SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

9th UG - Board of Studies Meeting in the department of
Civil Engineering

for the programme
B.Tech – Civil Engineering

Venue

Seminar Hall

Sri Manakula Vinayagar Engineering College

Madagadipet, Puducherry – 605 107

08.03.2024 at 10.30 am

Hybrid mode

AGENDA OF THE MEETING

Item No. 01 : BoS / UG / CIVIL 9 .1

Welcome Address by BoS Chairman.

Item No. 02 : BoS / UG / CIVIL 9 .2

Review and confirm of 8th BoS Minutes of Meeting.

Item No. 0 3 : BoS / UG / CIVIL 9 .3

To appraise on the curriculum structure of Regulation 2023 for I to VI Semesters.

Item No. 04 : BoS / UG / CIVIL 9 .4

To discuss and approve the R2023 curriculum and syllabi for VII & VIII Semester under Regulation 2023 for B.Tech. Civil Engineering.

Item No. 05 : BoS / UG / CIVIL 9 .5

To appraise and approve the following chosen Elective Courses,

i) Professional Elective courses for VI & VIII Semester under Regulation 2020 for the batches 2022 – 2026 and 2021-2025

ii) Professional Elective courses for IV Semester under Regulation 2023 for the batch 2023 – 2027.

iii) Open Elective courses for VI & VIII Semester under Regulation 2020 for the batches 2022 – 2026 and 2021-2025.

Item No. 06 : BoS / UG / CIVIL 9 .6

To appraise and approve on the following chosen Ability Enhancement Courses, Employability Enhancement Courses and Mandatory courses

i) Ability Enhancement Courses - Certification courses – II & IV for semester II & IV under regulation 2023 for the Batch 2024 – 2028 and 2023-2027 and for Skill Enhancement courses for IV semester under Regulation 2023 for the batch 2023 - 2027.

ii) Employability Enhancement Courses – Certificate course – VI and Skill Development Courses – 6, 7,8 and 9 under regulation 2020 for batches 2022-2026 and 2021-2025.

iii) Mandatory Courses for semester II & IV under regulation 2023 for batches 2024-2028 and 2023-2027 and for Semester VI under regulation 2020 for batch 2022-2026.

Item No.07: BoS / UG/ CIVIL 9.7

To Approve the modifications in the curriculum & syllabus and evaluation pattern of Honours/Minors degree programme offered under Regulation 2023.

Item No. 08: BoS / UG / CIVIL 9 .8

Any other item with the permission of chair.

Dr.S.Sundararaman

Chairman – BoS

MINUTES OF THE MEETING

Dr. S.Sundararaman, Chairperson, BoS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for valuable presence in this 9th Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairperson.

Item No. 1: BoS / UG / CIVIL 9 .1

The Chairperson declared the meeting open and welcomed all the members. He highlighted on the group of colleges in SMVE Trust with the names of Management Representatives & Director cum Principal. The Vision and Mission Statement of the Institution and the Department was also apprised to all the members present in the meeting.

Item No. 2 : BoS / UG / CIVIL 9 .2

Chairperson BoS, apprised the minutes of 8th BoS, its implementation and then it is confirmed with the approval for the incorporation of minor revisions needed as mentioned below.

S.No	Suggestions	Action Taken
1	Suggestion given that for the course Design of Steel Structures, Unit - I can be split into 2 units namely bolted and welded connections, Unit- III can have the tension members and the IV and V unit can be with compression members and design of beams respectively	As per suggestion given by the expert members, syllabus for the course Design of Steel Structures in Sixth Semester under Regulation 2023 has been revised.
2	In the panel of Examiner list the criteria for selection of examiners can alone be presented instead of the specialization and college/ University Name.	➢ Selection of examiners were based on Academic qualifications and experience ➢ Colleges were chosen based on NIRF Ranked Affiliated colleges, Universities and other reputed institutions.
3	It is also suggested by industrial expert to Incorporate Building Services Engineering as one of the core paper or elective paper which will be of more important for students getting jobs in future.	As per suggestion given by the expert members, Building Services Engineering is in Professional Elective – I basket.

(The details of suggestion and action taken of the meetings is attached in Annexure I)

Item No.3: BoS / UG / CIVIL 9 .3

Chairperson BoS,apprised on the Curriculum structure of Regulation 2023 for I to VI Semesters.

(The details of R23, Curriculum I to VI Semesters is attached in Annexure II).

Item No. 4: BoS / UG / CIVIL 9 .4

Discussed and approved the, Curriculum and Syllabi for VII & VIII Semester under Regulation 2023 for B.Tech. Civil Engineering.

(The details related to Curriculum and Syllabus for VII & VIII Semesters of Regulation 2023 is attached in Annexure III).

Item No. 5: BoS / UG / CIVIL 9 .5

The board Chairperson apprised the following chosen Elective Courses and the same were approved by the BoS Members.

I. Professional Elective courses for VI & VIII Semester under Regulation 2020 for the batches 2022 – 2026 and 2021-2025
II. Professional Elective courses for IV Semester under Regulation 2023 for the batch 2023 – 2027.
III. Open Elective courses for VI Semester under Regulation 2020 for the batch 2022 – 2026.

S.No	Regulation	Sem	Batch	Category	Course code	Course Name
1	2020	VI	2022-2026	Professional Elective	U20CEE614	Municipal Solid Waste Management
2	2020	VIII	2021 - 2025	Professional Elective	U20CEE825	Prefabricated Structures
3	2020	VIII	2021 - 2025	Professional Elective	U20CEE828	Repair and Rehabilitation of Structures
4	2023	IV	2023 - 2027	Professional Elective	U23CEE405	Alternative Building Materials and Technologies
5	2020	VI	2022-2026	Open Elective	U20EEO503	Conventional and Non-Conventional Energy sources

(The list of professional & open elective courses and syllabi for the chosen course has been attached in Annexure IV).

Item No. 6: BoS / UG / CIVIL 9 .6

Discussed and approved the following Chosen Ability Enhancement Courses, Employability Enhancement Courses and Mandatory courses

i) Ability Enhancement Courses - Certification courses – II & IV for semester II & IV under regulation 2023 for the Batch 2024 – 2028 and 2023-2027 and for Skill Enhancement courses for IV semester under Regulation 2023 for the batch 2023 - 2027.

ii) Employability Enhancement Courses – Certificate course – VI and Skill Development Courses – 6, 7,8 and 9 under regulation 2020 for batches 2022-2026 and 2021-2025.

iii) Mandatory Courses for semester II & IV under regulation 2023 for batches 2024-2028 and 2023-2027 and for Semester VI under regulation 2020 for batch 2022-2026.

S.No	Regulation	Sem	Batch	Category	Course code	Course Name
1	2023	IV	2023 - 2027	Ability Enhancement Course	U23CES402	1) MS Office – Word, Excel, Power Point
2	2020	VI	2022 - 2026	Skill Development Course	U20CES606	Skill Development Course 6: Foreign Language/ IELTS - II
3	2020	VI	2022 - 2026	Skill Development Course	U20CES607	Skill Development Course 7: Technical Seminar
4	2020	VI	2022 - 2026	Skill Development Course	U20CES608	Skill Development Course 8: NPTEL / MOOC – I
5	2020	VI	2022 - 2026	Skill Development Course	U20CES809	Skill Development Course 9: NPTEL / MOOC - II
6	2023	II	2023-2027	Chosen Mandatory Courses	U23CEM202	Sports Yoga and NSS
7	2023	IV	2023-2027	Chosen Mandatory Courses	U23CEM404	Right to Information and Good Governance
8	2020	VI	2022-2026	Chosen Mandatory Courses	U20CEM606	Essence of Indian Traditional Knowledge

Discussed and approved the B.Tech. degree NPTEL / MOOC & online certification courses of Batches 2023 – 2027 and 2022-2026.

(The list of Skill Development Courses and syllabi for the chosen course, list of Certification Course and List of NPTEL / MOOC has been attached in Annexure V)

Item No. 7: BoS / UG / CIVIL 9.7
Discussed and approved the Modifications in the Curriculum and Syllabus and evaluation pattern for Honours/ Minors Degree Programme Offered Under Regulation 2023. **(The details of R23, Curriculum and Syllabus of Honours/ Minors Degree Programme is attached in Annexure VI).**
Item No. 8: BoS / UG / CIVIL 9 . 8
• Members suggested that In the VII Semester, for the course "Construction Technology and Management" the units can be rearranged to have better continuity. • It is also Suggested that In the VII Semester for the course "Hydraulic and Water Resource Engineering" the topics such as sources of water and integrated water supply can be included in Unit -I. The unit – IV can be renamed as Catchment Characteristic & Runoff. • Members Suggested that in the professional Elective - IV one of the course namely "Structural Health and Monitoring" the 1st unit can have introduction topics on Non-Destructive Evaluations rather than Structural Modelling and Finite Element Model. • It is also suggested that for Professional Elective -IV in the course "Quality Control and Assurance" the syllabus need to have aspects related to construction rather than a general syllabus of quality control and assurance. • For the professional elective course IV offered in VII Semester namely "Tunneling Engineering" the Unit - III need to be shifted to Unit -V. • For professional elective courses in Regulation 2023., the prerequisite need to be mentioned as "Knowledge gained in the Course" rather than mentioning only the course name. • The IS Code Books mentioned in the syllabus need to carry the latest year of their reprints. The version of the software needs to be mentioned in all the Software related Civil Engineering laboratories.

The Meeting was concluded with vote of thanks by Dr.S.Sundararaman, Head of the Department, Department of Civil Engineering.

Dr. S.Sundararaman
Chairperson - BoS

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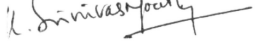
DEPARTMENT OF CIVIL ENGINEERING

9th BOARD OF STUDIES MEETING

EXPERT MEMBERS

BoS Meeting Date:08.03.2025 **Time:** 10.30 AM **Venue:** Seminar Hall

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, SMVEC	Chairman	
External Members			
2	Dr.K.Baskar Professor, National Institute of Technology, Tiruchirappalli Specialization: Structural Engineering e-mail: drkbaskar@yahoo.co.in Cell:9790180736	Subject Expert (Pondicherry University Nominee)	 Attended online
3	Dr. P. T. Ravichandran Professor & Head, Department of Civil Engineering, Faculty of Engineering and Technology, SRM Institute of Science and Technology, Kattankulathur Specialization: Geotechnical Engineering E-mail: ravichap@srmist.edu.in Cell: 9840798450	Subject Expert (Academic Council Nominee)	
4	Dr. A. Latha Professor Department of Civil Engineering Velammal College of Engineering and Technology. Madurai. Specialization: Environmental Engineering E-mail: lathaganesan.a@gmail.com Cell: 9962602435	Subject Expert (Academic Council Nominee)	
5	Dr. K. Srinivasamoorthy, Professor, Department of Earth Science, Pondicherry University, Puducherry – 605014 Email: moorthy.esc@pondiuni.edu.in Phone Number: 9443824903	Member	

Sl.No	Name of the Member with Designation and official Address	Members as per UGC Norms	Signature
6	Dr. S. Virapan Chairman & Managing Director Sanvir Associates Chennai Email: virapans@gmail.com Cell: 9444036627	Industry Representative	
7	Er. K.Surya, (Alumni) Er. Surya Civil Engineering & Contractor Email: ksuryapondy@gmail.com Cell: 73972 44333	Alumni	
Internal Members			
1	Dr.S.Jayakumar	Member	
2	Mrs.A.Kalyani	Member	
3	Mr.K.Srinivasan	Member	
4	Mr.J.Subash Chandra Boss	Member	
5	Mr.C.Raj Govind	Member	
6	Mrs.D.Sathiyasree	Member	
7	Mr.G.Senthil Raj	Member	
8	Mr.R.Badhrinadhan	Member	
9	Mr.S.Tiroumalai	Member	
10	Mr.V.Murugappan	Member	
11	Mrs.J.Jayapriya	Member	
12	Mr.MCK. Jamenraja	Member	
13	Mr.C. Karthikeyan	Member	
14	Mr.S. Sasidharan	Member	
15	Mrs.P.Saranya	Member	
Co-opted Members			
1	Mr. K. Raja	Member	
2	Dr.K.Kathikeyan	Member	
3	Dr.S.Jaichitra	Member	
4	Dr. K. Samuel	Member	

ANNEXURE I

Department	**Civil Engineering**			Programme: **B.Tech.**				
Semester	**VI**			Course Category Code: **PC**		End Semester Exam Type: **TE**		
Course Code	**U23CET610**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Design of Steel Structures**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Nil							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 o T understand the design philosophy in simple practical design and behavior of steel structural Joints using bolts.	**K3**
	CO2 Able to understand the design philosophy in simple practical design and behavior of steel structural Joints using welds.	**K3**
	CO3 Able to understand the behavior of tensile member and able to design of compound sections.	**K3**
	CO4 Able to understand the behavior of compression member and able to design with laced and battened columns.	**K3**
	CO5 Able to know the knowledge of beams and purlins and able to design flexural member.	**K3**

UNIT – I	**STEEL STRUCTURAL JOINTS- BOLTED CONNECTIONS**	**Periods:09**	
Introduction to Design philosophies by limit state and working stress method. Properties of steel - Structural steel sections - Types of connections, terminologies, failures in bolted joints, Design of Joints – lap joint, single cover butt joint and double cover butt joint using bolts under axial loading - Efficiency of joints.			**CO1**
UNIT – II	**STEEL STRUCTURAL JOINTS- WELDED CONNECTIONS**	**Periods:09**	
Introduction – Advantages and Disadvantages - Types of welds: Fillet welds, groove welds, plug and slot welds - Welding symbols as per IS 813 - Welding Processes and Joint Configurations - Strength of welds - Throat thickness - effective length, - Design of fillet welds and butt welds as per IS 800 – Modes of Failures.			**CO2**
UNIT – III	**DESIGN OF TENSION MEMBERS**	**Periods:09**	
Types of sections - Design of tension members – single and compound sections – concept of shear lag - tension splices – design of lug angles.			**CO3**
UNIT – IV	**DESIGN OF COMPRESSION MEMBERS**	**Periods:09**	
Theory of columns – Modes of failures, Design of axially and eccentrically loaded members, Built-up columns, Design of Lacings and Battens, Design of Column Base.			**CO4**
UNIT – V	**DESIGN OF BEAMS AND PURLINS**	**Periods:09**	
Modes of failures- Design of Laterally supported and unsupported beams -Design of built up beam- Design of purlins - Types of roof trusses for different spans- Estimation of dead, live and wind loads.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Subramanian, P., “Design of steel structures”, Oxford Publishers, New Delhi, 2007
2. Shiyekar, M.R., “Limit State Design in Structural Steel”, Second Edition, PHI Learning Private Ltd., Delhi, 2013. .
3. Bhavikatti, S.S., “Design of Steel Structures”, IK International Publishing House Pvt Ltd, New Delhi, 2014.

Reference Books

1. Shah, V.L., and Veena Gore, “Limit state design of Steel Structures”, Structures Publications, Pune, 2012.
2. Sai Ram K.S., “Design of Steel Structures”, Pearson Education Ltd., 2013.
3. VirendraGehlot, Ram Chandra, “Design of steel structures”, Vol.I& II, Standard Publishers, 2012.
4. IS: 800- 2007, “General Construction in Steel-Code of Practice”, Bureau of Indian Standards, New Delhi

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	PSO1	PSO2	PSO3
1	2	3	3	1	1	-	-	-	3	1	3	3	3	3
2	3	3	3	2	1	-	-	-	3	1	3	3	3	3
3	3	3	3	2	1	-	-	-	3	-	-	3	3	3
4	3	3	3	2	1	-	-	-	3	-	-	3	3	3
5	3	3	3	2	1	-	-	-	3	-	-	3	3	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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Puducherry

B.TECH.

CIVIL ENGINEERING

ACADEMIC REGULATIONS 2023
(R - 2023)

CURRICULUM

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

Mission

MI: Quality Education

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation

To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

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.

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.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:**

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning:

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Fundamental Knowledge

To gain a thorough fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities for a civil engineering career.

PEO2: Knowledge and Skills

To establish the knowledge and skills necessary for identifying and assessing design alternatives and the related social, economic, environmental, and public safety impacts.

PEO 3: Societal Implications

To develop the ability to deal effectively with ethical and professional issues, taking into account the broader societal implications of civil engineering

PEO 4: Competent Professionals

To create competent professionals who are trained in the design and development of Civil Engineering systems to engulf research and development activities

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Practical Knowledge

Inculcating practical knowledge in planning, analysis, design and construction management without much exploiting natural resources.

PSO 2: Critical Thinking

Imparting effective communicational skills, leadership attributes towards the team work and developing critical thinking abilities to find solutions for civil engineering problems of multi-disciplinary nature.

