Pvt Ltd, New Delhi, 28th Edition, 2020
2. M. Chakraborti, "Estimating, Costing, Specification and Valuation in Civil Engineering", Chakraborti, 29th revised Edition, 2006
3. A.K. Upadhyay, Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation, S K Kataria and Sons; Reprint 2013 edition, 2013
4. G. S. Birdie, A text book of Estimating and Costing, Dhanpat Rai Publishing Company Private Limited-New Delhi; Sixth edition (2014)
5. Dr. R P Rethaliya, Mayur R Rethaliya, Estimating costing and valuation, Atul Prakashan Publisher, January 2018

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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, 17<sup>th</sup> 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

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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	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

**SEMESTER – VI**

<b>U19CET61</b>	<b>DESIGN OF STEEL STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>60</b>

**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 (12Hrs)**

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 (Using C Programming).

**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 Lacing 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 and gantry girder (design procedure).

**UNIT – V DESIGN OF CONNECTIONS (12 Hrs)**

Types of end connections- Design of stiffened seated connection using bolts and welds, design of unstiffened seated connection using bolts and welds. Design of Column base under axial loading – slab base and gusseted base.

**Text Books**

1. N.Subramanian , "Design of Steel Structures" , Oxford University press, 2018.
2. S.K.Duggal, "Limit State Design of Steel Structures", Tata McGraw 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
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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

<b>U19CET62</b>	<b>STRUCTURAL ANALYSIS – II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>60</b>

**Course Objectives**

*This course should enable the students to*

- Analyze the different types of arches and cables with different end conditions
- Analyze statically determinate and indeterminate beams for ILD by using Rolling load and Muller Breslau's Principle
- Analyze statically indeterminate beams and frames by using Flexibility Matrix method
- Analyze statically indeterminate beams and frames by using Stiffness Matrix method
- Understand the concept of shape factor for various sections and plastic analysis of a beam and frame

**Course Outcomes**

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

- CO1** -Familiarized in finding the normal thrust, radial shear and bending moment in arches and horizontal thrust and tension in the cables with same and different level **(K3)**
- CO2** - Draw influence line diagram for various types of moving loads and indeterminate structures on beam by Muller Breslau principle **(K3)**
- CO3** - Analyze the basic concept of static indeterminacy of beam and frame by using force method **(K4)**
- CO4** - Analyze the basic concept of kinematic indeterminacy of beam and frame by using displacement method **(K4)**
- CO5** - Familiarize about shape factor of different sections and analyze the beams and frames by plastic theory **(K3)**

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

**UNIT I ARCHES AND CABLES****(12 Hrs)**

Arches as structural forms - Examples of arch structures - Types of arches - Analysis of three hinged and two hinged - Settlement and temperature effects - Analysis of forces in cables

**UNIT II INFLUENCE LINES FOR DETERMINATE AND INDETERMINATE STRUCTURES (12 Hrs)**

ILD for simply supported Moving loads –single and several point loads – maximum bending moment and maximum shear force –absolute maximum bending moment – Muller - Breslau's Theorem - principle and its application. Influence lines for continuous beams.

**UNIT III FLEXIBILITY MATRIX METHOD****(12 Hrs)**

Equilibrium and compatibility - Determinate Vs Indeterminate structures - Indeterminacy - Primary structure - Compatibility conditions - Analysis of indeterminate continuous beams (with redundancy restricted to two).

**UNIT IV STIFFNESS MATRIX METHOD****(12 Hrs)**

Displacement method or stiffness method - General – Procedure – Stiffness matrix – Procedure for stiffness matrix – Stiffness coefficient - comparison of Flexibility and Stiffness methods - Analysis of indeterminate continuous beams (with redundancy restricted to two) (Analysis the problem with C program)

**UNIT V PLASTIC ANALYSIS OF STRUCTURES****(12 Hrs)**

Plastic modulus - Shape factor - Load factor - Plastic hinge and mechanism - Upper and lower bound theorems - Plastic moment of resistance - Analysis of indeterminate beams and symmetry portal frames

**Text Books**

1. Vaidyanathan R and Perumal P, Structural Analysis, Vol. 2, Laxmi Publications Pvt. Ltd, New Delhi, 2017, 3<sup>rd</sup> Edition
2. Bhavikatti,S.S, Structural Analysis, Vol. 2, Vikas Publishing House Pvt. Ltd., New Delhi, 2018, 4<sup>th</sup> Edition
3. B.C.Punmia, Ashok Kumar Jain, Arun K. Jain, " Theory of Structures", Laxmi Publications Pvt. Ltd, 2017, 13<sup>th</sup> Edition

- Pandit G.S, and Gupta S. P, "Structural Analysis a Matrix Approach", Tata McGraw Hill Publications, New Delhi, 2008
- L.S. Negi and R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003

### Reference Books

- Wang. C. K., Intermediate Structural Analysis, McGraw Hill Publishing Co., Tokyo, Fourth Edition, 2017.
- Jindal, R. L., Indeterminate Structural Analysis, S. Chand and Company. New Delhi, 2000.
- Thandavamoorthy, "Analysis of Structures", Oxford and IBH Publishers, New Delhi.2008
- Arun Shyam, Karuna Basker, Structural Analysis, Medtech Publisher, 2019
- Roy Sujit Kumar, Chakrabarty Subrata, Fundamentals of Structural Analysis: With Computer Analysis and Applications Paperback, S Chand & Company Publisher, 2003, 2<sup>nd</sup> Edition

### Web References

- <https://nptel.ac.in/courses/105105166/>
- [https://onlinecourses.nptel.ac.in/noc20\\_ce35/unit?unit=50&lesson=51](https://onlinecourses.nptel.ac.in/noc20_ce35/unit?unit=50&lesson=51)
- <https://nptel.ac.in/courses/105101085/>

### 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



<b>U19CET63</b>	<b>DESIGN OF RC ELEMENTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>60</b>

**Course Objectives**

*The course should enable the students to*

- Gain knowledge on methods available for designing reinforced concrete structures
- Be familiar with design of beam using limit state method
- Know the behavior of RC beam in shear and torsion
- Be acquainted with the design of slab and column using limit state method
- Understand the design of footing and staircase using limit state method

**Course Outcomes**

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

**CO1** - Select the methods for designing reinforced concrete structures **(K3)**

**CO2** - Design the beam using limit state method **(K3)**

**CO3** - Design RC members for combined bending shear and torsion using Limit State Method. **(K3)**

**CO4** - Design the slab and column using limit state method **(K3)**

**CO5** - Design the footing and staircase using limit state method **(K3)**

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

**UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES (12 Hrs)**

Role of structural engineer in structural design – elements of structures – reinforced concrete – ductility versus brittleness – methods of design - advantages of limit state method over other methods - design codes and specification - Introduction to working stress method- Permissible stresses-Factor of Safety- modular ratio and cracking moment-IS 456 - limit state philosophy as detailed in current IS code.

**UNIT II LIMIT STATE DESIGN OF BEAM (12 Hrs)**

Introduction to flexural members - Behaviour of RCC beam under flexure – Design of singly and doubly reinforced rectangular (using C programming) and flanged beams for flexure, bond, shear and torsion.

**UNIT III LIMIT STATE DESIGN FOR SHEAR, TORSION, BOND AND ANCHORAGE (12 Hrs)**

Behaviour of RC beams in shear and torsion-shear and torsion reinforcement-limit state design of RC members for combined bending shear and torsion- use of design aids.

