Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF CIVIL ENGINEERING

Curriculum Structure and Syllabus of Minors in Sustainable Waste Management for Smart Cities (Course 2020)

Effective from Academic Year 2023-24

Institute Vision

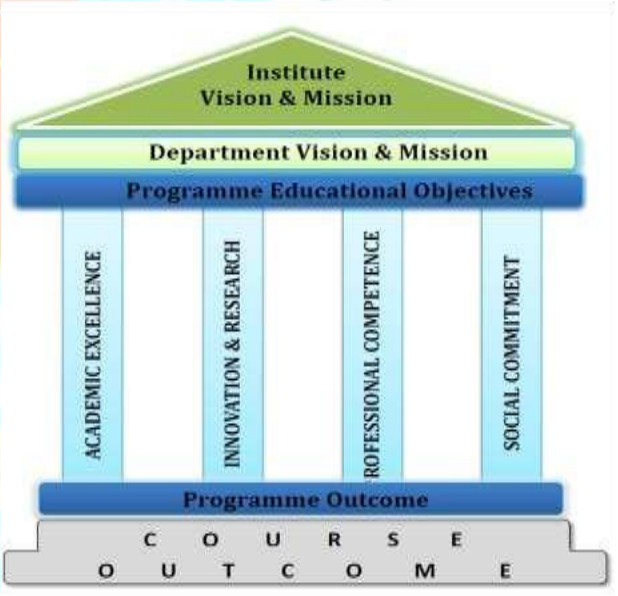
- To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations

Quality Policy

We at PCCOE are committed to impart to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of- the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



Pimpri Chinchwad Education Trust's
Pimpri Chinchwad College of Engineering

Department of Civil Engineering

Course Approval Summary

A) Board of Study- Department of Civil Engineering

Sr.No.	Name of the Course	Course Code	Semester	Page Number	Signature and stamp of BOS
1	Municipal Solid Waste Management in Smart City	MCI5991	V	5	
2	Solid Waste Engineering Lab – I	MCI5992	V	7	
3	Hazardous and e- Waste Management	MCI6991	VI	9	
4	Solid Waste Engineering Lab – II	MCI6992	VI	10	
5	Industrial Waste Management	MCI7991	VII	12	
6	Seminar	MCI7992	VII	14	
7	Mini Project	MCI8991	VIII	16	

Approved by Academic Council

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

Approved by Board of Governors:

Chairman, Board of Governor
Pimpri Chinchwad College of Engineering

Preface

Looking at Global Scenario to enhance the employability skills and impart deep knowledge in emerging/ multidisciplinary areas, an additional avenue is provided to passionate learners through the Minors and Honours Degree Scheme in academic structure.

For **Minors degree** program, student has to earn additional 20 credits in multidisciplinary areas of other domains.

Objectives of Minors Degree

• To impart knowledge in multidisciplinary areas.
• To provide effective yet flexible options for students to achieve basic to intermediate level competence in the multidisciplinary area.
• To enhance the employability skills through different combinations in the diverse fields of engineering.
• To provide an academic mechanism for fulfilling multidisciplinary demands of industries.
• To provide a strong foundation to students aiming to pursue research/ higher studies in an interdisciplinary field of study.

Preface of Minors in Sustainable Waste Management for Smart Cities

Worldwide the cities are planned and developed or converted into smart cities. Smart city will focus on solving majority of the problems of urbanization by use of information and communication technologies (ICT). One of the challenges these cities will have to handle is of scientific treatment and disposal of the waste generated by its dwellers i. e municipal solid waste (MSW)

The minor course designed by the Civil Engineering Department will help students in developing the understanding of the problems related to MSW, scientific data collection and estimation of the quantities that will be generated. The course will also make student capable of designing the compositing system. The course will further impart the knowledge of waste to energy systems, other various treatment and disposal technologies for MSW. The course will develop the holistic understand of the landfills, its construction and operations.