PSO 3: Challenging Employment

Ability to take up any challenging employment, entrepreneurship, research and development for sustainable civil society as a civil engineering graduate.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences including Management courses (HS)	15
2	Basic Science Courses (BS)	20
3	Engineering Science including workshop, drawing, basics of electrical / mechanical / computer etc. (ES)	28
4	Professional Core Courses (PC)	66
5	Professional Electives Courses (PE)	18
6	Open Electives Courses (OE)	9
7	Project Work and Internship (PA)	13
8	Ability Enhancement Courses (AEC*)	0
9	Mandatory Courses (MC*)	0
Total		**169**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	AICTE Suggested Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science (HS)	3	5	1	1	2	-	-	3	15
2	Basic Sciences(BS)	7	4	5	4	-	-	-	-	20
3	Engineering Sciences (ES)	11	5	4	4	4	-	-	-	28
4	Professional Core (PC)	1	7	13	10	8	15	12	-	66
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6	Open Electives (OE)	-	-	-	-	3	3	3	-	9
7	Project Work (PA)	-	-	-	-	1	1	2	8	12
8	Internship (PA)	-	-	-	-	-	-	1	-	1
9	Ability Enhancement Courses (AEC*)	-	-	-	-	-	-	-	-	0
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	0
Total		22	21	23	22	21	22	21	17	169

**** AEC and MC are not included for CGPA calculation***

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics - I	BS	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23ESTC01	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
4	U23ESTC02	Engineering Mechanics	ES	2	1	0	3	25	75	100
5	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English I	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC01	Basics of Electrical and Electronics Engineering Laboratory	ES	0	0	2	1	50	50	100
8	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
9	U23CEP101	Civil Engineering Practice Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23CEC1XX	Certification Course – I**	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23CEM101	Induction Programme	MC	2 Weeks			-	-	-	-
							22	425	575	1000

***** Certification courses are to be selected from the list given in Annexure III***

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SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics - II	BS	3	1	0	4	25	75	100
2	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
3	U23CET201	Mechanics of Solids - I	PC	3	0	0	3	25	75	100
4	U23CET202	Building Materials and Construction	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values - II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English II	HS	2	0	2	3	50	50	100
Practical										
7	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
8	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
9	U23CEP202	Strength of Materials Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23CEC2XX	Certification Course – II**	AEC	0	0	4	0	100	-	100
Mandatory Course										
11	U23CEM202	Sports Yoga and NSS	MC	0	0	2	0	100	-	100
							21	525	575	1100

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SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
3	U23CET303	Fluid Mechanics and Machinery	PC	3	0	0	3	25	75	100
4	U23CET304	Construction Technique, Equipment and Practices	PC	3	0	0	3	25	75	100
5	U23CET305	Mechanics of Solids-II	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23CEB301	Surveying and Geomatics	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	General Proficiency I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
10	U23CEP303	Fluid Mechanics and Machines Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CEC3XX	Certification Course – III**	AEC	0	0	4	0	100	-	100
12	U23CES301	Skill Enhancement Course - I*	SEC	0	0	2	0	100	-	100
Mandatory Course										
13	U23CEM303	Climate Change	MC	2	0	0	0	100	-	100
							23	675	625	1300

**** Skill Development Courses are to be selected from the list given in Annexure IV***

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SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC04	Numerical Methods and Optimization	BS	3	1	0	4	25	75	100
2	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
3	U23CET406	Soil Mechanics	PC	2	1	0	3	25	75	100
4	U23CET407	Design of RC Elements	PC	2	1	0	3	25	75	100
5	U23CEE4XX	Professional Elective - I#	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23CEB402	Concrete Technology	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency II	HS	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23CEP404	Geotechnical Engineering Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23CEC4XX	Certification Course – IV**	AEC	0	0	4	0	100	-	100
11	U23CES402	Skill Enhancement Course - II*	SEC	0	0	2	0	100	-	100
Mandatory Course										
12	U23CEM404	Right to Information and Good Governance	MC	2	0	0	0	100	-	100
							22	625	575	1200

 # Professional Electives are to be selected from the list given in Annexure I

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SEMESTER – V										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23ITTC02	Programming in Java	ES	3	0	0	3	25	75	100
3	U23CET508	Foundation Engineering	PC	3	0	0	3	25	75	100
4	U23CET509	Water supply and Wastewater Engineering	PC	3	0	0	3	25	75	100
5	U23CEE5XX	Professional Elective - II#	PE	3	0	0	3	25	75	100
6	U23XXO5XX	Open Elective – I$	OE	3	0	0	3	25	75	100
Practical										
7	U23ITPC02	Programming In Java Laboratory	ES	0	0	2	1	50	50	100
8	U23CEP505	Water and Wastewater Engineering Laboratory	PC	0	0	2	1	50	50	100
9	U23CEP506	REVIT Architecture Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23CEW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23CEC5XX	Certification Course – V**	AEC	0	0	4	0	100	-	100
Mandatory Course										
12	U23CEM505	Essence of Indian Traditional Knowledge	MC	2	0	0	0	100	-	100
							21	600	600	1200

$Open electives are to be selected from the list given in Annexure II

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SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23CET610	Design of Steel Structures	PC	3	0	0	3	25	75	100
2	U23CET611	Structural Analysis	PC	3	0	0	3	25	75	100
3	U23CET612	Transportation Engineering	PC	3	0	0	3	25	75	100
4	U23CEE6XX	Professional Elective - III#	PE	3	0	0	3	25	75	100
5	U23XXO6XX	Open Elective – II$	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23CEB603	Instrumentation and sensor Technologies for Civil Engineering Application	PC	2	0	2	3	50	50	100
Practical										
7	U23CEP607	STAAD PRO V8i Laboratory	PC	0	0	2	1	50	50	100
8	U23CEP608	Transportation Engineering Laboratory	PC	0	0	2	1	50	50	100
9	U23CEP609	Survey Camp	PC	0	0	0	1	50	50	100
Project Work										
10	U23CEW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23CEC6XX	Certification Course – VI**	AEC	0	0	4	0	100	-	100
Mandatory Course										
12	U23CEM606	Gender Equality	MC	2	0	0	0	100	-	100
							22	625	575	1200

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PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23CEE401	Composite Structures
2	U23CEE402	Environmental Law and Policy
3	U23CEE403	Building Services
4	U23CEE404	Remote Sensing and GIS
5	U23CEE405	Alternative Building Materials and Technologies
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23CEE506	Advanced Design of RCC Structures
2	U23CEE507	Air and Noise Pollution
3	U23CEE508	Sustainable and Lean Construction
4	U23CEE509	Airport and Harbor Engineering
5	U23CEE510	Green Building Technology
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23CEE611	Advanced Structural Analysis
2	U23CEE612	Pollution Control and Monitoring
3	U23CEE613	Buildings Codes and Requirement
4	U23CEE614	Traffic engineering and Management
5	U23CEE615	Urban Planning and Development

Annexure – II

OPEN ELECTIVE COURSES OFFERED BY CIVIL ENGINEERING

S. No	Course Code	Course Title
Open Elective – I		
1	U23CEOC01	Energy and Environment
2	U23CEOC02	Energy Efficient Buildings
Open Elective – II		
1	U23CEOC03	Disaster Management
2	U23CEOC04	Air Pollution and Solid Waste Management

Annexure -III

ABILITY ENHANCEMENT COURSES – CERTIFICATION COURSES

Semester	Course Code	R-2023 Course Title
I	U23CEC107	Autodesk AutoCAD - ACU
II	U23CEC248	Sketch Up
III	U23CEC360	Total Station
IV	U23CEC430	Fundamentals of Internet of Things
V	U23CEC511	Autodesk 3ds Max -ACU
VI	U23CEC656	MX Road

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Annexure - IV

Skill Enhancement Courses

Sl. No	Course Code	Course Title
1	U23CES301	**Skill Enhancement Course - I**
		1) Basic Vasthu
		2) Plane Table Surveying
		3) Auto level surveying
2	U23CES402	**Skill Enhancement Course - II**
		1) MS Office – Word, Excel, Power Point
		2) Measurements and Conversion
		3) Traditional construction in modern age

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NPTEL COURSE LIST

Sl.No.	List of Subjects
1	Geosynthetics and Reinforced Soil Structures
2	Principles of Construction Management
3	Introductory Field Structural Geology
4	Geotechnical Earthquake Engineering
5	Finite Element Method and Computational Structural Dynamics
6	Underground Space Technology
7	Environmental Chemistry
8	Sustainable Transportation Systems
9	Environmental Modeling and Simulation
10	Pavement Materials (Under Pavement Engineering)
11	Advanced Geomatics Engineering
12	Geometric Design of Highways
13	Plate Tectonics
14	Introduction to Engineering Seismology
15	Remote Sensing: Principles and Applications
16	Geotechnical Engineering - II
17	Environmental Geomechanics
18	Advanced Concrete Technology
19	Geotechnical Engineering Laboratory
20	Dynamics of Structures
21	Mechanics of Solids
22	Structural Geology
23	Reliability-Based Structural Design
24	River Engineering
25	Optimization Methods for Civil Engineering
26	Subsurface Exploration: Importance And Techniques Involved
27	Remote Sensing and GIS
28	Municipal Solid Waste Management
29	Fluid Mechanics
30	Bridge Engineering
31	Introduction to Multimodal Urban Transportation Systems (MUTS)
32	Rock Mechanics and Tunneling
33	Ground Improvement
34	Wastewater Treatment and Recycling
35	Sustainable Engineering Concepts and Life Cycle Analysis
36	Global Navigation Satellite Systems and Applications
37	Soil Mechanics/Geotechnical Engineering I
38	Railway Engineering
39	Geo Engineering
40	Earth Sciences for Civil Engineering Part - I & II
41	Foundation Engineering
42	Design Of Steel Structures

MOOC COURSE LIST

Sl.No.	List of Subjects
1	Construction Project Management
2	Python fundamentals for beginners
3	Risk and safety in civil engineering
4	Energy literacy training
5	Architecture urban design
6	Autodesk certified professional: AutoCAD for Design and Drafting exam prep
7	Transportation, Sustainable Buildings, Green Construction
8	AI for everyone: Master the basics
9	Python Basics for Data Science
10	Introduction to Engineering Mechanics
11	Construction Project Management
12	Python fundamentals for beginners
13	Risk and safety in civil engineering
14	Energy literacy training
15	Architecture urban design
16	Autodesk certified professional: AutoCAD for Design and Drafting exam prep
17	Transportation, Sustainable Buildings, Green Construction
18	AI for everyone: Master the basics
19	Python Basics for Data Science
20	Introduction to Engineering Mechanics

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ANNEXURE III

Department	**Civil Engineering**				Programme : **B.Tech.**				
Semester	**VII**				Course Category Code: **PC**			End Semester Exam Type: **TE**	
Course Code	**U23CET713**				Periods/Week			Credit	Maximum Marks
					L	T	P	C	CAM	ESE	TM
Course Name	**Construction Technology and Management**				**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	**Construction Techniques Equipment and Practice**										
Course Outcomes	**On completion of the course, the students will be able to**										**BT Mapping (Highest Level)**
	CO1	Select and Operate Construction Equipment									**K2**
	CO2	Utilize Concreting and Material Processing Equipment									**K2**
	CO3	Apply Construction Methods and Safety Engineering									**K2**
	CO4	Understand Construction Project Management									**K2**
	CO5	Analyze Cost and Resource Optimization									**K2**

UNIT – I	**CONSTRUCTION EQUIPMENT**	**Periods: 09**	
Compaction equipment – types of compaction rollers - Hoisting and earthwork equipment – hoists, cranes, tractors, bulldozers - Graders, scrapers, draglines, and clamshell buckets - Selection, operation, and maintenance of equipment			**CO1**
UNIT – II	**CONCRETING AND MATERIAL PROCESSING EQUIPMENT**	**Periods: 09**	
Crushing equipment – jaw crushers, gyratory crushers, impact crushers - Selection and operation of crushing equipment - Screening of aggregates - Concrete mixers – types, mixing, and placing methods - Consolidation and finishing of concrete			**CO2**
UNIT – III	**CONSTRUCTION METHODS AND SAFETY ENGINEERING**	**Periods: 09**	
Earthwork and excavation methods - Piling and foundation techniques - Formwork, fabrication, and erection techniques - Quality control in construction projects - Safety engineering and risk management in construction.			**CO3**
UNIT – IV	**CONSTRUCTION PROJECT MANAGEMENT**	**Periods: 09**	
Introduction to construction project management and its relevance - Qualities of a project manager - Project planning, coordination, scheduling, and monitoring - Bar charts and milestone charts - Critical Path Method (CPM) - Project Evaluation and Review Technique (PERT)			**CO4**
UNIT – V	**COST AND RESOURCE MANAGEMENT**	**Periods: 09**	
Project cost analysis and updating - Crashing for optimum cost and optimum resources - Resource allocation techniques - Construction equipment – economic considerations - Earthwork equipment – types and selection criteria - Trucks and handling equipment – rear dump trucks, capacities, and production calculation			**CO5**

Text Books

1. ‘Construction Planning, Equipment and Methods’ by Peurifoy and Schexnayder, Shapira, Tata Mcgrawhill.
2. ‘Construction Project Management Theory and Practice’by Kumar Neeraj Jha (2011), Pearson.
3. ‘Construction Technology’ by Subir K. Sarkar and Subhajit Saraswati, Oxford University press.

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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Department	**Civil Engineering**			Programme : **B.Tech.**					
Semester	**VII**			Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23CET714**			Periods/Week			Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Hydrology and Water Resource Engineering**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Water supply and Waste water Engineering									
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)	
	CO1	Understand the hydrologic cycle, precipitation measurement, and infiltration processes for water resource estimation.							**K2**	
	CO2	Analyze runoff, streamflow, hydrographs, and flood routing methods for effective flood management.							**K3**	
	CO3	Apply principles of groundwater hydrology, including aquifer properties, well hydraulics, and groundwater recharge techniques.							**K2**	
	CO4	Design irrigation systems, reservoirs, and canals using principles of water resource engineering for efficient water management.							**K3**	
	CO5	Evaluate hydraulic structures, sediment transport, river training works, and watershed management techniques for sustainable water conservation.							**K3**	

UNIT- I	**Hydrology and Precipitation**	**Periods: 09**
Hydrologic cycle, types and measurement of precipitation, gauge networks, average depth of precipitation over the basin, mass rainfall curves, intensity duration curves - hyetographs, IDF curves, estimates of missing data and adjustment of records, evaporation, transpiration – and infiltration processes with estimation methods.		**CO1**
UNIT II	**Runoff and Streamflow**	**Periods: 09**
Factors affecting runoff, Hydrograph analysis – Unit hydrograph theory and analysis, Space distribution and variability of runoff, stream flow measurement - selection of site, velocity and discharge measurements – base flow separation methods. flood routing (Muskingum method), and reservoir routing.		**CO2**
UNIT III	**Groundwater Hydrology**	**Periods: 09**
Occurrence and movement of ground water - Permeability and Transmissibility - Darcy's Law – Ground water yield - Aquifers and their types - Infiltration wells and Infiltration galleries - Measurement of yield - Recuperation test - Pumping test – Steady flow analysis only - Artificial recharge – Methods.		**CO3**
UNIT IV	**Water Resource Engineering & Irrigation**	**Periods: 09**
Water demand and planning – Irrigation and its necessity – Irrigation methods: surface, subsurface, sprinkler, and drip – Crop water requirement: duty, delta, base period – Canal design using Kennedy's and Lacey's theories – Reservoirs and storage structures – Types and functions of dams – Seepage analysis, failure modes, and control measures.		**CO4**
UNIT V	**Hydraulic Structures & Water Conservation**	**Periods: 09**
Design and components of hydraulic structures – Spillways (types and functions), Energy dissipators and stilling basins, Weirs and barrages – Design criteria and functions, Cross drainage works – Aqueducts, Syphon aqueducts, Canal escapes. Water conservation techniques – Rainwater harvesting, check dams, percolation tanks, contour bunding, and watershed management. Role of traditional and modern water conservation structures in sustainable water resource development.		**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Hydrology and Water Resources Engineerin by S.K. Garg, published in 2011 by Khanna Publishers.
2. Engineering Hydrolog by K. Subramanya, 4th Edition, published in 2013 by Tata McGraw-Hill Education.
3. Applied Hydrology by Ven Te Chow, David R. Maidment, and Larry W. Mays, published in 1988 by McGraw-Hill.

Reference Books

1. Hydrology in Practice by Elizabeth M. Shaw, 4th Edition, published in 2010 by CRC Press
2. Engineering Hydrology: An Introduction to Processes, Analysis, and Modeling by E.M. Wilson, 1st Edition, published in

2016 by McGraw-Hill Education.
3. Hydrology and Water Resource Systems Analysis by Maria A. Mimikou, Evangelos A. Baltas, Vassilios A. Tsihrintzis, and Haris Nakos, 1st Edition, published in 2016 by CRC Press.
4. Introduction to Water Engineering, Hydrology, and Irrigation" by Mohammad Albaji, 1st Edition, published in 2022 by CRC Press.
5. Water Resources Engineering by Ray K. Linsley, Joseph B. Franzini, David L. Freyberg, and George Tchobanoglous, 4th Edition, published in 1992 by McGraw-Hill.