**UNIT III LIMIT STATE DESIGN OF SLAB AND COLUMN (12 Hrs)**

Design of one way and two way slabs - Design of continuous (one-way only) slabs. Types of columns - design of short columns for axial, uni-axial and bi axial bending - design of long columns- use of design aids

**UNIT V LIMIT STATE DESIGN OF FOOTING AND STAIRCASE (12 Hrs)**

Design of Footings - Isolated footing with axial and eccentric loading- Combined Rectangular and Trapezoidal footing for two columns only, Design of Stair Case (ordinary and doglegged)

**Text Books**

1. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012.
2. Unnikrishnan Pillai and Devadas Menon, "Reinforced Concrete Design", Tata Mc-Graw Hill, 2012
3. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2012
4. N. Krishnaraju, and R. N.Pranesh, " Reinforced Concrete Design", New Age International Pvt. Ltd.,2009
5. Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hall of India, Private, Limited New Delhi, 2008.

**Reference Books**

1. Mallick, D.K. and Gupta A.P., "Reinforced Concrete", Oxford and IBH Publishing Company, 2007
2. Syal, I.C. and Goel, A.K., "Reinforced Concrete Structures", A.H. Wheelers and Co. Pvt. Ltd., 2012
3. Ram Chandra.N. and Virendra Gehlot, "Limit State Design", Standard Book House, 2004.
4. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
5. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2007
6. IS 875:Part1 1987, Code of practice for design loads (Other Than Earthquake) for buildings and structures: Part 1 dead loads - Unit weights of building materials and stored materials
7. S 875 : Part 2 : 1987, Code of practice for design loads (Other Than Earthquake) for buildings and structures: Part 2 imposed loads
8. IS 875 : Part 3 : 2015, Design Loads (Other than Earthquake) for Buildings and Structures - Code of Practice Part 3 Wind Loads
9. SP 64 (S & T) : 2001, Explanatory handbook on Indian standard code of practice for design loads (Other Than Earthquake) for buildings and structures

**Web References**

1. <https://nptel.ac.in/courses/105/105/105105105/>
2. [https://www.youtube.com/watch?v=1\\_SXPr\\_YTOU](https://www.youtube.com/watch?v=1_SXPr_YTOU)
3. [https://onlinecourses.nptel.ac.in/noc20\\_ce39/preview](https://onlinecourses.nptel.ac.in/noc20_ce39/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	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3

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

<b>U19CET64</b>	<b>ENVIRONMENTAL ENGINEERING – II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

*This course should enable the students to*

- Understand the basics of sewage, types of sewers and sewer material.
- Learn the features of various sewer appurtenances.
- Learn the objectives and methods of sewage treatment and to study the features and function of different primary treatment units.
- Study the features and function of different secondary treatment units.
- Learn the objectives and methods of sewage disposal and methods of solid waste and sludge management.

### Course Outcomes

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

**CO1** - Study, analysis and design sewerage systems **(K2)**

**CO2** - Capable to select and use techniques, skills and modern engineering practices to solve the sewage transpirations problem. **(K3)**

**CO3** - Design various waste water primary treatment units. **(K4)**

**CO4** - Design various waste water secondary treatment units. **(K4)**

**CO5** - Gain knowledge in various sewage disposal methods **(K2)**

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

### UNIT I INTRODUCTION

**(9 Hrs)**

Sewage Characteristics - sewer sewage and sewerage -methods of collection - conservancy system, water carriage system - classification of sewerage systems- quantity of sanitary sewage - fluctuation in sewage flow - design of flow of sewage for separate, storm and combined sewers – full flow and partial flow conditions - design of separate sewers using Manning's formula..

### UNIT II SEWAGE MATERIALS, COMSTRUCTION AND APPURTENANCES

**(9 Hrs)**

Materials for pipe sewers - construction - laying, jointing, dewatering and testing - sewer appurtenances - traps - plumbing system of drainage – one pipe system and two pipe system of plumbing - sanitary fittings.

### UNIT III SEWAGE TREATMENT

**(9 Hrs)**

Primary treatment - objectives - screening - grit chamber and primary sedimentation tanks design.

### UNIT IV SECONDARY TREATMENT

**(9 Hrs)**

Principles, functions and design - activated sludge unit and trickling filter - septic tank - sludge digestion tank - oxidation pond- aerobic reactor- anaerobic reactor.

### UNIT V SEWAGE DISPOSAL AND SOLID WASTE MANAGEMENT

**(9 Hrs)**

Sewage Disposal – Dilution - self-purification of running streams - oxygen sag curve land disposal - sewage farming - deep well injection - soil dispersion system. Objectives of sludge treatment - properties and characteristics of sludge - sludge digestion - thickening - dewatering - conditioning - drying beds - biogas recovery. Solid waste -generation-collection-conveyance-disposal.

### Text Books

1. Garg, S.K., - Environmental Engineering II, Khanna Publishers, New Delhi, 2016.
2. Modi, P.N., - Environmental Engineering II, Standard Book House, Delhi, 2018
3. Duggal K.N., - Elements of Environmental Engineering II, S.Chand and Co. Ltd., New Delhi, 2019

**Reference Books**

1. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 2013.
2. Metcalf and Eddy, M.C., Wastewater Engineering - Treatment and Reuse II , 4Th Edition, McGraw Hill India, 2016.
3. Birdie, G.S. and Birdie, Water Supply and Sanitary Engineering, DhanpatRaiand Sons,2016.
4. Punmia, B.C., Ashok K Jain and Arun K Jain, "Wastewater Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2016.

**Web References**

1. [https://onlinecourses.nptel.ac.in/noc20\\_ce23/announcements](https://onlinecourses.nptel.ac.in/noc20_ce23/announcements)
2. [https://swayam.gov.in/nd1\\_noc20\\_ce23/preview](https://swayam.gov.in/nd1_noc20_ce23/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	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

U19CEP61	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C	Hrs
		0	0	2	1	30

### Course Objectives

*This course should enable the students to*

- Aware about water and its importance to human survival.
- Understand how to classify and analyze various quality parameters of raw water.
- Prepare water quality assessment report.
- Suggest required type of treatment to purify raw water.
- Analyze different quality requirements for industrial waters and domestic waters.

### Course Outcomes

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

**CO1** - At the end of the course student will able to discuss about importance of water and its quality analysis. **(K5)**

**CO2** - Analyze various physico-chemical and biological parameters of water in case of quality requirements. **(K5)**

**CO3** - At the end of the course student will be able to assess complete water quality assessment for EIA and domestic supplies. **(K5)**

**CO4** - At the end of the course student will suggest various types of treatment methods required to purify raw water with different contaminants. **(K5)**

**CO5** - Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions. **(K5)**

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

### LIST OF EXPERIMENTS

Sampling and preservation methods and significance of characterization of water and wastewater.

### PHYSICAL ANALYSIS

1. Determination of Turbidity by using Nephelometer.
2. Measurement of pH
3. Measurement of Conductivity
4. Measurement of Total Solids.
5. Estimation of Suspended, volatile and fixed solids

### CHEMICAL ANALYSIS

6. Estimation of Alkalinity.
7. Estimation of Chlorides.
8. Estimation of Hardness.
9. Estimation of Residual Chlorine
10. Estimation of Dissolved Oxygen.
11. Estimation of Manganese.
12. Jar test for the determination of optimum coagulant Dose.
13. COD test for water and waste water..