Objectives:

1. To develop understanding of problems of solid waste, its characteristics and estimation of quantity of solid wastes.
2. To impart the knowledge of solid mathematics, science, and engineering for effective solid waste collection systems, for waste collection route optimization and its economics.
3. To build concept of design of composting systems, maintain and operate composting process for effective organic waste recycling.
4. To develop understanding of waste to energy system and design of bio-methanation and incineration system.
5. To develop understand construction and operations of landfill facilities and management of legacy solid waste.

Outcomes:

After learning the course, the students should be able to:

1. Develop outline solid waste management systems with respect to its generation rate (quantity), sampling, characteristics and regulatory/legal requirements.
2. Explain and suggest relevant method of storage, collection and transportation of solid waste for the given site condition with justification.
3. Develop understanding of technological applications for processing and material recovery from solid waste with its economics and design composting system for organic waste.
4. Describe the fundamental and technological aspects of waste to energy systems from solid waste and to design anaerobic digester and incineration system.
5. Outline the operation, and maintenance of sanitary landfill and management of legacy waste.
6. Explain the functional element for management of special waste and suggest the relevant method of reuse and recycling for the given type of waste in the given situation.

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LIST OF ABBREVIATIONS IN CURRICULUM STRUCTURE

Sr. No.	Abbreviation	Expansion
1.	L	Lecture
2	P	Practical
3	T	Tutorial
4	H	Hours
5	CR	Credits
6	IE	Internal Evaluation
7	MTE	Mid Term Evaluation
8	ETE	End Term Evaluation
9	TW	Term Work
10	OR	Oral
11	PR	Practical
12	PROJ	Project

Curriculum Structure

Minors in
Sustainable Waste Management for Smart Cities

CURRICULUM STRUCTURE

For Minors in Sustainable Waste Management for Smart Cities

(Civil Engineering)

Semester	Course Code	Course Name	Teaching Scheme					Evaluation Scheme						
			L	P	T	H	CR	IE1	IE2	ETE	TW	PR	OR	Total
V	MCI5991	Municipal Solid Waste Management in Smart City	3	-	-	3	3	20	30	50	-	-	-	100
V	MCI5992	Solid Waste Engineering Lab – I	-	4	-	4	2	-	-	-	50	-	-	50
VI	MCI6991	Hazardous and e-Waste Management	3	-	-	3	3	20	30	50	-	-	-	100
VI	MCI6992	Solid Waste Engineering Lab – II	-	4	-	4	2	-	-	-	50	-	-	50
VII	MCI7991	Industrial Waste Management	3	-	-	3	3	20	30	50	-	-	-	100
VII	MCI7992	Seminar	-	4	-	4	2	-	-	-	50	-	-	50
VIII	MCI8991	Mini Project	-	10	-	10	5	-	-	-	100	-	50	150
		Total	**9**	**22**	**-**	**31**	**20**							**600**

L- Lecture, T- Tutorial, P- Practical, H-Hours, CR- Credit, CIE-Continuous Internal Evaluation, IE – Internal Evaluation, MTE – Mid Term Examination, ETE – End Term Examination, TW – Term Work, PR- Practical Exam, OR – Oral Exam

Course Syllabus

Semester- V

Minors in

Sustainable Waste Management for Smart Cities

Program:	Minors in Sustainable Waste Management for Smart Cities			Semester:	V		
Course:	Municipal Solid Waste Management in Smart City			Code:	MCI5991		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE1	IE2	ETE	Total
3	-	3	3	20	30	50	100

Pre-requisite:
Environmental studies

Objectives:

1. To develop understanding of problems of solid waste, its characteristics and estimation of quantity of solid wastes.
2. To impart the knowledge of solid mathematics, science, and engineering for effective solid waste collection systems, for waste collection route optimization and its economics.
3. To build concept of design of composting systems, maintain and operate composting process for effective organic waste recycling.
4. To develop understanding of waste to energy system and design of bio-methanation and incineration system.
5. To develop understand construction and operations of landfill facilities and management of legacy solid waste.