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1. https://www.youtube.com/watch?v=iohKd5FWZ74
2. https://www.youtube.com/watch?v=0TjTz-HsPjs
3. https://www.youtube.com/watch?v=0uJpsuRbfUo

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
1	2	2	1	3	2	-	-	-	-	-	-	1	3	1	2
2	2	3	1	2	2	-	-	-	-	-	-	1	3	1	-
3	3	3	3	2	2	-	-	-	-	-	-	1	2	3	-
4	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
5	3	3	2	2	3	-	-	-	-	-	-	1	1	2	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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Department	**Civil Engineering**			Programme: **B.Tech.**				
Semester	**VII**			Course Category Code: **PC**		End Semester Exam Type: **TE**		
Course Code	**U23CET715**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Prefabricated Structures**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Construction Technology and Management							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Gain knowledge of maintenance and various assessment techniques	**K2**
	CO2	Understand the methods of non-destructive testing systems	**K2**
	CO3	Understand the types and properties of repair material	**K2**
	CO4	Understand the corrosion and damaged structures	**K2**
	CO5	Gain knowledge of strengthening of structures	**K3**

UNIT- I	**INTRODUCTION**	**Periods: 09**
Need for prefabrication – Principles – Materials – Modular coordination – Standarization – Systems –Production – Transportation – Erection.		**CO1**
UNIT II	**PREFABRICATED COMPONENTS**	**Periods: 09**
Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls		**CO2**
UNIT III	**DESIGN PRINCIPLES**	**Periods: 09**
Disuniting of structures – Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.		**CO3**
UNIT IV	**JOINT IN STRUCTURAL MEMBERS**	**Periods: 09**
Joints for different structural connections – Dimensions and detailing – Design of expansion joints		**CO4**
UNIT V	**DESIGN FOR ABNORMAL LOADS**	
Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

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

Reference Books

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

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

COs/POs/PSOs Mapping

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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Department	**Civil Engineering**	Programme : **B.Tech.**					
Semester	**VII**	Course Category Code: **PC**			End Semester Exam Type: **LE**		
Course Code	**U23CEP710**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Simulation Software Laboratory (Ansys)**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 MATLAB to solve simple problems in vibration	**K4**
	CO2 Analyze the structural components using software	**K5**
	CO3 Analysis using link elements in Trusses, cables	**K5**
	CO4 Vibration analysis of spring-mass systems	**K3**
	CO5 Model analysis of beams	**K3**

LIST OF EXPERIMENTS

A. Simulation

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

B. Analysis

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

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Web References

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

COs/POs/PSOs Mapping

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

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

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Madagadipet, Puducherry, India

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23CEP711**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Estimation Costing and Valuation Engineering**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Water supply and Waste water Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Measure and estimate various elements in Civil Engineering works **(K2)**	**K2**
	CO2 Prepare Detailed Estimate for a given building **(K3)**	**K3**
	CO3 Rate analysis for different types of works **(K2)**	**K2**
	CO4 Estimate the material quantities, prepare a bill of quantities and tender documents of project **(K2)**	**K2**
	CO5 Prepare value estimates and report for a residential building. **(K3)**	**K3**

LIST OF EXPERIMENTS

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

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

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

Govt of Tamil Nadu PWD – “Standard Schedule of Rates”, 2017-18

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

COs/POs/PSOs Mapping

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

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

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Department	Civil Engineering			Programme: **B.Tech.**				
Semester	VII			Course Category Code: **PC**		End Semester Exam Type: **LE**		
Course Code	U23CEP712	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Modeling and Analysis Laboratory**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Water supply and Waste water Engineering							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Demonstrate the basic features of an analysis package	**K3**
CO2	Analyze the structure using E-TABS software	**K3**
CO3	Design the structure using E-TABS software	**K3**
CO4	Performing analysis and interpretation of results for final design	**K3**
CO5	Students would have gained knowledge on the usage of the software	**K3**

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 at both ends
6. Analysis and Design of Plane Frames
7. Modeling Analysis and Design of G+1 Story building
8. Modeling and Analysis of G+5 Story building
9. Analysis and Design of 2D Reinforced Concrete Frame
10. Seismic Analysis and Design of 10 Story RC building

Software Required

ETABS

Lecture Periods: 30	Tutorial Periods: -	Practical Periods: -	**Total Periods: 30**

Reference Books

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

Govt of Tamil Nadu PWD – “Standard Schedule of Rates”, 2017-18

Web References

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

COs/POs/PSOs Mapping

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

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

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Department	**Civil Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23CEW703**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Phase II**	**0**	**0**	**4**	**2**	**50**	**50**	**100**

Prerequisite		
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the problem statement for the project work through the literature survey	**K2**
	CO2 Choose the proper Methodology as per the requirement of the project**.**	**K2**

Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of project supervisor(s). Each student batch shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the supervisor. A student shall register for the Project Phase I and II in 7th and 8th semester respectively. The project team and the project title can be decided in the 6th semester itself.

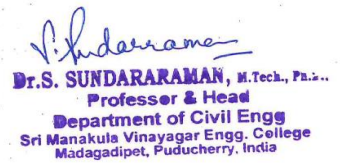
Criteria for Assessment of Project Work

- Interim project report shall be submitted before the project review with the approval of the supervisor. The Project Report prepared according to the approved guidelines and duly signed by the supervisor and the Head of the Department shall be submitted as per the timeline announced by the department.
- The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work. Internal Evaluation – 50 Marks and External Evaluation – 50 marks.

Evaluation Method

Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	10	15
		Supervisor	5	
b	Review 2	Review Committee#	10	15
		Supervisor	5	
c	Review 3	Review Committee#	15	20
		Supervisor	5	
			Total CAM	50
2	**End Semester Marks**			
a	Evaluation of Phase I report and Viva-voce	Report	15	50
		Presentation and Viva	20	
		Demonstration	15	
			Total ESM	50
			Total Marks	100

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods: 60**



Department	**Civil Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23CEW704**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internship / Implant Training**	**0**	**0**	**2**	**1**	**100**	**-**	**100**

CIVIL

Prerequisite	**Civil Engineering, C Programming**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)

The student is required to undergo 'internship' in industry / research laboratory / higher learning institution for a minimum period of 4 weeks during vacations and shall complete the internship before the completion of 7th semester.
(i) The internship carries 1 credit.
(ii) Each spell of internship shall be for a period not less than 2 weeks.
(iii) The main purpose of internship is to enhance the general professional outlook and capability of the student to advance his/her chances of improving the career opportunities. The student should get prior approval from the Head of the Department and Training and Placement cell in the college before undertaking the internship and need to submit a detailed report after completion for the purpose of assessment. The internship marks will be given in 7th semester mark sheet.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 200**	**Total Periods: 200**

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Department	**Civil Engineering**		Programme : **B.Tech.**					
Semester	**VIII**		Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23HSTC03**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Entrepreneurship and Business Management**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	-							
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Examine the types and importance of entrepreneurship						**K4**
	CO2	Demonstrate about Small Scale Enterprise						**K2**
	CO3	Analyse various entrepreneurial opportunities						**K4**
	CO4	Evaluate various Institutional support						**K5**
	CO5	Elaborate on Women Entrepreneurship and Rural Entrepreneurship						**K6**

UNIT- I	**Introduction to Entrepreneurship**	**Periods: 07**
Entrepreneur and entrepreneurship- Definition - Nature of Entrepreneurship- Entrepreneur Background and Characteristics - Types, Ethics and Social Responsibilities of an Entrepreneur. Entrepreneurship: Importance, Growth and Role of Entrepreneurship in Economic Development– EDPs in India and Social Entrepreneurship.		**CO1**
UNIT II	**Creativity and the Business Idea for Micro and Small Enterprises**	**Periods: 10**
Sources of New Ideas - Methods of Generating Ideas - Creative Problem Solving – Innovation – Types – Definition & Classification of New Product – Opportunity Recognition – Product Planning and Development Process – Establishing Evaluation Criteria - Micro and Small-Scale Enterprise: Definition, Characteristics - Steps involved to start SSE - Problems of SSE		**CO2**
UNIT III	**Formulation of Business Plan & Project Appraisal**	**Periods: 09**
Business Plan – Meaning &Definition – Contents of Business Plan – Significance of Business Plan – Formulation of Business Plan – Planning Commission's Guidelines for Formulating Project Report – Network Analysis – Common Errors in Business Plan formulation. Concept of Project Appraisal – Methods of Project Appraisal – Economic Analysis – Financial Analysis – Market Analysis – Technical Feasibility – Managerial Competence - Environmental Clearance for Small Scale Enterprise.		**CO3**
UNIT IV	**Institutional Finance to Entrepreneurs & Taxation Benefits**	**Periods: 09**
Institutional Finance - Meaning & Definition - Sources of Finance - Institutional support to small enterprise: Need - Institutional support by State and Central Government - SWOT Analysis – Tax Benefits – Types - Rational Behind tax benefits - Incentives and concession for Small-Scale and Tiny Industries		**CO4**
UNIT V	**Women Entrepreneurship and Entrepreneurship in Informal Sector**	**Periods: 08**
Women Entrepreneurship – Functions – Growth of women Entrepreneurship – Problems faced by Women Entrepreneurs – Development of women Entrepreneurship – Rural Entrepreneurship – Tourism Entrepreneurship – Agri-Preneurship – Social Entrepreneurship.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd – Entrepreneurship (Tata McGraw Hill) 10th Edition, 2017.
2. S.S. Khanka: Entrepreneurial Development (S. Chand) Revised Edition, 2012

Reference Books

1. Poornima M. Charantimath: Entrepreneurship Development in Small Business Enterprises (Pearson Education)
2. Prasanna Chandra: Projects Planning Analysis, Reductions implementation & Review (Tata McGraw Hill) Sahey and Nirjar: Entrepreneurship (Excel)
3. Vasant Desai: The Dynamics of Entrepreneurial Development and Management (Himalaya Publishing House)
4. 5. K. Nagarajan: Project Mangement (New Age International Publishers)
5. Poornima M. Charantimath: Entrepreneurship Development in Small Business Enterprises (Pearson Education)

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
1	3	-	3	2	1	-	-	-	-	-	-	-	3	3	3
2	3	1	2	1	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
4	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3
5	2	-	3	2	2	-	-	-	-	-	-	-	3	3	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	10	25	5	100*	100

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Department	**Civil Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23CEW703**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Phase II**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
Prerequisite								

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Take up any challenging practical problems and find solution by formulating proper methodology	**K2**
	CO2 To arrive at the conclusions of the findings from the project.	**K2**

Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of project supervisor(s). Each student batch shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the supervisor. A student shall register for the Project Phase II in 8th semester. The project team and the project title can be decided in the 6th semester itself.

Criteria for Assessment of Project Work

- Interim project report shall be submitted before the project review with the approval of the supervisor. The Project Report prepared according to the approved guidelines and duly signed by the supervisor and the Head of the Department shall be submitted as per the timeline announced by the department.
- The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work. Internal Evaluation – 50 Marks and External Evaluation – 50 marks.

Evaluation Method

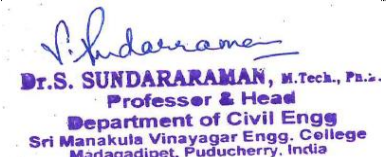
Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	10	15
		Supervisor	5	
b	Review 2	Review Committee#	10	15
		Supervisor	5	
c	Review 3	Review Committee#	15	20
		Supervisor	5	
			Total CAM	50
2	**End Semester Marks**			
a	Evaluation of final report and Viva-voce	Report	20	80
		Presentation and Viva	40	
		Demonstration	20	
b	Expected Outcome from the project ##	Publication / communication of papers / prototypes/ patents etc		20
			Total ESM	**100**
			Total Marks	**150****

Review committee consists of internal faculty members nominated by the Head of the Department. The Supervisor of the student being examined shall not be part of the committee.

Expected outcome from the project, in terns of paper publication, patents, product development and industry projects shall be awarded based on the document proof submitted by the student concerned

** To be weighted for 100 marks

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 200**	**Total Periods: 200**



Professional Elective - IV

Department	**Civil Engineering**	Programme: **B.Tech.**					
Semester	**VII**	Course Category Code: **PE**			End Semester Exam Type: **TE**		
Course Code	**U23CEE716**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Structural Health Monitoring**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite		
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Able to model the structure to understand the behaviour	**K4**
	CO2 Understanding the type of sensors and its data acquisition system	**K4**
	CO3 Understanding the structural monitoring system for the condition assessment	**K4**
	CO4 Analyse the data procured and its interpretation	**K4**
	CO5 Able to conduct investigations to both new and aged structures	**K4**

UNIT- I	**STRUCTURAL MODELLING AND FINITE ELEMENT MODELS**	**Periods: 09**
Review of Structural Modelling and Finite Element Models: Modelling for damage and collapse behaviour of structures, finite element modelling, theoretical prediction of structural failures.		**CO1**
UNIT- II	**SIGNALS, SYSTEMS, SENSORS AND DATA ACQUISITION SYSTEMS**	**Periods: 09**
Review of Signals, Systems and Data Acquisition Systems: Frequency and time domain representation of systems, Fourier/Laplace transforms, modelling from frequency response measurements, D/A and A/D converters, programming methods for data acquisition systems. Sensors for Health Monitoring Systems: Acoustic emission sensors, ultrasonic sensors, piezo ceramic sensors and actuators, fibre optic sensors and laser stereography techniques, imaging techniques.		**CO2**
UNIT - III	**MONITORING SYSTEMS**	**Periods: 09**
Health Monitoring/Diagnostic Techniques: Vibration signature analysis, modal analysis, neural network-based classification techniques. Integrated Health Monitoring Systems: Intelligent Health Monitoring Techniques, Neural network classification techniques, extraction of features from measurements, training and simulation techniques, and connectionist algorithms for anomaly detection, multiple damage detection, and case studies.		**CO3**
UNIT - IV	**INFORMATION TECHNOLOGY FOR HEALTH MONITORING**	**Periods: 09**
Information Technology for Health Monitoring: Information gathering, signal analysis, information storage, archival, retrieval, security; wireless communication, telemetry, real time remote monitoring, network protocols, data analysis and interpretation.		**CO4**
UNIT - V	**PROJECT BASED HEALTH MONITORING TECHNIQUES**	**Periods:09**
Project Based Health Monitoring Techniques: Health monitoring techniques based on case studies, practical aspects of testing large bridges for structural assessment, optimal placement of sensors, structural integrity of aging multistory buildings, condition monitoring of other types of structures		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Structural Health Monitoring – Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes.
2. Health Monitoring of Structural Materials and Components – Douglas E. Adams.
3. Structural Health Monitoring: An Overview – Charles R. Farrar & Keith Worden.

Reference Books

1. Philip W., Industrial sensors and applications for condition monitoring, MEP, 1994.
2. Armer G.S.T (Editor), Monitoring and assessment of structures, Spon, London, 2001
3. Wu, Z.S. (Editor), Structured health monitoring and intelligent infrastructure, Vols. 1 & 2, Balkema, 2003.
4. Harris C.M., Shock vibration handbook, McGraw-Hill, 2000.
5. Rao J.S., Vibratory condition monitoring of machines, Narosa Publishing House, India, 2000

Web References
1. https://www.nde-ed.org
2. https://www.nist.gov
3. https://www.techno-press.org/?journal=sss

COs/POs/PSOs Mapping

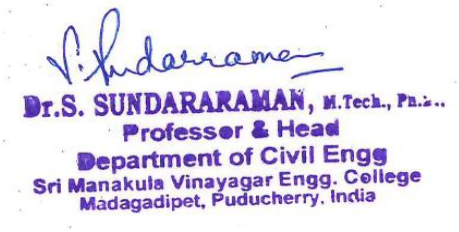
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
2	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
3	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
4	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
5	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CEE717**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Municipal Solid Waste Management**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite		
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the nature and characteristics of municipal solid wastes.	**K4**
	CO2 Understand the concept of reduction, reuse and recycling of waste.	**K2**
	CO3 Plan and design systems for storage, collection, transport, processing and disposal of municipal solid Waste	**K3**
	CO4 Understand the issues on solid waste management from an integrated source	**K4**
	CO5 Design and operate sanitary landfill	**K3**

UNIT- I	**SOURCES AND CHARACTERISTICS**	**Periods: 09**
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.		**CO1**
UNIT- II	**SOURCE REDUCTION, WASTE STORAGE AND RECYCLING**	**Periods: 09**
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.		**CO2**
UNIT - III	**COLLECTION AND TRANSFER OF WASTES**	**Periods: 09**
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..		**CO3**
UNIT - IV	**PROCESSING OF WASTES**	**Periods: 09**
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.		**CO4**
UNIT - V	**WASTE DISPOSAL**	**Periods:09**
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.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. William A. Worrell, P. AarneVesilind (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 Tchobanoglouset.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 FrankKreith (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.
5. CPHEEO (2014), “Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization. Government of India, New Delhi.