### BIOLOGICAL ANALYSIS

14. BOD test for water and waste water
15. Estimation of E-Coli.

### Text Books

1. Garg, S.K., - Environmental Engineering I and II, Khanna Publishers, New Delhi, 2016
2. Modi, P.N., - Environmental Engineering I and II, Standard Book House, Delhi, 2016
3. Duggal K.N., - Elements of Environmental Engineering S.Chand and Co. Ltd., New Delhi, 2019

**Reference Books**

1. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2015.
2. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987.
3. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 2013.
4. Metcalf and Eddy, M.C., Wastewater Engineering - Treatment and Reuse II, 4Th Edition, McGraw Hill India, 2016.
5. IS10500 Indian Standards for Drinking Water.
6. IS 2490 Indian Standards for Industrial and sewage effluent discharge.

**Web References**

1. [https://swayam.gov.in/nd1\\_noc20\\_ce23/preview](https://swayam.gov.in/nd1_noc20_ce23/preview)
2. [https://onlinecourses.nptel.ac.in/noc20\\_ce23/announcements?force=true](https://onlinecourses.nptel.ac.in/noc20_ce23/announcements?force=true)

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CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

U19CEP62

**MODELING AND ANALYSIS LABORATORY**

L	T	P	C	Hrs
0	0	2	1	30

**Course Objectives**

*This course should enable the students to*

- Get exposed to the usage of software
- Model the structures
- Analyze the structures
- The ETABS will help professionals convert to quality civil design experts empowering them with exceptional designing qualities

**Course Outcomes:**

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

**CO1** - Model the structure using E-TABS software (**K4**)

**CO2** - Analyze the structure using E-TABS software (**K5**)

**CO3** - Structural elements of any building, using E-TABS software (**K3**)

**CO4** - Students would have gained knowledge on the usage of the software (**K3**)

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

**LIST OF EXPERIMENTS**

1. Introduction to Structural Analysis and Design using ETABS
2. Introduction to various commands of ETABS and their applications in detail.
3. Analysis and design of Trusses
4. Analysis and design of continuous beams with fixed at both ends
5. Analysis and design of continuous beams with simply supported ends
6. Analysis and design of Plane Frames
7. Modeling and Analysis of G+5 Story building.
8. Analysis and design of Vertical displacements in Tall buildings
9. Analysis and design of Reinforced concrete slab
10. Foundation analysis using SAFE, independent as well as importing results from the ETABS.

**Software Required**

- E-TABS

**Web References**

1. <https://www.youtube.com/watch?v=KgvQxd58BN0>
2. <https://www.youtube.com/watch?v=LOtuWW9-G68>

**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	3	3	3	1	1	1	3	3	3	3
CO2	3	3	3	2	2	3	3	3	1	1	1	3	3	3	3
CO3	3	3	3	2	2	3	3	3	1	1	1	3	3	3	3
CO4	3	3	3	2	2	3	3	3	1	1	1	3	3	3	3
CO5	3	3	3	2	2	3	3	3	1	1	1	3	3	3	3

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

<b>U19CEP63</b>	<b>DESIGN AND DRAWING LABORATORY (RCC AND STEEL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

**Course Objectives**

*This course should enable the students to*

- Prepare working drawings for concrete structures
- Prepare working drawings for steel structures
- Preparation of layout of the structure with detailed design details
- Preparation of working drawings with all dimensions required for execution/ fabrication of structures
- Increase ability to communicate with people through drawings

**Course Outcomes**

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

**CO1** – Understand the importance of basic concepts and principles of Design and Drawing. **(K5)**

**CO2** – Design steel and concrete structures. **(K5)**

**CO3** – Draft various concrete and steel structures / elements. **(K5)**

**CO4** – Detail various concrete and steel structures / elements. **(K5)**

**CO5** – Use the drawing instruments effectively and able to dimension the given figures. **(K5)**

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

**Detailed Design and Drawing of the following RCC elements/Structures:**

1. Continuous beams and slab systems.
2. Rectangular Combined footings.
3. Cantilever retaining walls
4. Elevated - circular and rectangular water tanks (excluding staging)
5. Staircases.

**Detailed Design and Drawing of the following Steel elements/Structures:**

1. Roof trusses and joints including purlins.
2. Stiffened welded seat connections – moment resisting welded connections for beams.
3. Welded plate girder.
4. Gantry girder.
5. Self-supporting chimney

**Text Books**

1. N.Subramanian , "Design of Steel Structures" , Oxford University press, 2018.
2. S.K.Duggal, "Limit State Design of Steel Structures", Tata McGraw Hill Education Pvt. Ltd, 2019
3. S.S.Bhavikatti, "Design of Steel Structures ", I.K.International Publishing House, 2019
4. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012.
5. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2012
6. N. Krishnaraju, and R. N.Pranesh," Reinforced Concrete Design", New Age International Pvt. Ltd.,2009
7. Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hall of India, Private, Limited New Delhi, 2008.

**Reference Books**

1. IS 800 -2007, General Construction in Steel - Code of Practice.
2. SP 6-1 (1964): ISI Handbook for Structural Engineers -Part1 Structural Steel Sections [CED 7: Structural Engineering and structural sections]



3. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2007
4. IS 3370-2 (2009): Code of Practice Concrete structures for the storage of liquids, Part 2: Reinforced concrete structures [CED 2: Cement and Concrete]

### Web References

1. <https://nptel.ac.in/courses/105105162/>
2. <https://nptel.ac.in/courses/105106113/>
3. <https://nptel.ac.in/courses/105106112/>
4. <https://nptel.ac.in/courses/105/105/105105105/>
5. [https://www.youtube.com/watch?v=1\\_SXPr\\_YTOU](https://www.youtube.com/watch?v=1_SXPr_YTOU)

### 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

## PROFESSIONAL ELECTIVE COURSES

<b>U19CEE51</b>	<b>GROUND IMPROVEMENT TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hours</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

*This course should enable the students to*

- Study the geotechnical problems in various types of soils and suggestions
- Learn the suitable dewatering techniques
- Study the apt ground improvement technique for various types of soils and site conditions.
- Study the earth reinforcement techniques.
- Learn the appropriate grouting materials and techniques to strengthen the soil.

### Course Outcomes

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

**CO1** - Assess the geo-technical problems in various types of soils and suggest suitable ground improvement techniques. **(K4)**

**CO2** - Choose suitable dewatering techniques for construction sites where the ground water table is at a higher level. **(K4)**

**CO3** - Identify the apt ground improvement technique for various types of soils and site conditions. **(K3)**

**CO4** - Apply the earth reinforcement techniques for retaining walls and slopes. **(K3)**

**CO5** - Select the appropriate grouting materials and techniques to strengthen the soil. **(K2)**

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

### UNIT I INTRODUCTION

**(9 Hrs)**

Role of ground improvement in foundation engineering - methods of ground improvement - Geotechnical problems in alluvial, laterite and black cotton soils - Selection of suitable ground improvement techniques based on soil condition.

### UNIT II DRAINAGE AND DEWATERING

**(9 Hrs)**

Drainage techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).

### UNIT III IN-SITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS

**(9 Hrs)**

In-situ densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains - Stone columns - Lime piles - Installation techniques only - relative merits of various methods and their limitations.

### UNIT IV EARTH REINFORCEMENT

**(9 Hrs)**

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth - use of Geotextiles for filtration, drainage and separation in road and other works. Prevention of land sliding and techniques adopted for the same.

### UNIT V GROUT TECHNIQUES

**(9 Hrs)**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring - Stabilisation with cement, lime and chemicals - Stabilisation of expansive soils.

### Text Books

1. Purushothama Raj, P. "Ground Improvement Techniques", Laxmi Publications, 2020.
2. NiharRanjanPatra, Ground Improvement Techniques, S.Chand Publishers 2012
3. Mittal.S, "An Introduction to Ground Improvement Engineering", Medtech Publisher, 2013.