Outcomes:
After learning the course, the students should be able to:

1. Develop outline solid waste management systems with respect to its generation rate (quantity), sampling, characteristics and regulatory/legal requirements.
2. Explain and suggest relevant method of storage, collection and transportation of solid waste for the given site condition with justification.
3. Develop understanding of technological applications for processing and material recovery from solid waste with its economics and design composting system for organic waste.
4. Describe the fundamental and technological aspects of waste to energy systems from solid waste and to design anaerobic digester and incineration system.
5. Outline the operation, and maintenance of sanitary landfill and management of legacy waste.
6. Explain the functional element for management of special waste and suggest the relevant method of reuse and recycling for the given type of waste in the given situation.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction to Solid Waste Management (SWM)** Definition, objectives of SWM, impacts of improper SWM, functional outlines of SWM, sources and types of solid waste. MSW: sampling, refuse analysis, composition, characteristics, generation rate, factors affecting generation rate, estimation of quantity of solid waste. Sustainable solid waste management for smart cities, role of urban local bodies in waste management, objectives and importance of MSW Rules 2016, rules and regulations of SWM in developed countries	8
2.	**Collection & Transportation of Solid Waste** Integrated solid waste management, storage, different methods of collection, collection systems, transfer and transportation of solid waste, uses of radio frequency identification (RFI)/global positioning system (GPS) for tracking vehicles location, optimization of route, measurement and methods of measuring solid waste, economics of solid waste collection and transport.	7
3.	**Processing and Transformation of Solid Waste** Decentralized system v/s centralized system, source reduction, segregation and salvage, material recovery facility centres, resource recovery of bye-products, recycling and reuse of solid waste, use of solid waste as raw materials in industry, value added products, recycling and carbon credits, economics of solid waste processing, circular economy in waste management, composting.	7
4.	**Waste to Energy** Bio-methanation: design of anaerobic digester. Energy content of MSW, estimation of low and high heating value (LHV, HHV), theory and types of incinerators, design of incineration plant. Pyrolysis, refused derived fuel (RDF), plasma gasification: working principle, energy recovery, advantages, limitations and applications, environmental impacts of waste to energy: dioxins, furans, heavy metals etc.	8

5.	**Disposal of Solid Waste** Landfill: Introduction, components of land filling, types of land filling, site selection, acceptable waste, construction techniques, maintenance and precautions, leachate and landfill gas: estimation, management, treatment and disposal/reuse, control of contamination of ground water,operation monitoring, closure and end-use, concept of bioreactor landfill: principle, types, applications. Legacy waste management or biomining: concept, methods, applications,economics and time duration.	**7**
6.	**Government Initiatives- Solid Waste Management** Swachh Survekshan and its impact on the SWM scenario in India, National Urban Livelihood Missions (NULM) and its role in SWM, social entrepreneurship, Swachhta & Rural Engagement cell (SESREC): government of India initiatives, success stories of SWM in India.	**8**
	Total	**45**

Text Books:

1. Integrated Solid Waste Management: Engineering Principles and Management Issues, George Tchobanoglous, Hilary Theisen, Samuel Vigil, Tchobanoglous George, Vigil Samuel, McGraw-Hill Companies, Incorporated.
2. Solid waste management, Dr. A.D. Bhide
3. Solid Waste Management, Sasikumar K and Sanoop Gopi Krishna, PHI.

Reference Books:

1. Solid waste Engineering, Vesilind P. A., Worrell W and Reinhart, Thomson Learning Inc., Singapore.
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

Program:	Minors in Sustainable Waste Management for Smart Cities			Semester:	V		
Course:	Solid Waste Engineering Lab – I			Code:	MCI5992		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	H	TW	OR	PR	Total
4	-	2	4	50	-	-	50

Objectives:

1. To impart knowledge to determine characteristics of solid waste
2. To develop understanding of identification of problems in solid waste and suggest solution to it.