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

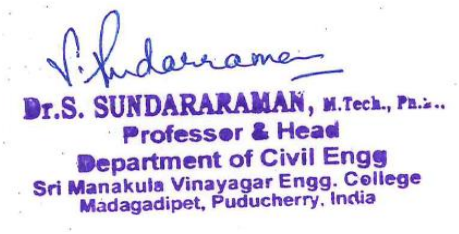
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	3	3	3	3	3	3	2	3	3	3	3	2
2	3	3	2	3	3	3	3	2	3	2	2	3	3	3	3
3	3	3	3	2	2	2	3	3	3	3	2	3	3	3	2
4	2	3	2	3	2	3	2	3	3	2	2	3	3	3	3
5	3	3	3	2	3	3	3	3	3	2	3	3	3	3	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23CEE718**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Quality Control and Assurance in Construction**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**-Nil-**	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Achieve the knowledge of quality management guidelines, and quality circles.	**K2**
	CO2 Apply the quality standards for preparing Quality system documents.	**K2**
	CO3 Explain the skill of preparing inspection procedures for quality planning.	**K2**
	CO4 Select the techniques and tools for Quality Assurance and Control in Construction Industry.	**K2**
	CO5 Achieve knowledge of quality improvement techniques	**K2**

UNIT-I	**QUALITY MANAGEMENT**	**Periods: 09**
Introduction – Definitions and objectives – Dimensions of quality - Factors influencing construction quality – Responsibilities and authority – Methods to improve quality – Quality Process - Quality plan – Quality Management Guidelines – Quality circles.		**CO1**
UNIT-II	**QUALITY SYSTEMS**	**Periods: 09**
Introduction – History of standards - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third-party Certification – Emission Norms – BS Norms.		**CO2**
UNIT-III	**QUALITY PLANNING**	**Periods: 09**
Quality Policy, Objectives and methods in the Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication		**CO3**
UNIT-IV	**QUALITY ASSURANCE AND CONTROL**	**Periods: 09**
Objectives – Regularity agent, owner, design, contract, and construction-oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals – Factors influencing construction quality – Critical, major failure aspects and failure mode analysis, – Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction		**CO4**
UNIT-V	**QUALITY IMPROVEMENT TECHNIQUES**	**Periods: 09**
Selection of new materials – Influence of drawings, detailing, specification, standardization – Bid preparation – Construction activity, environmental safety, social and environmental factors – Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Hutchins. G, ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva Books Pvt. Ltd., 1994.
2. James, J.O' Brian, Construction Inspection Handbook – Total Quality Management, Van Nostrand, 1997
3. KB Rajoria, Deepak Naryan, Deepak Gupta, ISO 9000 Practices in construction, CBS Publishers & Distributors Pvt. Ltd., ISBN:978-93-90709-33-5, 2021.

Reference Books

1. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, 1989.
2. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, McGraw Hill, 2001

3. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, 1998

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1. https://www.msajce-edu.in/academics/civil/LectureNote/GE8077-LN.pdf
2. https://www.slideshare.net/kumudajayaram/iso-9000-87352949
3. https://docs.builderscollege.edu.in/Downloads/naac/ssr/C1/1.3.2_mecem_2019_20.pdf

COs/POs/PSOs Mapping

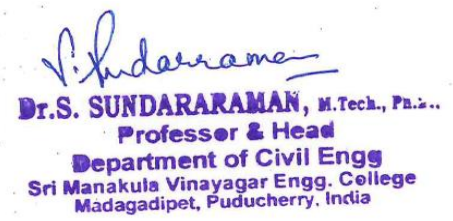
Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	-	-	-	-	-	-	-	-	-	3	2	2
2	2	2	1	-	-	-	-	-	-	-	-	-	2	2	2
3	1	2	1	-	-	-	-	-	-	-	-	-	1	2	2
4	2	2	3	-	-	-	-	-	-	-	-	-	3	2	2
5	1	2	1	-	-	-	-	-	-	-	-	-	1	2	2

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**			Programme: **B.Tech.**				
Semester	**VII**			Course Category Code: PE		*End Semester Exam Type: TE		
Course Code	**U23CEE719**			Periods / Week		Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Tunneling Engineering**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite										
Course Outcome	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)	
	CO1	Describe the different types of underground structures and their applications							**K2**	
	CO2	Identify the excavation methods for construction of underground structures in different In – situ conditions							**K2**	
	CO3	Analyze the underground structures in rock and soil using elastic and elastoplastic stress–strain behavior of rock and soil							**K2**	
	CO4	Design the underground structure using empirical, analytical and numerical approaches							**K2**	
	CO5	Solve underground problems by using codes and standards							**K2**	
UNIT-I	**Introduction**							**Periods: 09**		
Types and classification of underground openings, Factors affecting design, Design methodology, Functional aspects - Size and shapes, Support systems, Codal provisions										**CO1**
UNIT-II	**Excavation Methods**							**Periods: 09**		
Principles of rock breakage, Excavation methods, Blasting - types of explosives, blast hole design, Drilling methods and machines, Blast hole timing, TBM tunneling, Factors influencing and evaluation, Excavation mechanics, Geological considerations, Safety provisions										**CO2**
UNIT-III	**Design**							**Periods: 09**		
Design based on analytical methods, Empirical methods based on RSR, RMR, Q systems, Design based on Rock support interaction analysis, Observational method- NATM, Stability of excavation face and Tunnel portals. Use of appropriate software package										**CO3**
UNIT-IV	**Analysis**							**Periods: 09**		
Stresses and deformations around openings, Stresses and deformations around tunnels and galleries with composite lining due to internal pressure, Closed form solutions										**CO4**
UNIT-V	**Case Studies**							**Periods: 09**		
Tunnels, Energy storage caverns, Nuclear waste disposal repositories, Metros, Underground chambers and defence installations										**CO5**
Lecture Periods: 45		**Tutorial Periods: -**			**Practical Periods: -**			**Total Periods: 45**		

Text Books

1. Saxena, S.C., (Year) Tunneling and Tunnel Engineering, Dhanpat Rai Publications, New Delhi.
2. Chapman, D., Metje, N., and Stark, T., (2010) Introduction to Tunnel Construction, CRC Press, Taylor & Francis Group, London.
3. Das, B.N., (Year) Handbook on Tunnels and Underground Works, New Age International Publishers, New Delhi.
4. Verma, B.S., (Year) Rock Mechanics and Tunnelling Techniques, Khanna Publishers, New Delhi.
5. Bickel, J.O., and Kuesel, T.R., (1996) Tunnel Engineering Handbook, Springer, New York.
6. Sharma, A.K., (Year) Tunnel Engineering, CBS Publishers & Distributors, New Delhi.

Reference Books

1. Zhao, J., and Shirlaw, J.N., (Year) Modern Tunneling Science and Technology, World Scientific Publishing, Singapore.
2. Golser, M., (Year) Construction Methods in Tunnel Engineering, Ernst & Sohn, Germany.
3. Hoek, E., and Brown, E.T., (1980) Underground Excavations in Rock, Institution of Mining and Metallurgy, London.

4. Kirkland, C., (Year) The History of Tunneling and Underground Construction, ICE Publishing, London.

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1. https://nptel.ac.in/courses/105/106/105106232/
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/
3. https://ocw.tudelft.nl/courses/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	SPO2	PSO3
1	3	3	2	-	-	3	-	-	-	-	-	-	1	1	2
2	3	3	2	-	-	3	-	-	-	-	-	-	2	2	2
3	3	3	2	-	-	3	-	-	-	-	-	-	2	2	2
4	3	3	2	-	-	3	-	-	-	-	-	-	3	3	3
5	3	3	2	-	-	3	-	-	-	-	-	-	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
Professor & Head
Department of Civil Engg
Sri Manakula Vinayagar Engg. College
Madagadipet, Puducherry, India

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: PE			*End Semester Exam Type: TE			
Course Code	**U23CEE720**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Architecture and Town Planning**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite		
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the history and architectural developments	**K2**
	CO2 Comprehend the past, follows present, ascendance the future	**K2**
	CO3 Design interior building services	**K3**
	CO4 Understand and plan for site development	**K3**
	CO5 Plan and design sustainable cities and town	**K3**

UNIT-I	**ARCHITECTURE AND ITS DEVELOPMENT**	**Periods: 09**
Indian Indus valley, Vedic, Buddhist, Indo-Aryan, Dravidian and Mughal periods; European Egyptian, Greek, Roman, medieval and renaissance periods- construction and architectural styles; vernacular and traditional architecture. Architectural developments and impacts on society since industrial revolution; influence of modern art on architecture.		**CO1**
UNIT-II	**SKILLS FOR AN ARCHITECTURAL UNDERSTANDING**	**Periods: 09**
Understanding the construction methods and materials through study of Egyptian, Greek, Roman, European, Indian Architectural History - Modern Architecture Thinking & Analytical Skills - Empathy - Philosophical Understanding from Idea to Form - Psychological and Social Understanding.		**CO2**
UNIT-III	**BUILDING SERVICES**	**Periods: 09**
Water supply, sewerage and drainage systems; sanitary fittings and fixtures; plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings, intelligent buildings; elevators & escalators, their standards and uses; air-conditioning systems; firefighting systems, building safety and security systems		**CO3**
UNIT-IV	**TOWN PLANNING**	**Periods: 09**
Objectives and Principles of Town Planning, Stages of Town Development (Indian), Levels of planning, Different types of plan, land use planning, Zoning – Principles, advantages, classification. Planning ideologies - Drainage and water supply in the selection of site for the development – Residential – Commercial – Industrial – Public – Transportation, Utility and services – Agriculture		**CO4**
UNIT-V	**CITY, HOUSING AND LANDSCAPE PLANNING**	**Periods: 09**
Evolution of cities; principles of city planning; types of cities & new towns; planning regulations and building byelaws; eco-city concept; sustainable development. Concept of housing; neighbourhood concept; Principles of landscape design and site planning; environmental considerations in landscape planning.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

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

6. V.S.Limaye, A.D.Pawar, Architectural Planning And Design Of Buildings, Nirali Prakashan Publication, Edition 2016

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	SPO2	PSO3
1	-	-	-	-	-	2	1	2	-	-	-	3	3	1	2
2	-	-	-	1	1	2	1	1	1	-	-	2	3	1	-
3	2	2	2	1	2	2	1	1	-	-	1	2	2	3	-
4	1	1	1	1	2	1	2	2	1	-	-	2	2	2	3
5	3	2	2	-	2	1	2	1	-	-	1	3	1	2	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
Professor & Head
Department of Civil Engg
Sri Manakula Vinayagar Engg. College
Madagadipet, Puducherry, India

Professional Elective - V

Department	**Civil Engineering**	Programme : **B.Tech.**						
Semester	**VIII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CEE821**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Precast Structures**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	**Structural Analysis, Design of RC Elements**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the applications, advantages, and limitations of precast construction	**K2**
	CO2 Identify and classify major precast elements, their types, applications, and erection processes.	**K2**
	CO3 Analyze and select appropriate precast structural systems for various building types.	**K4**
	CO4 Gain knowledge of precast production, storage, handling, and logistics processes, ensuring quality control.	**K2**
	CO5 Design joints and connections for load transfer and apply safe handling and erection methods.	**K4**

UNIT- I	**Introduction to Precast**	**Periods: 09**	
Introduction – current scenario and constraints, the difference between precast vs conventional construction methods, needs, types, features, Advantages (for owners, architects, engineers, contractors, end users) and Limitations, Residential, Commercial & Industrial Applications of precast, Materials used, Code provisions and clauses.			**CO1**
UNIT- II	**Precast Elements**	**Periods: 09**	
Major elements (Beam, slab, wall, column, foundation, staircase, roof elements, façade) : Classification, Types and shapes, selection, application, erection, advantages, Infra works -Pipes & drains, duct bank, baggage handling tunnel, culvert and sleeper, facia element, pavement and channel.			**CO2**
UNIT - III	**Precast Structural Systems**	**Periods: 09**	
Structural System: Skeletal System, Portal Frame system, Large Panel system, Cell Block system and hollow block system, Guide lines of selection – Residential & office buildings, Industrial Buildings, Commercial buildings, Structural Stability and Structural Behaviour.			**CO3**
UNIT - IV	**Precast Production, Storage, & Logistics**	**Periods: 09**	
Plant and Production: Introduction -Types & Process, Production – Design and shop drawings, check lists, Moulding, Casting and its types, Concreting, Curing, Demoulding and inspection. Storage, Delivery, Handling- introduction and types of equipment, lifting devices, Erection and installation - Horizontal components, vertical components, special elements, Quality Inspection and Tolerance			**CO4**
UNIT - V	**Connections, Handling & Erection**	**Periods: 09**	
Design of joints and connections for load transfer. Lifting, transportation, and site erection methods. Stability, tolerances, and alignment issues. Safety regulations during handling and installation.			**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Elliott, Kim S. – “Precast Concrete Structures”, Butterworth-Heinemann, 2016
2. Nawy, Edward G. – “Prestressed Concrete A Fundamental Approach”, Prentice Hall, 2010.
3. Muthu, K. U., Vijayanand, S., Iyer, N. R., & Sasidhar, C. – “Basic Structural Analysis & Design of Buildings Using Staad Pro”, I.K. International Publishing, 2018.

Reference Books

1. Precast/Prestressed Concrete Institute (PCI) – PCI Design Handbook (8th Edition, 2017)
2. Ghali, A., Favre, R., & Elbadry, M. – Concrete Structures: Stresses and Deformations (CRC Press, 2011)
3. Moskvin, V. A. – Precast Concrete Structures (Mir Publishers, 1980)

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1. https://bmtpc.org/DataFiles/CMS/file/PDF_Files/61_PAC_Urbaanic_Final.pdf
2. https://www.researchgate.net/publication/383095334_Precast_Concrete_Building_Construction_In_India
3. https://archive.nptel.ac.in/courses/105/105/105105105/

COs/POs/PSOs Mapping

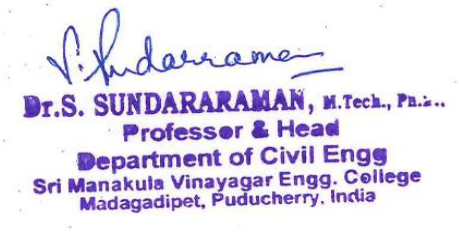
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	2	2	3	2	2	3	3	1	2	3	2
2	3	2	2	3	2	2	3	2	2	3	3	1	2	3	2
3	3	2	2	3	2	2	3	2	2	3	3	1	2	3	2
4	3	2	2	3	2	2	3	2	2	3	3	1	2	3	2
5	3	2	2	3	2	2	3	2	2	3	3	1	2	3	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**	Programme : **B.Tech.**						
Semester	**VIII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CEE822**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Industrial Waste Disposal and Treatment**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Structural Analysis, Design of RC Elements**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 An ability to use the recent techniques.	**K3**
	CO2 Describe the importance of Pretreatment Methods	**K3**
	CO3 Apply the various techniques for Treatment Methods of Industrial Wastes	**K3**
	CO4 Describe the solve problems related to Industrial Waste Water management and Disposal	**K3**
	CO5 Carry out Industry and power plants studies case studies	**K3**

UNIT- I	**PRECIPITATION**	**Periods: 09**
Uses of water by Industry - Sources and types of wastewaters, quality criteria, effluent standards- Individual and common effluent treatment plants - Population equivalent, Effects of industrial wastes on streams, land, air and waste water treatment plants		**CO1**
UNIT- II	**PRETREATMENT METHODS**	**Periods: 09**
Pretreatment Methods: Process modification – methods and materials changes – Reduce, reuse and recycle methods, housekeeping etc. to reduce waste discharge and strength of the waste and established methods for by products recovery within the plant operations		**CO2**
UNIT - III	**TREATMENT METHODS OF INDUSTRIAL WASTES**	**Periods: 09**
Equalization – Neutralization - Oil separation – Floatation – Precipitation –Adsorption - Aerobic and anaerobic biological treatment - High rate reactors. Chemical oxidation – Ozonation –Ion Exchange – Membrane technologies..		**CO3**
UNIT - IV	**TREATMENT METHODS OF RESIDUALS**	**Periods: 09**
Residuals of Industrial waste treatment – Characteristics of sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge.		**CO4**
UNIT - V	**CASE STUDIES**	**Periods: 09**
Industry and power plants - manufacturing process description - wastewater characteristics and waste treatment flow sheet for typical industries – Textiles – Tanneries – Pulp and Paper –Metal finishing – Petroleum refining – Chemical industries - Sugar and distilleries –Dairy –Iron and Steel- Fertilizers –Nuclear power plants		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

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

Reference Books

1. Nemerow,N.L., Theories and Practices of Industrial Wastes Treatment, Addisson and Wesley, 2015.
2. Gurnham,C.F., Principles of Industrial Waste Treatment, John Wiley, New York,2012.
3. Varshney, R.S., Industrial Waste Disposal and Treatment,, Nem Chand & Bros., 2017.