### Reference Books

1. Das, B.M. – "Principles of Foundation Engineering" 7th edition, Cengage learning, 2016
2. Robert M. Koerner , "Designing with Geosynthetics Vol. 1and2", Xlibris; 6 edition, 2012
3. Jie Han, Principles and Practice of Ground Improvement, John Wiley and Sons, 2015

### Web References

1. <https://nptel.ac.in/courses/105/108/105108075/>
2. <https://nptel.ac.in/courses/105/103/105103097/>
3. <https://nptel.ac.in/courses/105/101/105101201/>

### 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	2	3	2	3	2	3	3	2	2
CO2	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO3	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO4	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO5	3	3	3	3	3	3	2	3	2	3	2	3	3	2	2

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

<b>U19CEE52</b>	<b>FUNDAMENTALS OF NANO SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hours</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

*This course should enable the students to*

- Gain a general knowledge on Nano science and Nanotechnology
- Understand the classification of nanostructure.
- Understand the properties and design aspects of nanomaterial.
- Understand the surface modification of nanoparticles.
- Understand the smart materials and its behavior for product development.

### Course Outcomes

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

**CO1** - Recognize the history, background and the nature of the Nan science and technology. **(K2)**

**CO2** - State the different type of nanostructures and analyze the top down and bottom up approach for nano scale device preparation and differentiate the different properties of nano materials. **(K2)**

**CO3** - Distinguish the functionality of nanostructures and their characteristic evaluation and designing it. **(K3)**

**CO4** - Recognize the surface modification of nanoparticles by surface fictionalization and their application. **(K5)**

**CO5** - Appraise the different smart materials like thermos-responsive, piezo electric electrostrictive and biometric materials, smart gel, shape memory and their application towards product formation. **(K4)**

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

### **UNIT I INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY (9 Hrs)**

History, background scope and interdisciplinary nature of nanoscience and nanotechnology, scientific revolutions, nanosized effects surface to volume ratio, atomic structure, molecules and phases, energy at the nanoscale molecular and atomic size, quantum effect.

### **UNIT II CLASSIFICATION OF NANOSTRUCTURES (9 Hrs)**

Zero dimensional, one-dimensional and two dimensional nanostructure materials - semiconductors, ceramics and nanocomposites, size dependent phenomena, quantum dots, nanowires, nanotubes, nanosheets, nano and mesopores, misnomers and misconception of nanotechnology.

### **UNIT III PROPERTIES OF NANOMATERIALS AND DESIGN (9 Hrs)**

Mechanical properties - Thermo physical properties - Electric properties - Electrochemical properties - Magnetic properties - Optical properties, Catalytic properties, properties of gas permeation and separation membranes. Functionality of nanostructures and their characteristic evaluation, Size effect in semiconductor nanoparticles- Particle size, shape density - Melting point, surface tension, wettability - Specific surface area and pore- assembly of nanoparticles and functionalization, Self-assembly. Nanoparticle dispersion and aggregation behavior.

### **UNIT IV SURFACE MODIFICATION OF NANOPARTICLES (9 Hrs)**

Surface modification of inorganic nanoparticles by organic functional groups, Development of photocatalyst inserted into surface of porous aluminosilicate - Dispersion control of nanoparticles in solvents - development of biodegradable PLGA nanospheres and application.

### **UNIT V SMART MATERIALS AND SYSTEMS (9 Hrs)**

Thermoresponsive materials, piezoelectric materials, electrostrictive and magnetostrictive materials, ER and

MR fluids, biomimetic materials, smart gel, shape memory alloys.

### Text Books

1. Edward L. Wolf, "Nanophysics and Nanotechnology - An Introduction to Modern Concepts in Nanoscience" Second Edition, John Wiley and Sons, 2006.
2. K.W. Kolasinski, —Surface Science: Foundations of Catalysis and Nanoscience, Wiley, 2002.
3. G.A. Ozin and A.C. Arsenault, — Nanochemistry : A chemical approach to nanomaterials, Royal Society of Chemistry, 2005.
4. Nanostructures and Nanomaterials synthesis, properties and applications, G. Cao, Imperial College press 2004.

### Reference Books

1. Y-W Vladimir P. Torchilin (2006) Nanoparticulates as Drug Carriers, Imperial College Press.
2. M. Reza Mozafari (2007) Nanomaterials and Nanosystems for Biomedical Applications, Springer.
3. Nanotechnology – Basic Science and Emerging Technologies, Chapman and Hall/CRC 2002.
4. Nanomaterials Nanotechnologies and Design: An introduction for Engineers and architects, Micheal F. Ashby, P.J. Ferreria, D.L.Schodek.

### Web Reference

1. <https://nptel.ac.in/courses/118/104/118104008/>

### 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	-	-	-	-	-	1	2	2	1
CO2	2	3	3	3	1	2	2	-	-	-	-	1	2	2	1
CO3	3	3	2	2	2	1	-	-	-	-	2	1	2	2	1
CO4	2	1	-	-	-	-	-	-	-	-	2	1	2	2	1
CO5	3	3	3	3	2	-	-	-	-	-	2	1	2	2	1

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

U19CEE53

## SMART CITY

L	T	P	C	Hours
3	0	0	3	45

### Course Objectives

*This course should enable the students to*

- Understand the basic of smart techniques
- Understand the IoT methods to government and international e-practice
- Understand the current practices and future trends about smart city
- Understand the capacity of critique the current practice and provide recommendations
- Understand about the various devices and uses

### Course Outcomes

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

**CO1** - Understand the fundamental knowledge of the sustainable and smart city (**K2**)

**CO2** - Understand the technologies used for sustainable and smart cities (**K2**)

**CO3** - Integrate and apply the learnt knowledge to conduct a case study in an organized way (**K3**)

**CO4** - Present the study clearly to audiences (**K2**)

**CO5** - Demonstrate critical thinking and discovery (**K3**)

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

### UNIT I INTRODUCTION AND APPLICATIONS

(9 Hrs)

Introduction and Applications - Smart mobility - smart environment - smart people - smart governance - smart economy - smart living

### UNIT II INTERNET OF THINGS

(9 Hrs)

IoT and low energy consuming sensors – Processing - Transmission – operating systems

### UNIT III APPLICATION OF VARIOUS BUILDINGS

(9 Hrs)

Methods to redesign and redefine back and front offices in order to build smarter and transparent governments

### UNIT IV SERVICES AND TECHNIQUES

(9 Hrs)

Methodologies for user involvement, profiling customers and identifying needs; test methodologies to transfer these needs in appropriate services; and test techniques to fit the right channel to the specific services and customers thereby are setting a framework for a higher level of e-services in the NSR.

### UNIT V TECHNOLOGIES AND APPLICATION

(9 Hrs)

Pilot new service channels, Bluetooth services for public transport, online forms in mobile phones and wireless city services.

### Text Books

1. Christopher Grant Kirwan, Zhiyong Fu, Smart Cities and Artificial Intelligence Convergent Systems for Planning, Design, and Operations, Elsevier Publisher, 2020
2. G.R. Kanagachidambaresan, Internet of things in smart technologies for sustainable urban development, Springer publisher, 2020
3. Jonathan Roichental, Smart cities for Dummies, The MIT Press, 2020
4. Ben Green, The Smart Enough City: Putting Technology in Its Place to Reclaim Our Urban Future, MIT Press, 2019
5. Anthony M, Townsend, Smart Cities – Big Data, Civic Hackers, and the Quest for a New Utopia, W. W.