Outcomes:

After learning the course, the students should be able to:

1. Determine the physical and chemical characteristics of solid waste.
2. Estimate future solid waste generation rate and quantity.
3. Identify problems of solid waste and propose different solutions to it.

Detailed Syllabus:

1. Report of site visit to municipal solid waste management: Housing society/village/town/city.
2. Practical identification of impacts and problems of improper management of municipal solid waste.
3. Practical sampling methods and characterization study of municipal solid waste: present and future trend, estimation of quantity of refuse.
4. Determine moisture content and volatile solids for organic faction of municipal solid waste by using oven and muffle furnace.
5. Determine carbon/ nitrogen/ phosphorous content of manure produced from composting process or organic faction of municipal solid waste.
6. Determine calorific value of municipal solid waste by using bomb calorimeter.
7. Practical/theoretical determination of municipal solid waste generation rate and estimation of quantity of MSW for present and future scenario
8. Preparation of a report based on field visit or case study to study use of smart technologies in solid waste management sector (sensors for segregation of waste using of VTS /GPS/ RFID system and reverse vending machine installed at bus station, railway station.)

Reference Books:

1. Integrated Solid Waste Management: Engineering Principles and Management Issues, George Tchobanoglous, Hilary Theisen, Samuel Vigil, Tchobanoglous George, Vigil Samuel, McGraw-Hill Companies, Incorporated.
2. Solid waste management, Dr. A.D. Bhide
3. Solid Waste Management, Sasikumar K and Sanoop Gopi Krishna, PHI.
4. Solid waste Engineering, Vesilind P. A., Worrell W and Reinhart, Thomson Learning Inc., Singapore.
5. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000

Course Syllabus

Semester- VI

Minors in

Sustainable Waste Management for Smart Cities

Program:	Minors in Sustainable Waste Management for Smart Cities			Semester:		VI	
Course:	Hazardous and e- Waste Management			Code:		MCI6991	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE1	IE2	ETE	Total
3	-	3	3	20	30	50	100

Pre-requisite:

1. Environmental studies
2. Municipal solid waste management in smart Cities.

Objectives:

1. To provide the knowledge on basics of hazardous waste and its management.
2. To impart the knowledge of chemical, physico-chemical and biological treatment of hazardous waste.
3. To develop the understanding of the landfill design.
4. To impart knowledge on fundamentals and management of E-Waste with respect to recovery of resources
5. To develop the understanding of control measures for reduction of E-waste at source.

Outcomes:

After Completing this course, student will be able to:

1. To define the hazardous waste and explain its management.
2. To explain various chemical , physico-chemical and biological treatments for hazardous waste
3. To design the landfill for the hazardous waste.
4. To explain the fundamentals and management of E-Waste with respect to resource recovery and control measures for reduction of E-waste at source

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Hazardous Waste Management – Fundamentals** Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects. Objectives and key points of Hazardous Waste Management Rules, 2016.	8
2.	**Physico-chemical Treatment of Solid and Hazardous Waste** Chemical treatment processes for HW (combustion, stabilization and solidification of hazardous wastes); physico-chemical processes for hazardous wastes (soil vapour extraction, air stripping, chemical oxidation); ground water contamination and remediation.	7
3.	**Biological Treatment of Solid and Hazardous Waste** Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.	7
4.	**Landfill design** Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration	8
5.	**E-waste: Fundamentals and management** Introduction, toxicity due to hazardous substances in e-waste and their impacts, guidelines for environmentally sound management of e-waste, domestic e-waste disposal, e-waste management, technologies for recovery of resource from electronic waste occupational and environmental health perspectives of recycling e-waste in India. Objectives and key points of E-Waste Management Rules – 2016.	7
6.	**E-waste: Control measures** Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance ofRules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source.	8
	Total	45

Text Books:

1. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
2. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.