COs/POs/PSOs Mapping

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
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Sri Manakula Vinayagar Engg. College
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Department	**Civil Engineering**		Programme :**B.Tech.**					
Semester	**VIII**		Course Category Code: **PE**			End Semester Exam Type: **TE**		
Course Code	**U23CEE823**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Construction Safety**		**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the fundamentals, codes of practice and bridge failures.	**K4**
	CO2	Understand the estimation of forces for the design bridge structural elements	**K4**
	CO3	Design of the slab and girder beam bridges using appropriate method	**K4**
	CO4	Understand the design principles of long span bridges	**K4**
	CO5	Understand the design of substructure components e to model the structure to understand the behaviour	**K4**

UNIT- I	**INTRODUCTION TO CONSTRUCTION SAFETY**	**Periods: 09**
Importance of safety in construction-Common hazards and risks in construction- Safety laws, regulations, and standards (OSHA, BIS, NBC)- Roles and responsibilities of stakeholders in construction safety- Case studies on construction accidents and lessons learned.		**CO1**
UNIT- II	**HAZARD IDENTIFICATION AND RISK ASSESSMENT**	**Periods: 09**
Types of hazards in construction (physical, chemical, biological, ergonomic)-Hazard identification techniques (HAZOP, FMEA, JSA)-Risk assessment methods (qualitative & quantitative)-Safety audits and inspections-Control measures and mitigation strategies.		**CO2**
UNIT - III	**SAFETY MANAGEMENT AND ACCIDENT PREVENTION**	**Periods: 09**
Safety management systems (SMS) and their implementation-Accident causation theories (Domino theory, Human Factors theory)-Personal protective equipment (PPE) and safety gear-Emergency response planning and first aid in construction sites-Behavioral safety and safety culture in construction.		**CO3**
UNIT - IV	**TECHNOLOGY & ADVANCEMENTS IN CONSTRUCTION SAFETY**	**Periods: 09**
Role of automation and robotics in construction safety-IoT, AI, and wearables for real-time safety monitoring-Drones for site safety inspection-Digital safety reporting and documentation-Case studies on technology-driven safety improvements.		**CO4**
UNIT - V	**PROJECT-BASED SAFETY PRACTICES & CASE STUDIES**	**Periods:09**
Safety practices in high-rise buildings, tunnels, and bridges-Fire safety in construction projects-Site-specific safety planning and execution-Best practices for contractor and laborer safety-Real-world case studies on successful safety implementations.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Construction Safety Management and Engineering – David L. Goetsch.
2. Construction Safety Handbook – V.J. Davies & K. Tomasin.
3. Occupational Safety and Health in Construction – OSHA Publications

Reference Books

1. Construction Safety and Health **–** Richard J. Coble *Covers safety management, risk analysis, and accident prevention techniques in construction.*
2. Construction Safety Management and Engineering – David L. Goetsch *Provides in-depth knowledge of construction safety regulations, hazard identification, and safety management.*
3. Construction Site Safety: A Guide for Managing Contractors – Richard D. Hislop *Focuses on contractor safety management, compliance, and risk mitigation.*
4. Handbook of OSHA Construction Safety and Health– Charles D. Reese *Explains OSHA standards, safety regulations, and practical safety procedures.*
5. Construction Safety and Health – Richard J. Coble *Covers safety management, risk analysis, and accident prevention techniques in construction.*

Web References
1. https://www.osha.gov
2. https://www.ilo.org/safework
3. https://www.tandfonline.com/toc/tose20/current

COs/POs/PSOs Mapping

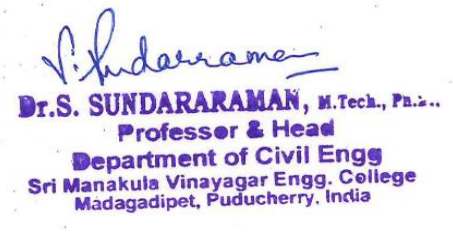
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
2	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
3	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
4	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
5	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**	Programme : **B.Tech.**						
Semester	**VIII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CET824**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Intelligent Transportation Systems**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Transportation Engineering**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand ITS fundamentals, roles, responsibilities, security, and safety issues.	**K2**
	CO2 Analyze ITS architecture, hardware, sensors, and vehicle detection techniques.	**K2**
	CO3 Evaluate advanced traffic management (ANPR, video detection, DTA, algorithms).	**K3**
	CO4 Understand smart route systems, travel info dissemination, and business scope.	**K2**
	CO5 Assess global ITS implementations, automated highways, and vehicle platooning.	**K3**

UNIT- I	**INTRODUCTION TO INTELLIGENT TRANSPORT SYSTEM**	**Periods: 09**
Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection – Critical issues – Security – Safety		**CO1**
UNIT- II	**ITS ARCHITECTURE AND HARDWARE**	**Periods: 09**
Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS – Toll Collection		**CO2**
UNIT - III	**ADVANCED TRANSPORT MANAGEMENT SYSTEM**	**Periods: 09**
.Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies- ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Issues -– Historical – Current – Predictive Guidance – Data Collection – Analysis – Dynamic Traffic Assignment (DTA) – Components – Algorithm.		**CO3**
UNIT - IV	**ADVANCED TRAVELLER AND INFORMATION SYSTEM**	**Periods: 09**
Travel Information – Pre-Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of Information – Business Opportunities		**CO4**
UNIT - V	**CASE STUDIES**	**Periods: 09**
Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Intelligent Transportation Systems – R. Srinivasa Kumar (Orient BlackSwan, 2022)
2. Intelligent Transport Systems: Technologies and Applications – Asier Perallos et al. (Wiley, 2015)
3. Intelligent Transportation Systems: Functional Design – Robert Gordon (Springer, 2016)

Reference Books

1. *Intelligent Transportation Systems: Theory and Practice – Amit Kumar Tyagi (Springer, 2023)*
2. *Intelligent Transportation Systems: From Good Practices to Standards – Paolo Pagano (CRC Press, 2016)*
3. *Advanced Technologies for Intelligent Transportation Systems – Marco Picone et al. (Springer, 2015)*
4. *Intelligent Transportation Systems: Concepts and Cases – Sumedha B. Rajakaruna (Cambridge Scholars, 2022)*
5. *5. Intelligent Transportation Systems: New Principles and Architectures – A. K. S. S. S. R. Murthy (CRC Press, 2000)*

Web References
1.http:// Intelligent Transportation Systems: Theory and Practice.nic.in
2.https://nptel.ac.in/noc/courses/noc670/SEM2/noc19-ge22/
3.http://www. Intelligent Transport Systems: Technologies and Applications.in/wp-content/uploads/2017/03/

COs/POs/PSOs Mapping

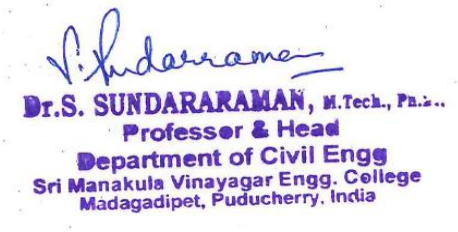
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	-	3	-	-	-	-	-	1	3	-	-
2	-	3	3	-	3	-	-	-	-	-	-	1	-	3	-
3	-	-	3	3	-	-	3	-	-	-	-	1	3	3	-
4	-	-	-	-	3	3	-	-	3	-	-	1	3	-	-
5	-	-	-	-	-	-	3	3	3	-	-	1	-	3	-

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**			Programme: **B.Tech.**				
Semester	**VIII**			Course Category Code: **PE**			*End Semester Exam Type: **TE**	
Course Code	**U23CEE825**			Periods/ Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**Interior Design**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	**-Nil-**									
Course Outcome	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Understand the importance of interior design								**K2**
	CO2	Gain knowledge in different materials used for various surfaces in the kitchen								**K2**
	CO3	Understand the concept and application of colors in interiors								**K2**
	CO4	Understand and learn the concepts of lighting.								**K2**
	CO5	Know about the selection and arrangement of furniture.								**K2**
UNIT-I	**Introduction of Interior Design**						**Periods: 09**			
Design – Meaning and Definition, Types – Structural and Decorative design, their characteristics, classification of decorative design - Elements of Design – Meaning, various elements – line, form and shape, size, color, texture, pattern, space, light.										**CO1**
UNIT-II	**Kitchen Design**						**Periods: 09**			
Kitchen planning – Functions performed in a kitchen, types of kitchen, principles of planning kitchen – orientation and location, ventilation, storage needs, work triangle, colour, light and safety - Principles of Design – Harmony, Balance, Rhythm, Emphasis, proportion - Application of design principles in interiors.										**CO2**
UNIT-III	**Colour in Interior Design**						**Periods: 09**			
Importance of Colour – Colour wheel – Dimension of colour - Hue, value, intensity – Classification of colour - Prang color system, color harmonies – Colour Temperature and Mood – Colour response - Related and contrasting color harmonies, psychology of color. Application of colour in interiors.										**CO3**
UNIT-IV	**Lighting Design**						**Periods: 09**			
Lighting in interiors – importance, classification based on sources, uses, illumination, Factors to be considered in lighting for different areas of house.										**CO4**
UNIT-V	**Furniture Design**						**Periods: 09**			
Furniture - Meaning, need, and purpose. Factors influencing – climate, family needs and preferences, availability, comfort, principles of design and financial limits - Selection and arrangement – Furniture for various rooms –Living room, dining room, bedroom, kitchen, study room, office. Principles of design in furniture arrangement.										**CO5**
Lecture Periods: 45		**Tutorial Periods:**		**Practical Periods: -**			**Total Periods: 45**			

Text Books

1. Seetharaman.P. ,Paannu.P , “Interior Design and Decoration”, CBS Publishers and Distributers Pvt Limited., Chennai India ,2009.
2. Varghese and Ogale, “Home Management”, Wiley Eastern, New Delhi, 1994.
3. Faulkner S, Faulkner R, “Inside Today’s Home”, Rine hart Publishing Company, Newyork, (1987)
4. Caroline cliften et. al., “The Complete Home Decorator”, Portland House New York.

Reference Books

1. Gandotra.V, Shukul.M, and Jaiswal.N, (2011) Introduction to Interior Design and Decoration, Dominant Publishers and Distributors New Delhi.
2. Pratap R.M (1988), “Interior Design Principles and Practice”, Standard Publishers Distribution, Delhi.
3. Goldstein, “Art in Everyday life”, Oxford and IBH Publishing House.

Web References
1. https://ebooks.inflibnet.ac.in/hsp02/chapter/principles-of-design-application-of-design-principles-in-interior/
2. https://www.uou.ac.in/sites/default/files/slm/BHM-602CT.pdf
3. https://interiordesignstudent.com/study-notes/colour-in-interior-design/

COs/POs/PSOs Mapping

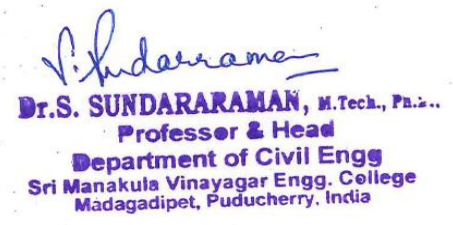
Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
2	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
3	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
4	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
5	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus



Professional Elective - VI

Department	**Civil Engineering**			Programme: **B.Tech.**			
Semester				Course Category Code: **PE**		End Semester Exam Type: **TE**	
Course Code	**U23CEE826**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Prestressed Concrete Structures**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite								

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Design a prestressed concrete beam accounting for losses.	**K3**
	CO2	Design for flexure and shear.	**K3**
	CO3	Design the anchorage zone for post tensioned members and deflection in beams.	**K3**
	CO4	Design composite members and continuous beams.	**K3**
	CO5	Design water tanks, pipes and poles.	**K3**

UNIT- I	**INTRODUCTION**	**Periods: 09**
Historical developments – Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.		**CO 1**

UNIT- II	**DESIGN FOR FLEXURE AND SHEAR**	**Periods: 09**
Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per IS.1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on IS1343-2012 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on IS1343-2012 Code.		**CO 2**

UNIT - III	**DEFLECTION AND DESIGN OF ANCHORAGE ZONE**	**Periods: 09**
Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343-2012 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.		**CO 3**

UNIT - IV	**COMPOSITE BEAMS AND CONTINUOUS BEAMS**	**Periods: 09**
Analysis and design of composite beams - Shrinkage strain and its importance – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.		**CO 4**

UNIT - V	**MISCELANEOUS STRUCTURES**	**Periods: 09**
Design of tension and compression members – Design of sleepers, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.		**CO 5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, fifth edition, 2012.
2. Pandit.G.S. And Gupta.S.P. Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition, 2014.

Reference Books

1. Lin T.Y. and Ned.H.Burns, Design of prestressed Concrete Structures, John Wiley and Sons, Third Edition, 1981.
2. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2002.
3. Dayaratnam.P., Sarah P, Prestressed Concrete Structures, Seventh Edition, Oxford and IBH, 2017.
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.

Web References
1. https://nptel.ac.in/content/storage2/courses/105105109/pdf/m3l15.pdf
2. https://www.youtube.com/watch?v=uMuFpT1gFVI
3. https://youtu.be/6CLEWA2WNqM
4. https://nptel.ac.in/content/storage2/courses/105101085/downloads/lec-24.pdf
5. https://nptel.ac.in/content/storage2/courses/105105109/pdf/m2l12.pdf

COs/POs/PSOs Mapping

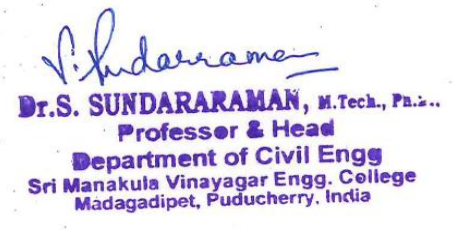
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	2	-	-	1	1	-	1	-	-	-
2	3	2	3	-	-	1	-	-	1	1	-	1	1	1	1
3	3	2	3	-	-	1	-	-	1	1	-	1	1	-	2
4	2	2	3	-	-	1	-	-	1	1	-	1	-	1	-
5	2	2	3	-	-	1	-	-	1	1	-	1	-	2	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**			Programme : **B.Tech.**				
Semester	**VIII**			Course Category Code: **PE**		End Semester Exam Type: **TE**		
Course Code	**U23CET827**			Periods/Week			Credit	Maximum Marks
				L	T	P	C	CAM / ESE / TM
Course Name	**Environmental Impact Assessment**			**3**	**0**	**0**	**3**	**25 / 75 / 100**
Prerequisite	**Environmental Engineering**							
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Understand the concept of Environmental protection laws						**K2**
	CO2	Understand about EIA methodologies						**K2**
	CO3	Analyze the various mitigation measures						**K3**
	CO4	Understand the concept of socio-economic impact assessment						**K2**
	CO5	Assess the concept about economic profile of the community						**K3**

UNIT- I	**Laws and Acts**	**Periods: 9**	
Historical perspective of environmental protection laws and acts in India - Definition of EI, EIA, EIS - Industrial policy statement of the Government of India. Legal and Regulatory aspects in India - Types and Limitations of EIA - Minimum National Standards – Bureau of Indian Standards – WHO standards			**CO1**
UNIT- II	**Methodologies**	**Periods: 9**	
EIA methodologies – Appropriate Methodologies, Quantification, - Cost benefit analysis - Risk assessment, Test Model format - Preliminary assessment			**CO2**
UNIT - III	**Air Quality Impact**	**Periods: 9**	
Background - Typical considerations and factors, air quality impact of industry, transport systems, mitigation methods. Water quality impact: Water quality criteria and standards, Field Surveys waterquality- impacts by developmental projects –Land and soil quality impacts- Soil fertility and remediation. Noise impact: Noise and sound, the effects of noise on people, noise scales and rating methods, estimating transportation noise impact.			**CO3**
UNIT - IV	**Energy Impact**	**Periods: 9**	
Energy impact considerations, data sources, energy conservation data, EIA of hydro, thermal and nuclear power plants, Vegetation and Wild life impact: Biological concepts and terms, impact on flora and fauna, mitigating measures, alternatives - Types, steps in performing socio economic impact assessment, analysis of public services and facilities, impacts, social impacts			**CO4**
UNIT - V	**Summarization of Environmental Impacts**	**Periods: 9**	
Environmental Management plan, public involvement - impacts of economic profile of the community, Exchange of information - comparison of alternatives-Training			**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Trivedi.P.R, Trivedi, P.R, Environmental Impact Assessment, APH Publishing, 2011.
2. S.R. Khandeshwar N.S. Raman, A.R. Gajbhiye "Environmental Impact Assessment" 2010
3. Larry Canter "Environmental Impact Assessment" McGraw Hill publications.1995