Norton & Company; Reprint edition , 2014

### Reference Books

1. Rajendra Joshi, Smart Cities : Breaking the Poverty Barrier, Notion Press, 2019
2. Madrid, Lorenzo, Bower, Linda, Smart City 3.0, 2019
3. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
4. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by NicosKomninos
5. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend

### Web References

1. [http://smartcities.gov.in/content/city\\_challenge.php?page=city-challenge--website.php](http://smartcities.gov.in/content/city_challenge.php?page=city-challenge--website.php)
2. [http://smartcities.gov.in/upload/smart\\_solution/5a277bcb24008BHUBANESWAR%20E-MOBILITY%20PLAN.pdf](http://smartcities.gov.in/upload/smart_solution/5a277bcb24008BHUBANESWAR%20E-MOBILITY%20PLAN.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	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	2	2	3	3	3	3	2	3	2	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

U19CEE54

## AIR AND NOISE POLLUTION

L	T	P	C	Hours
3	0	0	3	45

### Course Objectives

*This course should enable the students to*

- Gain a basic knowledge on the air pollution on environment
- Understand the interaction of air pollutants on the meteorological parameters
- Understand about the control measures of air pollutants from various sources
- Understand the sources and control of indoor air pollution
- Understand the importance of Control of Noise pollution.

### Course Outcomes

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

**CO1** - Identify the types and sources of air pollutants(**K2**)

**CO2** - Predict the effects of air pollutants on human health and the environment(**K2**)

**CO3** - Choose appropriate technologies for removal of particulates and gaseous pollutants(**K2**)

**CO4** - Measure the pollutant concentration in indoor environment(**K2**)

**CO5** - Suggest the control techniques for Noise pollution. (**K2**)

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

### UNIT I INTRODUCTION

(9 Hrs)

Air pollutants – Sources – Classification of air pollutants – Particulates and gaseous pollutants – Effects of air pollutants on human health, vegetation and property – Global issues and air pollution – Global warming – Ozone layer depletion – Ambient air quality and emission standards – Air pollution indices – Air act.

### UNIT II METEOROLOGY AND AIR POLLUTION

(9 Hrs)

Meteorology and Air pollution – Atmospheric stability – Inversions – Mixing height –Plume behaviour – Plume rise estimation – Effluent dispersion theories –Air pollutants Modelling.

### UNIT III CONTROL OF PARTICULATE POLLUTANTS

(9 Hrs)

Control of Air pollutants: particulates – Filters – Gravitational settling chambers – Centrifugal-multiple type cyclones – Collection efficiency - Electrostatic precipitators – Wet collectors-Centrifugal spray scrubbers - Venturi scrubbers.

### UNIT IV GASEOUS POLLUTION CONTROL

(9 Hrs)

Gaseous pollution control – Absorption - Principles – Description of equipment, Adsorption – Principal adsorbents – Equipment descriptions – Condensation – Contact condensers, Incineration –Equipment description.

### UNIT V NOISE POLLUTION CONTROL

(9 Hrs)

Sound and noise - Source of noise pollution - Environmental and industrial noise -Effects of noise pollution - Fundamentals of sound - generation, propagation, etc., Sound measurement, sound level meters – Measures for prevention and control of noise -Environmental and industrial noise - Noise control legislation.

### Text Books

1. Rao.M.N. et al., Air Pollution, Tata Mc.Graw Hill, 2018.
2. Rao.C.S., Environmental Pollution Control Engineering , New Age International Publishers, 2017.



### Reference Books

1. Noel de Nevers, Air Pollution Control Engineering, Mc.Graw Hill, New York. 2016.
2. Stern, A.C., Air Pollution ,Vol.I, II and III, Academic Press, 2015.
3. Cunniff, P.F., Environmental Noise Pollution, John Wiley and Sons, 2017.

### Web References

1. [https://onlinecourses.nptel.ac.in/noc20\\_ce23/announcements](https://onlinecourses.nptel.ac.in/noc20_ce23/announcements)
2. [https://swayam.gov.in/nd1\\_noc20\\_ce23/preview](https://swayam.gov.in/nd1_noc20_ce23/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	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	2	2	3	3	3	3	2	3	2	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

<b>U19CEE55</b>	<b>PREFABRICATED STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

*This course should enable the students to*

- Understand the need and importance of Prefabrication.
- Understand the various components of Prefabrication
- Understand the design principles of different structure using Prefabrication concept
- Understand the concept of dimensioning and detailing of various structural members
- Understand the various loading natures and its effect on structures.

### Course Outcomes

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

**CO1** - Design principles and standards of prefabrication **(K2)**

**CO2** - Acquire knowledge about shear all system and design. **(K2)**

**CO3** - Get knowledge in various design problems in joint structures. **(K3)**

**CO4** - Gain knowledge about types of walls used in prefabrication construction, sealants, design of joints. **(K2)**

**CO5** - Acquire knowledge about design loads and progressive collapse in different 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 – Standardization – 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. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA, 1991.
2. Lewitt, M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
3. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst and Sohn, Berlin, 2011.

## Reference Books

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009.

## Web References

1. <https://www.scribd.com/document/375618710/Precast-concrete-materials-manufacture-properties-and-usage-pdf>
2. <https://tailieu.vn/doc/precast-concrete-materials-manufacture-properties-and-usage-1189145.html>
3. [http://www.brainkart.com/subject/Prefabricated-Structures\\_42/](http://www.brainkart.com/subject/Prefabricated-Structures_42/)

## 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	3	3	2	-	2	2	2	3	1	3	3
CO2	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO3	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO4	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO5	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3

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

U19CEE61

## ROCK ENGINEERING

L	T	P	C	Hours
3	0	0	3	45

### Course Objectives

*This course should enable the students to*

- Impart knowledge on fundamentals of rock mechanics
- Apply its application in solving simple problems associated with rock slopes and underground openings.
- Understand the estimation of stresses by using various method
- Gain the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.
- Understand the knowledge of rock stabilization

### Course Outcomes

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

**CO 1** - Understand classification of the rock, study the index properties of rock systems. **(K2)**

**CO 2** - Understand the modes of rock failure, stress-strain characteristics, failure criteria. **(K3)**

**CO 3** - Estimate the stresses in rocks. **(K4)**

**CO 4** - Apply rock mechanics in engineering. **(K3)**

**CO 5** - Get knowledge on rock stabilization **(K2)**

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

### UNIT I CLASSIFICATION AND INDEX PROPERTIES

**(9 Hrs)**

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose

### UNIT II ROCK STRENGTH AND FAILURE CRITERIA

**(9 Hrs)**

Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and compressive strength. Stress - strain behavior of rock under Hydrostatic compression and deviator loading – Mohr –Coulomb failure criteria and Hock

### UNIT III INITIAL STRESSES AND ITS MEASUREMENTS

**(9 Hrs)**

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses

### UNIT IV APPLICATION OF ROCK MECHANICS IN ENGINEERING

**(9 Hrs)**

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence

### UNIT V ROCK STABILIZATION

**(9 Hrs)**

Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.

### Text Books

1. Goodman, P.E. "Introduction to Rock Mechanics", John Wiley and Sons, 1999.
2. Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications, 1996.
3. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt. Ltd., 3rd Edition, 2014
4. Brown, E.T. "Rock Characterisation Testing and Monitoring". Pergaman Press 1991.
5. Arogyaswamy, R.N.P., "Geotechnical Application in Civil Engineering", Oxford and IBH, 1991.