Reference Books:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. Johri R., "E-waste: implications, regulations, and management in India and current global best practices", TERI Press, New Delhi

Program:	Minors in Sustainable Waste Management for Smart Cities				Semester:	VI	
Course:	Solid Waste Engineering Lab – II				Code:	MCI6992	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	H	TW	OR	PR	Total
4	-	2	4	50	-	-	50

Objectives:

1. To develop understanding of identification of problems in hazardous waste & e-waste and suggest solution to it.
2. To develop ability to note critical observations and interpret them for waste management activities.

Outcomes:

After Completing this course, student will be able to:

1. Identify problems of hazardous waste and propose different solutions to it
2. Identify problems of e-waste and propose different solutions to it.
3. Prepare a site visit report including critical observations and interpretation regarding the visited site.

Detailed Syllabus:

1. Study of developing value added products form waste.
2. Identify any hazardous waste problem and suggest appropriate solution.
3. Prepare a report for management of e-waste based field visit.
4. Prepare a report for management of hazardous waste based on field visit.
5. Report on MSW management by NGO/ ULBs for zero waste management concepts.
6. Prepare a report based on filed visit or case study for pay as you pollute or extended producer responsibility (EPR) behavioral analysis in solid waste management.

Reference Books:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.
4. Johri R., “E-waste: implications, regulations, and management in India and current global best practices”, TERI Press, New Delhi

Course Syllabus

Semester- VII

Minors in

Sustainable Waste Management for Smart Cities

Program:	Minors in Sustainable Waste Management for Smart Cities			Semester:	VII		
Course:	Industrial Waste Management			Code:	MCI7991		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE1	IE2	ETE	Total
3	-	3	3	20	30	50	100

Pre-requisite:

1. Environmental Studies
2. Municipal Solid Waste Management for smart cities
3. Hazardous and E-Waste Management

Course Objectives:

1. To develop understanding of classification and segregation of industrial waste.
2. To impart the knowledge of construction and demolition waste management.
3. To build the concept of physical, chemical and biological treatment methods for residue form industries.
4. To impart the knowledge of waste management audit and its significance
5. To build the concept of plastic waste management.

Outcomes:

After learning the course, the students should be able to:

1. Explain fundamental concepts of industrial waste and construction and demolition waste management
2. Understand physical, chemical and biological treatment methods for residue form industries
3. Describe necessity and standards of waste management audit.
4. Explain the plastic waste management practices.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction:** Impact of Industrial Waste on the society and environment. Environmental standards applicable to industrial units. Segregation and classification of waste from the industries. Treatment and disposal methods.	8
2.	**Construction and Demolition Waste (C&D waste):** Introduction, characteristic, Storage of C&D waste, collection and transportation, 3R concept, Disposal.	7
3.	**Residual waste management from industries and treatment plants:** Physical, chemical and biological characteristics of residues from industries and treatment plants; Treatment methods- physical, chemical and biological treatment methods; Disposal methods	7
4.	**Treatment Process of Industrial Effluent** Equalization, neutralization, removal of suspended and dissolved organic solids, chemical oxidation, adsorption, removal of dissolved inorganics, combined treatment of industrial and municipal wastes, residue management, dewatering, disposal	8
5.	**Waste management audit:** Necessity for internal audit, standards for audits, audit planning, materiality and sampling, internal control overview of compliance, Evaluate the Economics of Pollution Prevention, Environmental Audit, understanding of rules and regulations, documentation procedures, recordkeeping requirements.	7
6.	**Plastic waste:** Plastic Waste – Sources, Production, Global and Indian Context; Plastic Waste Management Practices – Plastic management- recycling, energy production, landfilling, other application.	8
	Total	45

Text Books:

1. Frank Woodard, (2001). Industrial Waste Treatment Handbook. Elsevier, USA
2. T. T. Shen, “Industrial Pollution Prevention”, Springer

Reference Books:

1. Tchobanoglous G., Theisen H., and Vigil S.A. (2014). Integrated Solid Waste Management, Engineering Principles and Management Issues, 2nd Ed., McGraw-Hill, USA
2. John Pichtel (2014). Waste Management Practices: Municipal, Hazardous and Industrial, 2nd Ed., CRC Press, USA
3. Vesilind, P.A., and Worrell W. A. (2016) Solid Waste Engineering, 2nd Ed., Cengage India 4. Peavy, H.S, Rowe, D.R., and Tchobanoglous, G., (2017).
4. Environmental Engineering, Indian ED, McGraw Hill Inc., India
5. Tchobanoglous G., Frank Kreith., (2002). Hand Book of Solid Waste Management, 2nd Ed., McGraw Hill, USA.
6. CPHEEO (2016). Manual on Municipal Solid Waste Management, Ministry of Urban Development, India.
7. R.L. Stephenson and J.B.Blackburn, Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New York

Program:	Minors in Sustainable Waste Management for Smart Cities			Semester:	VII		
Course:	Seminar			Code:	MCI7992		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	H	TW	OR	PR	Total
4	-	2	4	50	-	-	50

Detailed Syllabus:

Objectives:

1. To work on a specific technical topic in solid waste management, in order to acquire the skills for technical communication.
2. To acquire technical writing abilities for seminars and conferences.

Outcomes:

After learning the course the students should be able to:

1. Identify and define a problem statement in the area of sustainable solid waste management
2. Evaluate literature in the area of research and establish scope of work.
3. Develop and suggest the solution for the problem statement defined.
4. Prepare technical report.

Guidelines:

1. Individual student need to study recent topics in the field of solid waste management under the guidance of allocated guide.
2. The extensive literature survey, mathematical modeling of particular method, experimentation and valuable conclusion is expected from seminar study.
3. Seminar Report should be submitted as a compliance of term work.
4. Technical paper publication as an outcome of seminar is appreciated.
5. Total Duration: 24 Contact Hours and additional 24 Hours should be spent by students on completion of related activities and requirements.

Course Syllabus

Semester- VIII

Minors in

Sustainable Waste Management for Smart Cities

Program:	Minors in Sustainable Waste Management for Smart Cities			Semester:		VIII
Course:	Mini Project			Code:		MCI8991
Teaching Scheme				Evaluation Scheme		
Practical	Tutorial	Credit	H	TW	OR	Total
10	-	5	10	100	50	150

Detailed Syllabus:

Objectives:

1. To plan for various activities of the project and channelize the work.
2. To analyze, design and implement real time application using available platforms.

Outcomes:

After learning the course the students should be able to:

1. Understand, plan and execute a Mini Project.
2. To apply various methods, techniques, software necessary for solid waste management
3. Prepare a technical report based on the Mini project.

Guidelines:

1. Individual student needs to design and demonstrate Mini-project under the guidance of allocated guide.
2. Students can choose the project considering implementation in the career prospects.
3. The use of various technical methods, techniques and software is necessary
4. Mini-Project Report should be submitted as a compliance of term work.
5. Paper publication associated with mini-project as research outcome is appreciable.

Vision and Mission of the Civil Engineering Department

Vision of the Department

To be recognized as one of the leading department in respect of professional education and innovation in the western region.

Mission of the Department

To develop a multidisciplinary approach to relate civil engineering challenges to social and human context through team spirit, right attitude, morals, and higher education.

PEOs of Civil Engineering

I. To impart sound academic fundamentals among the students to formulate, analyze and solve civil engineering problems.
II. To develop student's ability to adopt and apply recent trends in civil engineering.
III. To prepare students for the challenging needs of civil engineering profession and higher academic pursuits.
IV. To develop professional ethics among students for functioning as an individual or in a team for betterment of society and environment.

PSOs of Civil Engineering

I. The graduate will be able to apply necessary Civil Engineering skill sets for quality construction work in industrial and infrastructural development.
II. The graduate will be able to demonstrate skill sets required for entrepreneur in Civil Engineering