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

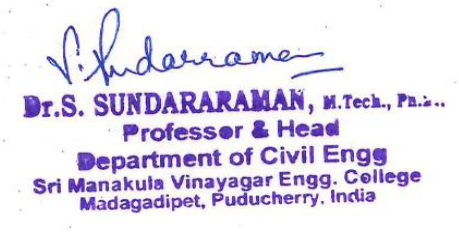
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	3	2	2	-	-	-	-	-	-	1	2	2	3
2	3	3	2	3	3	-	-	-	-	-	-	1	3	3	2
3	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3
4	2	3	3	2	3	-	-	-	-	-	-	1	2	3	3
5	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**			Programme: **B.Tech.**				
Semester	**VIII**			Course Category Code: PE		*End Semester Exam Type: TE		
Course Code	**U23CEE828**			Periods/ Week		Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Natural Disaster and Mitigation**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite										
Course Outcome	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)	
	CO1	Impart knowledge of causes of various disaster and its impact.							**K2**	
	CO2	Identify the consequences and understand control of disasters							**K2**	
	CO3	Understand disaster management cycle and its framework							**K2**	
	CO4	Recognize various disaster management followed in India.							**K2**	
	CO5	Learn about applications of science and technology for disaster management & mitigation							**K2**	
UNIT-I	**Fundamentals of Disaster Management**						**Periods: 09**			
Definitions and types of disasters (natural and man-made). Concepts of hazard, vulnerability, risk, and capacity - Relationship between disaster and development - Overview of disaster management principles.										**CO1**
UNIT-II	**Types and Trends of Disasters**						**Periods: 09**			
Geological, hydro-meteorological, biological, technological, and man-made disasters - Global disaster trends and emerging risks - Impact of climate change on urban disasters.										**CO2**
UNIT-III	**Disaster Management Cycle and Strategies**						**Periods: 09**			
Overview of the disaster management cycle - Pre-disaster risk assessment and analysis - Risk mapping, prevention, and mitigation strategies - Early warning systems and preparedness measures - Response mechanisms including search and rescue operations, emergency operation centers, and incident command systems - Recovery frameworks such as IDNDR, Yokohama Strategy, and Hyogo Framework.										**CO3**
UNIT-IV	**Disaster Management Framework in India**						**Periods: 09**			
Disaster profile of India including mega disasters and lessons learned - Disaster Management Act of 2005 - Institutional and financial mechanisms for disaster management in India - Role of government, NGOs, and inter-governmental agencies in disaster response.										**CO4**
UNIT-V	**Technology and Mitigation in Disaster Management**						**Periods: 09**			
Role of geo-informatics in disaster management - Disaster communication systems - Land use planning and development regulations for disaster resilience - Structural and non-structural mitigation measures.										**CO5**
Lecture Periods: 45		**Tutorial Periods:**		**Practical Periods: -**			**Total Periods: 45**			

Text Books

1. Disaster Management Guidelines (GOI-UND Disaster Risk Program) (2009-2012)
2. Introduction to International Disaster Management by Damon P. Copola (2006), Butterworth Heinemann.
3. Disaster Management and Risk Reduction: Role of Environmental Knowledge by A.K. Gupta, S.S. Niar, S. Chatterjee (2013), Narosa Publishing House.
4. Disaster Management by D.B.N. Murthy (2012), Deep & Deep Publications.
5. Managing Natural Disasters by S. Modh (2010), Macmillan Publishers.

Reference Books
1. Natural Hazards and Disaster Management: Vulnerability and Mitigation by R.B. Singh. 2. Disaster Management: Approaches in India by Paritosh Srivastava. 3. Management and Mitigation of Natural Disasters by Rajan Kumar Sahoo.
Web References
1. https://www.unisdr.org/ 2. http://www.fema.gov/about/regions/regionii/toolkit_risk.shtm. 3. http://www.colorado.edu/hazards/dr/currentdr.html

COs/POs/PSOs Mapping

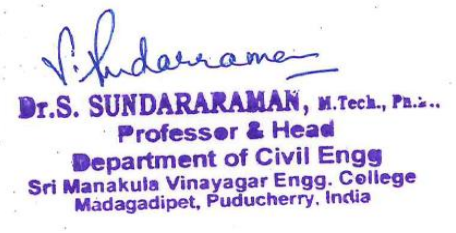
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	2	1	2	3	1	-	1	3	2	2	1
CO2	2	1	1	-	2	1	2	3	1	-	1	3	2	2	1
CO3	1	2	2	3	3	3	2	2	2	2	1	3	3	3	2
CO4	2	1	1	2	3	2	3	2	2	1	3	3	2	3	2
CO5	2	2	2	-	1	3	3	2	1	-	-	-	3	2	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**			Programme :**B.Tech.**				
Semester	**VIII**			Course Category Code: **PE**		End Semester Exam Type: **TE**		
Course Code	**U23CEE829**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Bridge Engineering**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the fundamentals, codes of practice and bridge failures.	**K2**
	CO2 Understand the estimation of forces for the design bridge structural elements	**K2**
	CO3 Design of the slab and girder beam bridges using appropriate method	**K4**
	CO4 Apply principles to design long-span bridges and modern bridge	**K3**
	CO5 Design of substructure components and bearing systems	**K4**

UNIT- I	**Introduction**	**Periods: 09**
Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations, bridge failures.		**CO1**
UNIT- II	**Loads on Bridges**	**Periods: 09**
Indian Road Congress (IRC) bridge codes – dimensions – dead and live loads – impact effect – wind and seismic forces – longitudinal and centrifugal forces – hydraulic forces – earth pressure – temperature effect and secondary stresses.		**CO2**
UNIT - III	**Slab and T – Beam Bridges**	**Periods: 09**
Design of slab bridges – skew slab culverts – box culverts. T –Pigeaud curves –Courbon's theory – Hendry Jaegar method design of T – beam bridges.		**CO3**
UNIT - IV	**Long Span Bridges**	**Periods: 09**
Design Principles of box girder bridges, balanced cantilever bridges, continuous girder bridges, Cable Stayed bridges and Suspension bridges- Design of Prestressed concrete bridges by Courbon's theory (Girder section only) – Design of Steel Concrete composite bridges by Courbons's theory (Girder section only)- Seismic Isolation and damping devices		**CO4**
UNIT - V	**Bearings and Substructure**	**Periods:09**
Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of Open and deep foundations (well foundation only).		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. **Essentials of Bridge Engineering** – D.J. Victor *Fundamental concepts, design principles, and construction techniques of bridges.*
2. **Bridge Engineering** – Ponnuswamy *Explains different types of bridges, load considerations, and construction techniques.*
3. **Concrete Bridge Practice: Analysis, Design and Economics** – V.K. Raina *Focuses on the design of reinforced and prestressed concrete bridges.*

Reference Books

1. Bridge Engineering Handbook – Wai-Fah Chen & Lian Duan.
2. Steel Bridges: Conceptual and Structural Design – Manfred Hirt & Jean-Paul Lebet.
3. Structural Analysis and Design of Tall Buildings and Bridges – Bungale S. Taranath.
4. Innovations in Bridge Engineering Technology– Khaled Mahmoud.

Web References

1. https://www.fhwa.dot.gov/bridge/nbi.cfm
2. https://www.fhwa.dot.gov/bridge/
3. https://www.fhwa.dot.gov/bridge/nbi.cfm

COs/POs/PSOs Mapping

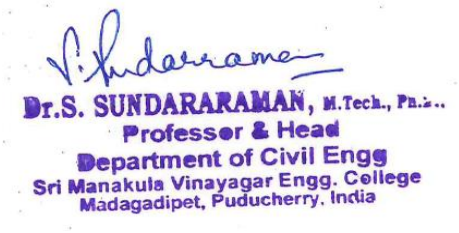
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
2	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
3	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
4	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2
5	1	2	-	3	-	1	-	-	-	-	-	1	2	-	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**					Programme: **B.Tech.**		
Semester	**VIII**					Course Category Code: PE	*End Semester Exam Type: TE	
Course Code	**U23CEE830**					Periods / Week	Credit	Maximum Marks
			L	T	P	C	CAM	ESE	TM
Course Name	**Smart City**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite									
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Describe the concept of smart city and associated challenges.						**K2**	
	CO2	Identify the planning and development of smart cities.						**K2**	
	CO3	Analyze the process of project management in smart cities.						**K2**	
	CO4	Understand the importance of infrastructure planning and development for smart cities.						**K2**	
	CO5	Learn about transportation system for smart cities						**K2**	

UNIT-I	**Introduction**	**Periods: 09**
Introduction to smart cities- Definition, dimensions, scope Smart Cities –Global Standards and Performance Benchmarks, Practice Code, Principal stakeholders, key trends in smart cities developments		**CO1**
UNIT-II	**Smart Cities Planning and Development**	**Periods: 09**
Planning for Urban Infrastructure, Introduction to city planning, key trends in smart cities developments, Sustainable features for smart cities. Role of Planner in the provision of urban networks for different services, Case Study.		**CO2**
UNIT-III	**Project management in Smart Cities**	**Periods: 09**
Phases, Stages of project and work break down Structure. Project organization structure, Planning, Scheduling and CPM. Project cost analysis, resource allocation & leveling, Line of balancing technique. Project monitoring and control, Project risk management.		**CO3**
UNIT-IV	**Infrastructure Planning and Development for smart Cities**	**Periods: 09**
Feasibility studies for infrastructure projects, planning for major infrastructure projects, Various Infrastructure Program and policies by MOUD, PPP (DBOOT, BOOT, etc.) in infrastructure projects. Dimension of smart cities, Financing smart cities development, Governance of smart cities, Smart Cities Regulations & Smart Techniques, Case Study.		**CO4**
UNIT-V	**Transportation system for Smart Cities**	**Periods: 09**
Urbanization and urban mobility, urban land use and transport. Concepts of sustainable mobility, public transportation, pedestrians and bicyclists and parking, fundamentals of the intelligent transportation systems (ITS), Case Study.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jo Beall (1997); “A city for all: valuing differences and working with diversity”; Zed books limited, London (ISBN: 1-85649-477-2).
2. UN-Habitat; “Inclusive and sustainable urban planning: a guide for municipalities”; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4).
3. Arup Mitra; “Insights into inclusive growth, employment and wellbeing in India”; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2
4. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf.

Reference Books

1. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany (ISBN: 0-87395-678-8)
2. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
3. "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development

Web References

1. IEEE Xplore (www.ieeexplore.ieee.org) – Research papers on smart infrastructure.
2. Springer & Elsevier Journals (www.springer.com, www.elsevier.com) – Civil engineering advancements in Smart Cities.
3. Smart Cities Mission (India) (https://smartcities.gov.in) – Updates on urban smart city projects.

COs/POs/PSOs Mapping

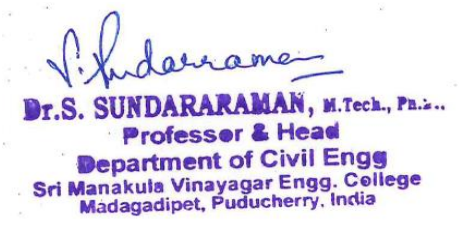
Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
2	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
3	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
4	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3
5	3	3	2	-	-	3	-	-	-	-	-	-	1	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus



Open Elective Courses Offered by Civil Department

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**V/VI**	Course Category Code: **OE**			*End Semester Exam Type: **TE**			
Course Code	**U23CEOC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Energy and Environment**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to ECE, ECE, MECH, BME, IT, Mechatronics)

Course Outcome		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Apply the knowledge of science & engineering to the contemporary issues of Energy for better humankind & environment	**K3**
	CO2	Identify, review & analyze the complex problems of Energy crises in environment	**K4**
	CO3	Designing solutions for the energy crises in the form of renewable energy systems to meet the needs by understanding the limitations	**K4**
	CO4	Understanding the impact of energy on environment and providing solutions for sustainable development.	**K5**
	CO5	Apply biomass energy under relevant technologies	**K3**

UNIT-I	**ENERGY**	**Periods: 09**	
Introduction, Importance of energy, role of energy consumption in economic and social transformation, Energy needs and crisis. Energy production and utilization. Types and classification of energy sources, Conventional & unconventional energy, Renewable sources & Nonrenewable sources of energy advantages, limitations, comparisons			**CO1**
UNIT-II	**ENVIRONMENT**	**Periods: 09**	
Impact of energy on economy &environment. Regional impacts of temperature change - Global warming, Greenhouse effect, Acid rain, Ozone layer depletion. Indian environment degradation, Environmental laws - Water Act-1974 (Prevention & control of pollution), The environment protection act 1986, Air act.			**CO2**
UNIT-III	**HYDROPOWER & GEOTHERMAL ENERGY**	**Periods: 09**	
Hydropower Energy – Introduction, Site selection, layout of hydro power plant, components & working, classifications, power station, structure and control. Geothermal Energy - Introduction, Site selection, layout of power plant, components & working, Advantages and disadvantages.			**CO3**
UNIT-IV	**SOLAR & WIND ENERGY**	**Periods: 09**	
Sun as source of energy - Introduction, Site selection, layout of power plant components & working, classifications, Types of collectors, collection systems efficiency, Solar cells. Wind Energy - Introduction, advantages/limitations, Site selection, layout of power plant, components &working, classification.			**CO4**
UNIT-V	**ENERGY AUDIT AND MANAGEMENT**	**Periods: 09**	
Introduction, advantages/limitations, Photosynthesis, biomass fuel, biomass gasification, biogas from waste biomass, factors affecting biogas generation, types of biogas plant, Biomass programme in India,			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Trivedi R.R. and Jalka K.R, “Energy Management”, Commonwealth Publication, 20177.
2. Diamant R.M.E., “Total Energy”, Pergamon, OxfordPublishers, 2017.
3. N.G. AJJANNA “ Energy auditing & demand side management” first edition, Gouthami Publications, Shimoga
4. Chakrabarti, M.L.Soni, P.V. Gupta,U.S. Bhatnagar “ Power system Engineering” 2001, DhanpatRai&Co, New Delhi.
5. D.P.Kothari, K.C Singal, Rajesh Ranjan, “Renewable Energy sources and Emerging Technologies” second edition , PHI , India

Reference Books

1. Boyle G, Everett B and Ramett J, “Energy systems and sustainability”, Oxford University Press, 2018
2. "Pollution Control Acts, Rules and Notifications", CPCB, Pollution Control series, PC/2/2014, Vol.I,2014
3. Peavy.H, Rowe.D, and Tchobanoglous, G., Environmental Engineering, Tata McGraw-Hill, 2013
4. S.Rao, Dr. BB Parulekar “Energy Technologies” Khanna Publications , New Delhi
5. David M Buchla, Thomas E Kissel, Thomas L Floyd “Renewable Energy systems” Pearson, India
6. Godfrey Boyle “Renewable Energy power for sustainable future” oxford Publications , New Delhi

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1. https://onlinecourses.nptel.ac.in/noc20_ce23/announcements
2. https://swayam.gov.in/nd1_noc20_ce23/preview
3. www.iucn.org
4. www.cites.org
5. www.thesummitbali.com/
6. http://engineering geology.gov.in/

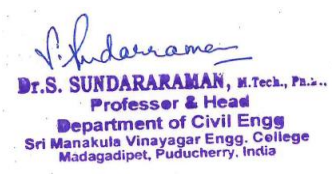
COs/POs/PSOs Mapping .