## Reference Books

1. Braday, B.H.G. and Brown, E.T., Rock mechanics for underground mining (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006
2. Vutukuri, V.S., Lama, R.D. and Saluja, S.S. Handbook on Mechanical Properties of Rocks. Vol. 1, Trans Tech. Publications, 1975.
3. Zhang Lianyang. Engineering Properties of Rocks. Elsevier, 2005.
4. Bieniawski, Z.T.. Engineering Rock Mass Classifications. John Wiley and Sons, 1989.
5. John Jaeger and N. G. Cook. Fundamentals of Rock Mechanics. Wiley-Blackwell. 2007

## Web References

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2. <https://nptel.ac.in/courses/105/105/105105106/>

## 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	3	3	3	3	3	3	3
CO2	3	2	2	2	3	3	3	3	2	3	2	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

U19CEE62

## INTELLECTUAL PROPERTY RIGHTS

L	T	P	C	HOURS
3	0	0	3	45

### Course Objectives

*This course should enable the students to*

- Understand about Intellectual Property Rights
- Understand trademarks, Patents and Industrial Design
- Understand International Treaties and Conventions on IPRs
- Gain idea about different laws in IPR
- Understand the IPR different case study.

### Course Outcomes

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

**CO1** - Know about Intellectual Property Rights. **(K3)**

**CO2** - Make details on trademarks, Patents and Industrial Design **(K4)**

**CO3** - Get details about Agreements and Legislations **(K4)**

**CO4** - Gain knowledge about different laws in IPR **(K4)**

**CO5** - Manage Intellectual Property portfolio to enhance the value of the firm. **(K3)**

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

### UNIT I INTRODUCTION

**(9 Hrs)**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

### UNIT II REGISTRATION OF IPRS

**(10 Hrs)**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

### UNIT III AGREEMENTS AND LEGISLATIONS

**(10 Hrs)**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

### UNIT IV DIGITAL PRODUCTS AND LAW

**(9 Hrs)**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

### UNIT V ENFORCEMENT OF IPRS

**(7 Hrs)**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

### Text Books

1. V. ScopleVinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, EssEss Publications, New Delhi, 2002
3. Intellectual property right, Deborah, E. BoDcboux, Cengage learning

## Reference Books

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. PrabuddhaGanguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

## Web References

1. <https://nptel.ac.in/courses/109/106/109106137/>
2. <https://nptel.ac.in/courses/109/105/109105112/>

## 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	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

<b>U19CEE63</b>	<b>SHORING SCAFFOLDING AND FORM WORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

*This course should enable the students to*

- Gain knowledge about the latest methods of form construction.
- Understand the materials associated with formwork
- Understand the design aspects of formwork under various requirements
- Understand the planning and erection aspects of form work
- Understand about a few special types of forms

### Course Outcomes

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

**CO1** - Understand few other special types of forms **(K2)**

**CO2** - Study the planning and erection aspects of form work for buildings. **(K2)**

**CO3** - Know the design of forms and shores. **(K3)**

**CO4** - Study the design aspects of formwork under various requirements. **(K3)**

**CO5** - Study the materials associated with formwork. **(K2)**

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

### **UNIT I PLANNING, SITE EQUIPMENT AND PLANT FOR FORM WORK (9 Hrs)**

Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.

### **UNIT II MATERIALS ACCESSORIES PROPRIETARY PRODUCTS AND PRESSURES (9 Hrs)**

Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress - Plywood - Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.

### **UNIT III DESIGN OF FORMS AND SHORES (9 Hrs)**

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.

### **UNIT IV BUILDING AND ERECTING THE FORM WORK (9 Hrs)**

Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities.



## UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS (9 Hrs)

Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

### Text Books

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 2006.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 2003
3. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw -Hill, 2006. "Guide for Concrete Formwork", American Concrete Institute, Box No. 9150, Michigan 48219.
4. "Safety Requirements for Scaffolding", American National Standards Institute, New York, 1994

### Reference Books

1. Michael P. Hurst, Construction Press, London and New York, 2003.
2. "Safety Requirements for Scaffolding", American National Standards Institute. Broadway, New York, 10018.
3. Indian Concrete Institute, "Technical Monograph for Formwork", 2002.
4. Tudor Dinescu and Constantin Radulescu, "Slipform Techniques", Abacus Press, Turn Bridge Wells, Kent, 1992.
5. "Guide for Concrete Formwork", American Concrete Institute Detroit, Michigan, 1996.

### Web References

1. <https://nptel.ac.in/courses/108/105/108105017/>
2. <https://nptel.ac.in/courses/105/102/105102195/>
3. <https://nptel.ac.in/courses/105/102/105102088/>

### 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
<b>CO1</b>	3	2	2	2	3	3	3	-	3	-	2	3	3	3	3
<b>CO2</b>	3	2	3	3	2	3	3	-	3	-	3	3	3	3	3
<b>CO3</b>	3	2	2	2	3	3	3	-	3	-	2	3	3	3	3
<b>CO4</b>	3	2	2	2	3	3	3	-	3	-	2	3	3	3	2
<b>CO5</b>	3	2	2	2	3	3	3	-	3	-	2	3	3	3	2

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

**U19CEE64                      MUNICIPAL SOLID WASTE MANAGEMENT**

L	T	P	C	Hours
3	0	0	3	45

**Course Objectives**

*This course should enable the students to*

- Impart knowledge on sources and generation of municipal solid waste.
- Gain adequate knowledge in reduction and recycle of waste.
- Understand the concept of collection methods and routes.
- Gain knowledge about the transport method of municipal solid waste
- Impart knowledge of disposal method of waste.

**Course Outcomes**

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

**CO 1** - Understand the nature and characteristics of municipal solid wastes.(K2)

**CO 2** - Understand the concept of reduction, reuse and recycling of waste. (K4)

**CO 3** - Plan and design systems for storage, collection, transport, processing and disposal of municipal solid Waste.(K3)

**CO 4** - Understand the issues on solid waste management from an integrated source.(K4)

**CO 5** - Design and operate sanitary landfill.(K5)

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

**UNIT I SOURCES AND CHARACTERISTICS**

**(9 Hrs)**

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics –functional Elements of solid waste management – Requirements and salient features of Solid waste management rules (2016) -Role of public and NGO"s- Public Private participation – Elements of integrated Municipal Solid Waste Management Plan.

**UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING**

**(8 Hrs)**

Waste Management Hierarchy –3R-Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics, and Construction/Demolition wastes.

**UNIT III COLLECTION AND TRANSFER OF WASTES**

**(8 Hrs)**

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance- options under Indian conditions – Field problems- solving.

**UNIT IV PROCESSING OF WASTES**

**(12 Hrs)**

Objective(s) of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste -composting and biomethanation; Thermal processing options – case studies under Indian conditions.

**UNIT V WASTE DISPOSAL**

**(8 Hrs)**

Land disposal of solid waste- Sanitary landfills – site selection- design and operation of sanitary landfills – Landfill liners– Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation.

### Text Books

1. William A. Worrell, P. Aarne Vesilind (2012) Solid Waste Engineering, Cengage Learning, 2012.
2. John Pitchel (2014), Waste Management Practices-Municipal, Hazardous and industrial – CRC Press, Taylor and Francis, New York.
3. George Tchobanoglous et al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 1993.
4. B. Bilitewski, G. HardHe, K. Marek, A. Weissbach, and H. Boeddicker, "Waste Management", Springer, 1994.

### Reference Books

1. CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization. Government of India, New Delhi.
2. George Tchobanoglous and Frank Kreith (2002). Handbook of Solid waste management, McGraw Hill, New York.
3. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000
4. R.E. Landreth and P.A. Rebers, "Municipal Solid Wastes – problems and Solutions", Lewis Publishers, 1997.