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**V/VI**	Course Category Code: **OE**			*End Semester Exam Type: **TE**			
Course Code	**U23CEOC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Energy Efficient Buildings**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
	(Common to ECE, ECE, MECH)							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concept and effects of global warming	**K2**
	CO2 Understand Climate system, earth's atmosphere and its components**.**	**K2**
	CO3 Analyze the Impacts of Climate Change on various sectors	**K4**
	CO4 Assess the concept about carbon credit and clean development mechanism	**K3**
	CO5 Understand climate changes, its impact and mitigation activities.	**K2**

UNIT-I	**INTRODUCTION**	**Periods: 09**
Energy consumption of building, Energy efficiency potential in buildings, Energy efficient building design (procedure), Energy efficient building technologies, energy efficient materials, certification of energy efficient building, cooling comfort in hot climates		**CO1**

UNIT-II	**ENERGY EFFICIENCY IMPLEMENTION**	**Periods: 09**
Energy efficiency policies, Target setting and stakeholder engagement, Various building codes and standards, Energy efficient building operation, Passive solar, Natural ventilation, Day lighting of building		**CO2**

UNIT-III	**ENERGY EFFICIENCY MEASUREMENT**	**Periods: 09**
Data and energy efficiency indicators, Evaluation of energy efficiency, The multiple benefits of energy efficiency. Electrical Energy Measurements, Thermal Energy Measurements, Mechanical & Utility System Measurements, Measurement & Verification. Case studies.		**CO3**

UNIT-IV	**ENERGY EFFICIENCY INVESTMENT**	**Periods: 09**
Energy efficiency investment – through policy, through project standardization, through procurement, through funding, finance and fiscal instruments, through energy markets. Case studies with cutting edge of sustainable construction.		**CO4**

UNIT-V	**ENERGY AUDIT AND MANAGEMENT**	**Periods: 09**
Definition, energy audit, need, types of energy audit. energy management (audit) approach - understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering, precautions, smart metering.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Ana-Maria Dabija, "Energy Efficient Building Design", Springer Nature, 2020
2. Dean Hawkes and Wayne Forster, "Energy Efficient Buildings", W.W. Norton & Company, 2002
3. Amritanshu Shukla, Atul Sharma, "Sustainability Through Energy-Efficient Buildings", CRC Press, 2018.
4. Ursula Eicker, "Energy Efficient Buildings with Solar and Geothermal Resources", John Wiley & Sons, 2014.
5. Jacob J. Lamb and Bruno Georges Pollet, "Energy-Smart Buildings: Design, Construction and Monitoring of Buildings for Improved Energy Efficiency", Institute of Physics Publishing, 2020

Reference Books

1. Umberto Desideri, Francesco Asdrubali, "Handbook of Energy Efficiency in Buildings: A Life Cycle Approach", Butterworth-Heinemann, 2019.
2. Susan Roaf and Mary Hancock, “Energy Efficient Building: A Design Guide”, Wiley, 1992
3. Xiaoqiang Zhai and Ruzhu Wang, "Handbook of Energy Systems in Green Buildings", Springer Berlin Heidelberg, 2018
4. Roberto Gonzalo, “Energy-efficient architecture”, Walter de Gruyter, 2012
5. José Manuel Andújar and Sergio Gómez Melgar, “Energy Efficiency in Buildings: Both New and Rehabilitated”, MDPI, 2020

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

COs/POs/PSOs Mapping

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **OE**			*End Semester Exam Type: **TE**			
Course Code	**U23CEOC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Disaster Management**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to EEE, ECE, CSE, IT, ICE, MECH, BME,CCE,AI&DS)

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Infer Disasters, man-made Hazards and Vulnerabilities	**K2**
	CO2 Summarize the flood management studies	**K2**
	CO3 Identify disaster mitigation and management mechanism	**K1**
	CO4 Estimate the disaster safety precaution	**K2**
	CO5 Determine the disaster plan and act	**K3**

UNIT-I	**DEFINITION AND TYPES**	**Periods: 09**
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		**CO1**

UNIT-II	**STUDY OF IMPORTANT DISASTERS**	**Periods: 09**
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.		**CO2**

UNIT-III	**MITIGATION AND MANAGEMENT**	**Periods: 09**
Concepts of risk management and crisis management - Disaster management cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness- Planning for relief.		**CO3**

UNIT-IV	**SAFETY PROCESS**	**Periods: 09**
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		**CO4**

UNIT-V	**PLANNING AND ACT**	**Periods: 09**
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		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

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

COs/POs/PSOs Mapping

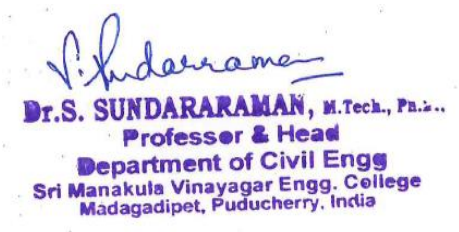
	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO2	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO3	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO4	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO5	3	2	3	2	3	3	2	-	2	2	2	3	1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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **OE**			*End Semester Exam Type: **TE**			
Course Code	**U23CEOC04**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Air Pollution and Solid Waste Management**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS)

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	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**

UNIT-I	**DEFINITION AND TYPES**	**Periods: 09**
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		**CO1**

UNIT-II	**STUDY OF IMPORTANT DISASTERS**	**Periods: 09**
Meteorological Aspects: Atmospheric stability, plume behavior, Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.		**CO2**

UNIT-III	**MITIGATION AND MANAGEMENT**	**Periods: 09**
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.		**CO3**

UNIT-IV	**SAFETY PROCESS**	**Periods: 09**
Introduction to solid waste management, sources, quantification and characterisation, classification and components, sampling and analysis, Method of collection.		**CO4**

UNIT-V	**PLANNING AND ACT**	**Periods: 09**
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.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
Professor & Head
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ANNEXURE IV

Honours / Minors Degree Programme

Green Technologies and Sustainable Engineering

Green Technologies and Sustainable Engineering												
Sl. No	**Sem**	**Course Code**	**Course Title**	**Category**	**Course Type***	**Periods**			**Credits**	**Max. Marks**		
						L	**T**	**P**		**CAM**	**ESM**	**Total**
1	**IV**	**U23GXT401**	Energy, Environment and Renewable Energy Technologies	PC/IC	T	3	0	0	3	25	75	100
2	**V**	**U23GXT502**	Sustainable Energy Systems	PC/IC	T	3	0	0	3	25	75	100
3	**VI**	**U23GXB603**	Green Technologies & Renewable Energy Systems	PC/IC	B	3	0	2	4	50	50	100
4	**VII**	**U23GXB704**	Sustainability in the Built Environment	PC/IC	B	3	0	2	4	50	50	100
5	**VIII**	**U23GXT805**	Green Management	PC/IC	T	3	0	0	3	25	75	100
6	**VIII**	**U23CXW806**	Project work	PC/IC	PA	0	0	4	2	50	50	100
Total Credits									19	225	375	600
Equivalent NPTEL Courses**												
1	**IV**	Energy, Environment and Renewable Energy Technologies		Environmental Chemistry					3	12 Weeks Course		
2	**IV**			Environmental Modeling and Simulation					3			
3	**V**	Sustainable Energy Systems		Sustainable Engineering Concepts and Life Cycle Analysis					3			

**The students shall be given to earn 3 credits through one 12-week NPTEL course (Equivalent) Instead of any one theory course listed for Honour/Minor degree programme and shall be completed before the commencement of eight semester. The equivalent course are subject to change based on its availability a per NPTEL Course List.

* T - Theory, B – Theory cum Practical, PA – Project Work

The students shall be given to earn 3 credits through one 12 week NPTEL course (Equivalent) Instead of any one theory course listed for Honour/Minor degree programme and shall be completed before the commencement of eight semester. The equivalent course are subject to change based o its availability a per NPTEL Course List.

Department	Civil Engineering			Programme: Honours/Minors				
Semester	IV			Course Category Code: PC		End Semester Exam Type: TE		
Course Code	U23CEX401	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Energy Environment and Renewable Energy Technologies	3	0	0	3	25	75	100

Prerequisite: Environmental Science

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Understand the nexus between energy, environment and sustainable development	K4
CO2	Appreciate energy ecosystems and its impact on environment	K4
CO3	Learn basics of various types of renewable and clean energy technologies.	K4
CO4	Serve as bridge to advanced courses in renewable energy	K4
CO5	Understand about energy and economics.	K4

UNIT- I	ENERGY	Periods: 09
Introduction to the nexus between energy, environment and sustainable development, Energy sources over view and classification, sun as the source of energy, fossil fuel reserves and resources - overview of global/ India's energy scenario. Energy consumption models – Specific Energy Consumption.		CO1

UNIT- II	ECOLOGY AND ENVIRONMENT	Periods: 09
Concept and theories of ecosystems, - energy flow in major man-made ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and the environment - environmental laws on pollution control, The environmental protection act: Effluent standards and ambient air quality, innovation and sustainability, eco-restoration: phyto-remediation.		CO2

UNIT - III	RENEWABLE SOURCES OF ENERGY	Periods: 09
Solar Energy: Solar radiation: measurements and prediction. Indian's solar energy potential and challenges, solar energy conversion principles and technologies: Photosynthesis, Photovoltaic conversion and Photo thermal energy conversion. Wind Energy: Atmospheric circulations, atmospheric boundary layers, classification, factors influencing wind, wind shear, turbulence, wind energy basics and power Content, wind speed monitoring, Betz limit, wind energy conversion system: classification, characteristics and applications. Ocean Energy: Ocean energy resources-ocean energy conversion principles and technologies: ocean thermal, ocean wave & ocean tide. Bioenergy: resources and types.		CO3

UNIT - IV	OTHER ENERGY SOURCES AND SYSTEMS	Periods: 09
Hydropower, Nuclear fission and fusion-Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; hydrogen energy, Magneto-hydro-dynamic (MHD) energy conversion – Radioisotope Thermoelectric Generator (RTG), Bio-solar cells, battery & super capacitor, energy transmission and conversions		CO4

UNIT - V	ENERGY AND ECONOMY	Periods: 09
Energy and Economics: gross domestic product (GDP) and energy – energy market and society – energy efficiency – energy – energy and economics – energy: security – equity – environmental sustainability index and global measure		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. Loulou, Richard; Waaub, Jean- Philippe,"Energy and Environment Set: Mathematics of Decision Making", Zaccour, Georges (Eds.), 2005.

2. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A "Energy and the Environment", 2nd Edition, John Wiley, 2006.

Reference Books
1. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, 2000.
2. Solar Energy: principles of Thermal Collection and Storage, S.P. Sukhatme, Tata McGraw-Hill (1984).
3. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000.
4. Wind Energy Conversion Systems, L.L. Freris, Prentice Hal 1990.
5. Geothermal Energy: From Theoretical Models to Exploration and Development by Ingrid Sober and Kurt Bucher, Springer, 2013.
6. Ocean Energy: Tide and Tidal Power by R. H. Charlier and Charles W. Finkl, Springer 2010

COs/POs/PSOs Mapping

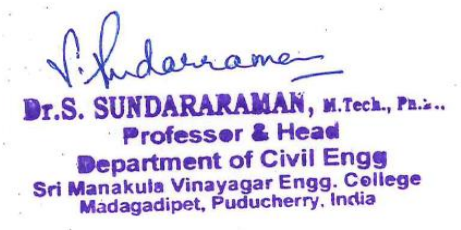
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3
2	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
3	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
4	2	3	-	1	2	3	3	1	-	1	-	2	-	-	3
5	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus



Department	**Civil Engineering**			Programme: **Honours/Minors.**				
Semester	**VI**			Course Category Code: **PC**		End Semester Exam Type: **TE**		
Course Code	**U23CEX502**			Periods/Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**Sustainable Energy Systems**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Environmental Science									
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)	
	CO1	Analyze the energy landscape and sustainability to provide solutions to energy problems using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.							**K4**	
	CO2	Analyze solar and wind energy systems to solve the complex energy problems using appropriate tools and techniques following relevant standards considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.							**K4**	
	CO3	Analyze biomass, geothermal, tidal and wave energy systems to solve the complex energy problems using appropriate tools and techniques following relevant standards considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.							**K4**	
	CO4	Analyze electric storage technology systems to solve the complex energy problems using appropriate tools and techniques following relevant standards and latest developments considering society, health, environment, sustainability and economics besides communicating effectively in graphical form							**K4**	
	CO5	Analyze grid integration of renewable energy to solve the complex energy problems using appropriate tools and techniques following relevant standards considering society, health, environment, sustainability and economics besides communicating effectively in graphical form.							**K4**	
UNIT- I	**THE ENERGY LANDSCAPE AND SUSTAINABILITY**								**Periods: 09**	
Current global energy use, National and international energy consumption and related greenhouse gas emissions, Lifetime of fossil fuels, Sustainability and energy use, Energy conversion technologies, Energy forms and conversion, First and second laws of thermodynamics and efficiencies; Devices - Heat engines, Refrigerators, Heat pumps; Instantaneous and average power										**CO1**
UNIT- II	**SOLAR AND WIND ENERGY**								**Periods: 09**	
Principles of solar radiation, Resource foundations, Technology challenges, Sustainability, Solar energy industry and economics, Net Metering; Origin of the wind, Power in the wind, Wind resource basics, Wind energy technologies, Challenges, Sustainability, Wind energy Industry.										**CO2**
UNIT - III	**BIOMASS, GEOTHERMAL, TIDAL AND WAVE ENERGIES**								**Periods: 09**	
Sources of feedstocks; Biofuels - Bioethanol, Biodiesel, Algal, Jatropha and Biogas; Conversion technology, Diesel and ethanol, Biogas, Electricity production, Transportation, Challenges, Sustainability, Economics; Geothermal energy - Principles, Geothermal potential and technology, Electricity production, Conversion technology, Challenges, Economics; Tidal and wave energies, Conversion technologies, Sustainability.										**CO3**
UNIT - IV	**ELECTRICITY STORAGE TECHNOLOGIES**								**Periods: 09**	
Introduction, Battery energy storage technologies - Lithium-ion batteries, Full cells, Nickel-based batteries, Lead-acid batteries, Sodium-sulfur batteries; Hydro energy storage - Applications of pump hydro energy storage plant, Site selection for pump hydro energy storage plant; Thermal energy storage, Capacitors and applications, Latest developments										**CO4**
UNIT - V	**GRID INTEGRATION OF RENEWABLE ENERGY**								**Periods: 09**	
Variability, Intermittency and dispatchability, Electric grid infrastructure, Integrating renewable energy into the grid, Growing a more efficient grid, The smart grid, Secure communication in the smart grid; Cogeneration plant and power distribution in industry, Micro grids.										**CO5**
Lecture Periods: 45		**Tutorial Periods: 15**		**Practical Periods: -**					**Total Periods: 60**	

Text Books

1. Boyle, Godfrey, "*Renewable Energy: Power for a Sustainable Future"*, Oxford University Press, 3rd Edition, 2012.
2. efferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, William A. Peters, "*Sustainable Energy (Choosing Among Options)"*, MIT Press, 2nd Edition, 2012.

Reference Books

1. Gilbert M. Masters, "*Renewable and Efficient Electric Power Systems"*, John Wiley &Sons, Inc., Hoboken, New Jersey, 2nd Edition, 2013
2. Vanek, F.M., Albright, L.D., "*Energy Systems Engineering - Evaluation and Implementation"*, McGraw-Hill, 2nd Edition, 2008.
3. David MacKay, "*Sustainable Energy: Without the Hot Ai"r*, UIT Cambridge Ltd., Cambridge, England, 2009.
4. Frank Kreith, "*Principles of Sustainable Energy Systems*," , CRC Press, Taylor and Francis group, 2nd Edition, 2014.

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
1	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3
2	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
3	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
4	2	3	-	1	2	3	3	1	-	1	-	2	-	-	3
5	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
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Department	**Civil Engineering**			Programme: **Honours/Minors.**			
Semester	**V**			Course Category Code: **PC**		End Semester Exam Type: **TE**	
Course Code	**U23CEX603**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Green Technologies & Renewable Energy Systems**	**2**	**0**	**2**	**4**	**25**	**75**	**100**
Prerequisite	Environmental Science							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Analyze cleaner development mechanism (CDM).	**K4**
	CO2	Understand various aspects of green buildings	**K4**
	CO3	Analyze renewable energy systems as a part of green technology	**K4**

UNIT- I	**CLEANER DEVELOPMENT MECHANISM**	**Periods: 10**
Cleaner development mechanisms, role of industry; reuse, reduce and recycle, raw material substitution; wealth from waste; carbon credits, carbon trading, carbon sequestration, eco labeling; Oxidation technology for waste water treatment- Cavitation, Fenton chemistry, photocatalysis and hybrid processes.		**CO1**
UNIT - II	**GREEN BUILDINGS & SUSTAINABLE URBANIZATION**	**Periods: 10**
Basic Features, advantages & limitations, Energy efficient buildings- methods for increasing energy efficiency of buildings, building components, ventilation system, Energy need and supply, use of solar photovoltaic system and sun-tracking system, Sustainable cities, Sustainable transportation.		**CO2**
UNIT - III	**RENEWABLE ENERGY**	**Periods: 10**
Various renewable energy sources, Solar Energy Systems: Solar radiations data; Solar energy collection, Storage and applications, Hydro Energy Systems: Resource assessment of micro and small hydro power: WindEnergy Systems, bio-fuels, fuel cells.		**CO3**

List of Experiments:

1. Calculate the carbon footprint of a small business
2. Calculate the carbon footprint of a household
3. Design a rainwater harvesting system for a small community
4. CAD software for sustainable building design
5. cost-benefit analysis for a solar farm
6. Life cycle assessment (LCA) tools

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. M. Lancaster, “Green Chemistry – An introductory text”, RSC.
2. Rashmi Sanghi and M.M. Srivastava, “Green Chemistry-Environment Friendly Alternatives”, NarosaPublishing House, New Delhi 2009.