### Web References

1. <https://nptel.ac.in/courses/120108005/>
2. <http://cpheeo.gov.in/upload/uploadfiles/files/Part1>
3. <https://nptel.ac.in/content/storage2/courses/104103022>

### 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	2	3	3	3	3	3	3	2	3	3	3	3	2
CO2	3	3	2	3	3	3	3	2	3	2	2	3	3	3	3
CO3	3	3	3	2	2	2	3	3	3	3	2	3	3	3	2
CO4	2	3	2	3	2	3	2	3	3	2	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	2	3	3	3	3	2

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

<b>U19CEE65</b>	<b>ADVANCED STRUCTURAL ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hours</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### 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 FE 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 tension coefficient method **(K2)**

**CO4** - Gain the knowledge about common feature in modern building construction, large roof spans in commercial and industrial buildings **(K3)**

**CO5** - Understand FEM method is fast, accurate and innovative approach to solving your most challenging design problems **(K4)**

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

### **UNIT I ANALYSIS OF MULTISTORIED FRAMES (12 Hrs)**

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

### **UNIT II ILD FOR INDETERMINATE STRUCTURES (12 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 (12 Hrs)**

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

### **UNIT IV CABLE STRUCTURES (12 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 (12 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, 3<sup>rd</sup> Edition
2. Bhavikatti, S.S, Structural Analysis, Vol. 2, Vikas Publishing House Pvt. Ltd., New Delhi, 4<sup>th</sup> 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.

- Reddy.J.N., " Introduction to the Finite Element Method", Tata McGraw Hill, 2013

### Reference Books

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

### Web References

- <https://nptel.ac.in/courses/105105109/>
- <http://www.digimat.in/nptel/courses/video/105101086/L01.html>

### 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	3	3	-	3	1	3	3	3
CO2	3	2	2	2	3	3	3	3	2	-	2	1	3	2	2
CO3	3	2	3	3	3	3	3	3	3	-	3	1	3	3	3
CO4	3	2	3	3	3	3	3	3	3	-	3	1	3	3	3
CO5	3	2	3	3	3	3	3	3	3	-	3	1	3	3	3

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

U19CEO53 /  
U19CEO63

## DISASTER MANAGEMENT

L	T	P	C	Hours
3	0	0	3	45

### Course Objectives

*This course should enable the students to*

- Understand the basic conceptual understanding of disasters
- Understand approaches of Disaster Management
- Build skills to respond to disaster
- Understand the safety precaution
- Understand the basic planning and policy act of the disaster

### Course Outcomes

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

**CO1** - Understanding Disasters, man-made Hazards and Vulnerabilities (**K2**)

**CO2** – Understanding the flood management studies (**K2**)

**CO3** - Understanding disaster mitigation and management mechanism (**K1**)

**CO4** - Understanding the disaster safety precaution (**K2**)

**CO5** – Understanding the disaster plan and act (**K3**)

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

### UNIT - I – DEFINITION AND TYPES

**(9 Hrs)**

Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

### UNIT – II STUDY OF IMPORTANT DISASTERS

**(9 Hrs)**

Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics and Environmental impact of disasters.

### UNIT - III MITIGATION AND MANAGEMENT

**(9 Hrs)**

Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics and Environmental impact of disasters.

### UNIT – IV SAFETY PROCESS

**(9 Hrs)**

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

## UNIT - V PLANNING AND ACT

(9 Hrs)

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

### Text Books

1. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Pvt. Ltd.
3. Jagbir Singh, Disaster Management : Future Challenges and Opportunities, K W Publishers Pvt. Ltd.
4. J. P. Singhal, Disaster Management, Laxmi Publications
5. C. K. Rajan, Navale Pandharinath, Earth and Atmospheric Disaster Management : Nature and Manmade, B S Publication

### Reference Books

1. Disaster Management by Mrinalini Pandey Wiley 2014.
2. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015
3. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
4. National Disaster Management Plan, Ministry of Home affairs, Government of India
5. Manual on Disaster Management, National Disaster Management, Agency Govt of India.

### Web References

1. <http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf>
2. <http://nidm.gov.in/pdf/guidelines/new/sdmp.pdf>
3. [http://sdmassam.nic.in/pdf/publication/undp/disaster\\_management\\_in\\_india.pdf](http://sdmassam.nic.in/pdf/publication/undp/disaster_management_in_india.pdf)

### 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
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CO2	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO3	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO4	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO5	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3

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

U19CEO54 /  
U19CEO64

## AIR POLLUTION AND SOLID WASTE MANAGEMENT

L	T	P	C	Hours
3	0	0	3	45

### Course Objectives

*This course should enable the students to*

- Provide general understanding of air pollution, air pollutants, their sources and their effects
- Provide knowledge about meteorological parameters, air sampling and measurement of pollutants.
- Provide knowledge of air pollution controlling technologies, air pollution due to automobiles and general idea of noise pollution.
- Study the importance of solid waste management by processing, treatment, disposal and reuse of solid waste.
- Study about the equipment used for waste collection and transportation of solids waste.

### Course Outcome

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

**CO1** - understand the type, sources & effect of air pollutants (**K2**)

**CO2** – know the parameters affecting air pollution and various methods of measurement and estimation of pollutants (**K3**)

**CO3** - gain knowledge of basics of noise pollution (**K2**)

**CO4** - understand various air pollution control equipment's & pollution caused due to automobile exhaust (**K4**)

**CO5** - understand the concepts of solid waste management (**K2**)

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

### **UNIT 1: INTRODUCTION TO AIR POLLUTION (8 Hrs)**

Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials

### **UNIT 2: METEOROLOGICAL ASPECTS (8Hrs)**

Meteorological Aspects: Atmospheric stability, plume behavior, Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.

### **UNIT 3: AIR POLLUTION CONTROL METHODS (9 Hrs)**

Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.

### **UNIT 4: SOLID WASTE MANAGEMENT (8Hrs)**

Introduction to solid waste management, sources, quantification and characterisation, classification and components, sampling and analysis, Method of collection

### **UNIT 5: EQUIPMENT (12 Hrs)**

Equipment used for collection and transportation, transfer stations, solid waste processing and management. Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.

### Text Books

1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.



2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.

### Reference books

1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd.
3. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author. Publisher: ABC-Clio
4. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal& Company.

### Web References

1. <https://nptel.ac.in/courses/120108005/>
2. <http://cpheeo.gov.in/upload/uploadfiles/files/Part1>
3. <https://nptel.ac.in/content/storage2/courses/104103022>

### 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	2	3	2	3	3	3	3	3	2	3	3	2	3
CO2	3	3	2	3	3	3	3	2	3	2	2	3	3	3	3
CO3	3	3	3	2	2	2	3	3	3	3	2	3	3	3	2
CO4	2	3	2	3	2	3	2	3	3	2	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3

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

**Annexure - IV**  
**PROFESSIONAL ELECTIVE COURSES**

<b>Professional Elective – I (Offered in Semester IV)</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	U19CEE41	Engineering Geology
2	U19CEE42	Geographic Information System
3	U19CEE43	Building Services
4	U19CEE44	Renewable Energy Sources
5	<b>U19CEE45</b>	<b>Alternative Building Materials and Technologies</b>

<b>19CEE45</b>	<b>ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- To understand the alternative concepts of Buildings
- To study about elements of structural Masonry
- To study on Structural Masonry Mortars
- To learn about the alternative building technology
- To study the concepts of equipment's of modern construction materials and Planning control.