Reference Books

1. Paul L. Bishop, Pollution prevention –Fundamentals and Practices, McGraw-Hill- international 2000
2. Mili Majumdar, “Energy Efficient Buildings in India”’ Tata Energy Research Institute.
3. Volker Quaschning, “Understanding Renewable Energy Systems”.
4. Abbasi & Abbasi, “Renewable Energy Sources and Their Environmental Impacts”, Prentice Hall of India.
5. B.H Khan, “Non conventional energy resources”, Tata McGraw-Hill, New Delhi 2006.

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
1	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3
2	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
3	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
4	2	3	-	1	2	3	3	1	-	1	-	2	-	-	3
5	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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Semester	VII	Course Category Code: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23CEX704**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Sustainability in the Built Environment**	**2**	**0**	**2**	**4**	**25**	**75**	**100**

Prerequisite	Environmental science		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Analyze sustainable urban development to solve problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form	**K4**
	CO2	Analyze sustainable site planning to solve complex problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.	**K4**
	CO3	Analyze sustainable buildings to solve complex problems associated with the built environment using appropriate tools and techniques following relevant standards considering society, health and environment besides communicating effectively in graphical form.	**K4**

UNIT - I	**SUSTAINABLE BUILDINGS**	**Periods: 10**
Introduction to sustainable buildings and standards, Green buildings, Energy efficiency and sustainability; Passive House; Net Zero Energy Buildings (NZEB), Examples of different types of NZEB.		**CO3**
UNIT - II	**BUILDING ENVELOPE AND SERVICES**	**Periods: 10**
Building envelope effect and energy efficiency measures, Renewable energy integration, Sustainable building services, Sustainable construction and materials, Integrated design, Energy use and CO2, Built environment - Aging and susceptibility to natural disasters.		**CO4**
UNIT - III	**MANAGEMENT OF SUSTAINABLE BUILT ENVIRONMENT**	**Periods: 10**
Life cycle planning, Measuring sustainability; Facilities management – Waste management, Improved amenities, Improved transport infrastructure, social mix, Accessibility issues, Cultural and historical issues.		**CO5**

List of Experiments:

1. Develop a sustainable transportation plan for a small community
2. Conduct an energy audit of a small building or facility.
3. Develop an energy-saving plan and present findings
4. Conduct an energy efficiency audit for a building.
5. Energy audit of a small building or home
6. Energy modeling software - **eQUEST**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. Alison Cotgrave and Mike Riley, "*Total Sustainability in the Built Environment"*, Macmillan Education, 1st Edition, 2012.
2. Kevin Lynch and Gary Hack, "*Site Planning"*, MIT Press, 3rd Edition, 1984.

Reference Books

1. William McLean and Pete Silver, "*Environmental Design Source Book: Innovative Ideas for a Sustainable Built Environment"*, RIBA Publishing, 1st Edition, 2021.
2. Tim Dixon, John Connaughton, Stuart Green, "*Sustainable Futures in the Built Environment to 2050: A Foresight Approach to Construction and Development"*, John
3. Rob Fleming, Saglinda H Roberts, "*Sustainable Design for the Built Environment"*, Routledge Press, London, 1st Edition, 2019

4. Charles J. Kibert, "*Sustainable Construction: Green Building Design and Delivery",* Wiley,4th Edition, 2021.

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
1	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3
2	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3
3	2	3	-	1	2	3	3	1	-	1	-	-	-	-	3
4	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3
5	2	3	-	1	2	3	3	1	-	1	2	-	-	-	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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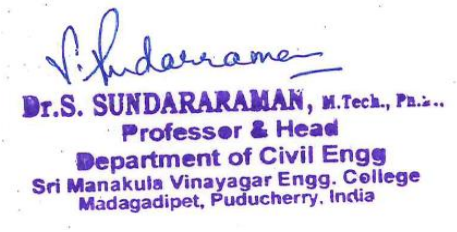
Annexure V

R2023 - Chosen Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23CEE401	Composite Structures
2	U23CEE402	Environmental Law and Policy
3	U23CEE403	Building Services
4	U23CEE404	Remote Sensing and GIS
5	U23CEE405	Alternative Building Materials and Technologies



Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: **CC**			*End Semester Exam Type: **TE**			
Course Code	**U23CEE405**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Alternative Building Materials and Technologies**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	**Building Material and Construction**							

Course Outcome			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Understand the various energies involved in the construction	**K2**
	CO2	Understand the different types alternative materials	**K2**
	CO3	Identify various eco-friendly materials	**K2**
	CO4	Recognize suitable alternative building technologies	**K2**
	CO5	Apply the cost concept involved in the planning of construction	**K3**

UNIT-I	**Introduction**	**Periods: 09**	
Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Environmental friendly and cost-effective building technologies, Requirements for buildings of different climatic regions.			**CO1**
UNIT-II	**Sustainable Materials**	**Periods: 09**	
Characteristics of building blocks for walls - Stones and Laterite blocks - Bricks and hollow clay blocks - Concrete blocks - Stabilized mud blocks - Fal-G Blocks - Manufacture of stabilized blocks.			**CO2**
UNIT-III	**Alternative Building Materials**	**Periods: 09**	
Fibre reinforced concretes – Types: metal and synthetic - Properties and applications - Fibre reinforced plastics – Types: organic and synthetic - Properties and applications. Building materials from agro and industrial wastes - Types of agro wastes - Types of industrial and mine wastes - Properties and applications			**CO3**
UNIT-IV	**Alternative Building Technologies**	**Periods: 09**	
Alternatives for wall constructions, composite masonry, confined masonry, cavity walls, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique, 3D Printing Technology. Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs			**CO4**
UNIT-V	**Machines & Planning Control**	**Periods: 09**	
Machines for manufacture of concrete, Equipment for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

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

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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Chosen Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U20CEE611	Rock Engineering
2	U20CEE612	Intellectual Property Rights
3	U20CEE613	Shoring scaffolding and Form Work
4	U20CEE614	Municipal Solid Waste Management
5	U20CEE615	Design of Industrial Structures

Chosen Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CEE821	Structural Dynamics and Earthquake Engineering
2	U20CEE822	Housing - Planning and Management
3	U20CEE823	Tall Structures
4	U20CEE824	Industrial Waste Disposal and Treatment
5	U20CEE825	Prefabricated Structures
Chosen Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20CEE826	Coastal and Offshore Structures
2	U20CEE827	Pavement Engineering
3	U20CEE828	Repair and Rehabilitation of Structures
4	U20CEE829	Environmental Impact Assessment
5	U20CEE830	Pre- Stressed Concrete Structures

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U20CEE614	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	C	Hrs
		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. AarneVesilind (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 Tchobanoglouset.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 FrankKreith (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

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U20CEE825 PREFABRICATED STRUCTURES

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

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

Course Outcomes

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

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

UNIT I INTRODUCTION (9 Hrs)

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

UNIT II PREFABRICATED COMPONENTS (9 Hrs)

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

UNIT III DESIGN PRINCIPLES (9 Hrs)

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

UNIT IV JOINT IN STRUCTURAL MEMBERS (9 Hrs)

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

UNIT V DESIGN FOR ABNORMAL LOADS (9 Hrs)

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse

Text Books

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

Reference Books

1. R.T.L. Allen, S.C. Edwards, and J.D.N. Shaw, “The Repair of Concrete Structures”, Blackie Academic & Professional, 2005
2. Walter F. Silva-Araya. Oladis T. De Rincon and Luis Pumarada O’Neill, “Repair and Rehabiliation of Reinforced Concrete Structures”, ASCE Publications, 1997.

3. Anibal Costa, Joao Miranda Guedes, Humberto Varum, “Structural Rehabilitation of Old buildings”, Springer, 2014
4. V.M. Malhotra,”Repair, Rehabiliation and Maintenance of Concrete Structures, and innovations in design and construction”, American Concrete Institute, 2000
5. Thomas Dyer, “Concrete Durability”, CRC Press, 2014

Web References

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

COs/POs/PSOs Mapping

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

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

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U20CEE828 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

This course should enable the students to

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

Course Outcomes

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

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

UNIT I MAINTENANCE AND REPAIR STRATEGIES (9 Hrs)

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

UNIT II DAMAGE DIAGNOSIS AND ASSESSMENT (9 Hrs)

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

UNIT III REPAIR TECHNIQUES (9 Hrs)

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

UNIT IV CORROSION OF STEEL IN CONCRETE (9 Hrs)

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

UNIT V STRENGTHENING OF CONCRETE STRUCTURES (9 Hrs)

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

Text Books

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

Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

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ANNEXURE VI

Mandatory Course

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23CEM202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sports Yoga and NSS**	0	0	2	Non-Credit	100	-	100
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility and relaxation.	**K2**
	CO2 Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	**K2**
	CO3 Develop understanding of psychological problems associated with age and lifestyle.	**K2**
	CO4 Recognize the importance of national service in community development.	**K2**
	CO5 Convert existing skills into socially relevant life skills.	**K2**

UNIT-I	**Introduction to Physical Education**	**Periods: 06**	
Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education **Physical Fitness, Wellness and Lifestyle:** Importance of Physical Fitness and Wellness - Components of Physical fitness - Components of Health-related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.			**CO1**
UNIT-II	**Yoga and Lifestyle**	**Periods: 06**	
Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures – Hypertension – Obesity - Back Pain-Diabetes - Asthema.			**CO2**
UNIT-III	**Training and Planning in Sports**	**Periods: 06**	
Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination. **Psychology and Sports** - Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies			**CO3**
UNIT-IV	**Introduction to National Service Scheme**	**Periods: 06**	
Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc.,			**CO4**
UNIT-V	**Community issues and the use of technology**	**Periods: 06**	
Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages.			**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Brar Ajmer Singh, Gill Jagtar Singh, Bains Jagdish, “Modern Textbook of Physical Education Health and Sports- I”, Kalyani Publishers , 6th Edition, 2014
2. B.K.S. Iyengar, “Light on Yoga: The Definitive Guide to Yoga Practice”,Thorsons Publishers, Thorsons Classics edition, 2015.
3. Joseph, Siby K, Mahodaya, “Bharat Essays on Conflict Resolution”, Institute of Gandhian Studies Publishers, 2007
4. Barman Prateeti , Goswami, “Document on Peace Education”, Triveni Akansha Publishing House, New Delhi, 2009
5. Prof R.B.S. Verma, “Field Work Practicum in Social Work-Emerging Concerns”, Rapid Publisher, Lucknow, 2020
6. Sibereisen, K , Richard M, “Lerner Approaches to Positive Youth Development”, Sage Publications, New Delhi, 2007
7. 7. Hoshiar Singh, “Administration of Rural Development in India”,Sterling Publisher, the University of Michigan, 2009

Web References

1. http://www.thebetterindia.com/140/national-service-scheme-nss
2. http://en.wikipedia.org/wiki/national-service-scheme 19=http://nss.nic.in/adminstruct
3. http://nss.nic. in
4. http://socialworknss.org/about.html
5. Young Journal on Youth published by SAGE: http://you.sagepub.com

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
Professor & Head
Department of Civil Engg
Sri Manakula Vinayagar Engg. College
Madagadipet, Puducherry. India

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: SEC				*End Semester Exam Type: **-**		
Course Code	U23CES402	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MS Office – Word, Excel, Power Point**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

UNIT-I	Introduction to MS Office and Word Processing	**Periods: 06**

Overview of MS Office Suite: Applications and features. Getting Started with MS Word: Interface, navigation, and basic tools, Document Creation: Formatting text, paragraphs, and pages. Styles and Templates: Applying and customizing templates for professional documents. Advanced Features: Mail merge, hyperlinks, bookmarks, and table of contents.

UNIT-II	**Advanced MS Word Features**	**Periods: 06**

Tables and Charts: Creating and formatting tables, embedding charts. Collaboration Tools: Track changes, comments, and sharing options. Document Protection: Password protection, editing restrictions. Printing and Exporting: Print setup, exporting as PDF, and file compatibility.

UNIT-III	**Introduction to MS Excel and Data Management**	**Periods: 06**

MS Excel Basics: Interface, navigation, and workbook structure. Data Entry and Formatting: Working with cells, rows, columns, and ranges. Formulas and Functions: Basic arithmetic, logical functions (IF, SUM, AVERAGE).

Sorting and Filtering Data: Techniques for organizing large datasets.

UNIT-IV	**Advanced Excel and Data Visualization**	**Periods: 06**

Charts and Graphs: Creating bar, line, pie charts, and sparklines. Pivot Tables and Pivot Charts: Summarizing and analyzing data. Conditional Formatting: Highlighting data trends and patterns. Data Validation and Protection: Creating drop-down lists and securing data. Macros: Introduction to automation using macros.

UNIT-V	**MS PowerPoint – Creating Professional Presentations**	**Periods: 06**

Basics of MS PowerPoint: Interface, slide layouts, and themes. Content Creation: Adding text, images, tables, and charts, Transitions and Animations: Applying effects to slides and objects. Presentation Tools: Slide show settings, speaker notes, and rehearsal. Tips for Effective Presentations: Design principles, consistency, and engagement.

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Evaluation Method

Assessment	**Internal Assessment Marks (CAM)**			**Total Marks**
	Attendance	**Report**	**Presentation/Demo/Skil Test**	
Marks	10	40	50	100

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.
Professor & Head
Department of Civil Engg
Sri Manakula Vinayagar Engg. College
Madagadipet, Puducherry, India

Department	**Civil Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: MC			*End Semester Exam Type: **-**			
Course Code	U23CEM404	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Right to Information and Good Governance**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

UNIT-I	Introduction	**Periods: 06**

Conceptual background — Right to know — Open Government — Transparency in governance and accountability — Right to information under the Indian Constitution - Article 19 (1Xa) and Article 21 of the Constitution — Role of NGOs and movement for right to information — Right to Information Act, 2005 — Scope and objectives.

UNIT-II	Obligation of Public Authorities	**Periods: 06**

Obligations of public authorities: Section 4. Designation of Public Information Officers: Section 5

Disposal of request: Section 7. Exemption from disclosure of information: Section 8.Grounds for rejection to access in certain cases. Section 9.Severability: Section 10.Third party information: Section I1

UNIT-III	**Central and State Information Commission**	**Periods: 06**

Constitution of Central and State Information Commissions, Terms of office and conditions of service, Removal of Chief Information Commissioner or Information Commissioner,Powers and functions of Information Commissions.

UNIT-IV	**Judiciary and Right to Information Act**	**Periods: 06**

Protection of right to access the information — Role of the Supreme Court and High Courts —Recent attempts of dilution of the right to information Law

UNIT-V	**Right to Information Act, 2005 and its relevance to other laws**	**Periods: 06**

Public Records Act, 1993.Whistle Blowers Protection Act, 2014.Official Secrets Act, 1923

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Evaluation Method

Assessment	**Internal Assessment Marks (CAM)**			**Total Marks**
	Attendance	**Report**	**Presentation/Demo/Skil Test**	
Marks	10	40	50	100

Dr.S. SUNDARARAMAN, M.Tech., Ph.D.,
Professor & Head
Department of Civil Engg
Sri Manakula Vinayagar Engg. College
Madagadipet, Puducherry, India

U20CEM606	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C	Hrs
		2	0	0	-	30

Course Objectives

This course should enable the students to

- To get a knowledge in Indian Culture
- To Know Indian Languages and Literature and the fine arts in India
- To explore the Science and Scientists of Medieval and Modern India

Course Outcomes

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

CO1 - Understand philosophy of Indian culture.
CO2 - Distinguish the Indian languages and literature.
CO3 - Learn the philosophy of ancient, medieval and modern India.
CO4 - Acquire the information about the fine arts in India.
CO5 - Know the contribution of scientists of different eras.

UNIT I INTRODUCTION TO CULTURE

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT II INDIAN LANGUAGES, CULTURE AND LITERATURE

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature

UNIT III RELIGION AND PHILOSOPHY

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING)

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Reference Books

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”, ISBN:81246033375,2005
2. “Science in Samskrit”, Samskrita Bharti Publisher,ISBN13:978-8187276333,2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450494-X,200
4. S.Narain,“ExaminationsinancientIndia”,AryaBookDepot,1993
5. SatyaPrakash,“FoundersofSciencesinAncientIndia”,VijayKumarPublisher,1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978-8120810990,2014

ANNEXURE VII

EXAMINERS SELECTION CRITERIA

1. Professors with Ph.D. and 5 Years Experience

List of colleges

1. Vellore Institute of Technology, Vellore
2. Puducherry Technological University
3. SRM Institute of Science and Technology
4. IIT
5. NIT
6. Annamalai University
7. Bharath Institute of Higher Education and Research
8. University College of Engineering, Panruti
9. Hindustan College of Engineering and Technology
10. Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Avadi, Chennai
11. Saveetha Engineering College
12. Dr.M.G.R Educational and Research Institute
13. VNR Vignana Jyothi Institute of Engineering and Technology
14. Meenakshi College of Engineering,
15. CK College of Engineering and Technology, Cuddalore
16. SNS College of Technology, Coimbatore