**Course Outcomes**

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

**CO1** - Know the concepts of alternative Buildings.(**K3**)

**CO2** - Understand the properties of elements of structural masonry. (**K3**)

**CO3** - Understand the properties structural masonry mortars. (**K3**)

**CO4** - Choose the alternative building technology. (**K3**)

**CO5** - Select the equipment's of modern construction materials and planning control(**K3**)

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

**UNIT I INTRODUCTION**

**(9 Hrs)**

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings-IGBC and LEED manuals-mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost-effective building technologies, Requirements for buildings of different climatic regions.

**UNIT II COMPONENTS OF STRUCTURAL MASONRY**

**(9 Hrs)**

Elements of Structural Masonry: Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fa- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

### UNIT III PROPERTIES OF STRUCTURAL MASONRY MORTARS

(9 Hrs)

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

### UNIT IV ALTERNATIVE BUILDING TECHNOLOGY

(9 Hrs)

Alternate Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique. Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

### UNIT V MODERN MATERIALS & PLANNING CONTROL

(9 Hrs)

Equipment for Production of Alternate Materials: Machines for manufacture of concrete, Equipments 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 pub.
2. Arnold W Hendry, Structural Masonry, Macmillan Publishers.
3. P. C Varghese, Building Materials, Prentice Hall of India ca-print-prentice\_hall,2015
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

#### Reference Books

1. S Christian Johnson, Concrete Technology, Dipti Press, 2017
2. G.C Sahu and Jayagopal Jena, Building Materials and Construction, McGrawhill Publication, 2015.
3. B C Punmia and Ashok kumar jain, Building Construction, Laxmi Publication, 2019

#### Web Reference

1. <https://nptel.ac.in/courses/105/102/105102195/>
2. <https://nptel.ac.in/courses/105/102/105102088/>
3. <https://nptel.ac.in/courses/105/106/105106053/>

#### 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	2	3	2	3	2	3	3	2	2
CO2	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO3	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO4	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO5	3	3	3	3	3	3	2	3	2	3	2	3	3	2	2

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

**Annexure - V**  
**PROFESSIONAL ELECTIVE COURSES**  
**OPEN ELECTIVE COURSES**

Sl. No	Course Code	Course Title	Offering Department	Permitted Departments
<b>Open Elective – I (Offered in Semester IV)</b>				
1	U19EEO41	Solar Photovoltaic Fundamentals and Applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics
2	U19EEO42	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE
3	U19ECO41	Engineering Computation with MATLAB	ECE	ICE, EEE, MECH, CIVIL, BME, Mechatronics
4	U19ECO42	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO41	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U19CSO42	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19CSO43	Programming in JAVA	CSE	ECE, MECH, Mechatronics
8	U19ITO41	Database System: Design & Development	IT	EEE, ECE, ICE, BME
9	U19ITO42	R programming	IT	EEE, ECE, ICE, BME, MECH, Mechatronics
10	U19ICO41	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL
11	U19ICO42	Control System Engineering	ICE	CSE, IT, MECH
12	U19MEO41	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME
13	U19MEO42	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
14	U19MEO43	Power Plants for Electrical Engineering	MECH	EEE
15	U19CEO41	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics
16	U19CEO42	Building Science and Engineering	CIVIL	EEE, MECH, BME
17	U19BMO41	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics
18	U19BMO42	Telemedicine	BME	EEE, ECE, CSE, IT, ICE
19	U19CCO41	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19CCO42	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics

	<b>SENSORS AND TRANSDUCERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19ICO41</b>	(Common to ECE, CSE, IT, MECH, CIVIL)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### 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. DoebelinE..O. "Measurement System Applications and Design", TMH, 5th Edition, 2004

### Reference Books

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

### Web References

1. [www.electrical4u.com](http://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 - VI

### EMPLOYABILITY ENHANCEMENT COURSES – (B).SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U19CES31	Skill Development Courses 1 : General Proficiency – I
2	U19CES32	Skill Development Courses 2 *
		1) MS Office – Word, Excel, Power Point
		2) Plane Table surveying
		3) Auto level survey
3	U19CES41	Skill Development Courses 3 : General Proficiency – II
4	U19CES42	Skill Development Courses 4 *
		1) Measurements and Conversion
		2) Air Quality Monitoring
		3) Experience with On-Site Construction Observation and Management
5	U19CES51	Skill Development Courses 5 : Foreign Language/ IELTS –I
6	U19CES52	Skill Development Courses 6 : Presentation Skills using ICT
7	U19CES61	Skill Development Courses 7 : Foreign Language/ IELTS – II
8	U19CES62	Skill Development Courses 8 : Technical Seminar
9	U19CES63	Skill Development Courses 9 : NPTEL/MOOC – I
10	U19CES81	Skill Development Courses 10 : NPTEL/MOOC-II

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

<b>U19CES42</b>	<b>SKILL DEVELOPMENT COURSES 4</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
	(Choose any one of the following course)	<b>0</b>	<b>0</b>	<b>2</b>	<b>-</b>	<b>30</b>

#### 1. 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.

## **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 - VII

### EMPLOYABILITY ENHANCEMENT COURSES –(A).CERTIFICATION COURSES

Sl. No	Course Code	Course Title
1	U19CECX1	3ds Max
2	U19CECX2	Advance Structural Analysis of Building using E-tabs
3	<b>U19CECX3</b>	<b>AutoCad for Civil</b>
4	U19CECX4	Bridge Analysis
5	U19CECX5	Internet of Things
6	U19CECX6	Project Management
7	U19CECX7	Python Programming
8	U19CECX8	STAAD Pro V8i
9	U19CECX9	Total Station

## Annexure - VIII



# SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)  
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution &  
Accredited by NAAC with "A" Grade)

Madagadipet, Puducherry - 605 107



## 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
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15.	Dr. Srinivasa Rao Naraganti	Structural Engineering	17	Associate Professor , J.B Institute of Engineering and Technology, Hyderabad	6281776979 srininarajbiet@gmail.com
16.	Mrs. J.P. Annie Sweetlin Jebarani	Structural Engineering	22	Associate Professor , Velammal College of Engineering and Technology, Viraganoor, Madurai	9443497176 jpas@vcet.ac.in
17.	Dr. P.T. Ravichandran	Geotechnical Engineering	27	Professor SRM Institute of Science and Technology, Chennai	9840798450 ptrsrm6@gmail.com
18.	Mr.V.Nageshwaren	Environmental Engineering	11	Assistant Professor , University College of engineering, Tindivanam	9486078639 nageshwaranv@gmail.com

19.	Dr. Mohan	Structural Engineering	35	Professor , Bharath Institute of Higher Education and Research, Chennai	9444642646 mohansjm@yahoo.com
20.	Dr. Zealakshmi	Structural Engineering	12	Professor and Head , Christ College of Engineering and Technology, Puducherry	8056375521 laxzea1978@gmail.com
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25.	Mr.R.Karthiravan	Environmental Engineering	15	Assistant Professor , Arunai College of Engineering, Tiruvannamalai	9994250111 Kathiravan_99@yahoo.com
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28.	Mr. J.Gopikrishna	Transport & Water Resources	6	Assistant Professor , Knowledge Institute of Technology, Salem	9965203643 gopikrishnag2@gmail.com
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30.	Mr.M.Shyamkumar	Structural	10	Assistant Professor, Layola Engineering	9940047244

		Engineering		college, Chennai	shyamcoumar@gmail.com
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38.	Dr G.Prabhakaran	Environmental Engineering	22	Professor , Siddharth institute of Engineering and Technology, Puttur, Andra Pradesh	9047088680 gprabhadhana@gmail.com
39.	Mr.T.D.Ramadasan	Transport & Water Resources	12	Assistant Professor , Adhiparasakthi engineering college, Melmaruvathur Tamil Nadu	9894652150 tdrdasan@gmail.com
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