



# Programme Specifications

M. Tech. Programme

Programme:  
Environmental Engineering and  
Management

Department:  
Civil Engineering

Faculty of Engineering & Technology  
M.S. Ramaiah University of Applied Sciences

### Programme Specification

<b>Programme: M. Tech. in Environmental Engineering Management</b>	
Faculty	Engineering and Technology
Department	Civil Engineering
Programme	M tech in Environmental Engineering management
Dean of Faculty	Dr H.M. RajashekarSwamy
HOD	Dr H.M. RajashekarSwamy

	<b>1. Title of the Award</b>
	Mtech in Environmental sanitation and waste management
	<b>2. Modes of study</b>
	Both Full Time and Part Time
	<b>3. Awarding Institution / Body</b>
	M. S. Ramaiah University of Applied Sciences – Bengaluru, India
	<b>4. Joint Award</b>
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	<b>5. Teaching Institution</b>
	Faculty of Engineering & Technology
	M S Ramaiah University of Applied Sciences - Bengaluru, India
	<b>6. Date of Programme Specification</b>
	DD/MM/YYYY
	<b>7. Date of Programme Approval by the Academic Council ofMSRUAS</b>
	DD/MM/YYYY
	<b>8. Next Review Date</b>
	DD/MM/YYYY
	<b>9. Programme Approving Regulatory Body and Date of Approval</b>
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	<b>10. Programme Accrediting Body and Date of Accreditation</b>
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	<b>11. Grade Awarded by the Accreditation Body</b>
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	<b>12. Programme Accreditation Validity</b>
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	<b>13. Programme Benchmark</b>
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	<b>14. Rationale for the Programme</b>
	<p>Civil Engineering is primarily infrastructure development involving planning, design, construction, and operation of facilities essential to modern life, ranging from transit systems to offshore structures to space satellites. Major disciplines within civil engineering that are closely interrelated are Structural, Environmental, Geotechnical, Water Resources, Transportation, Construction and Urban Planning.</p> <p>Until recently Civil Engineering teaching was limited to Planning, Analysis, Design and Execution of different types of infrastructure like buildings, roads, bridges, dams and power plants. However, increasing technological sophistication and demand for higher living standards fulfilled by economic growth and concerns about environmental impact have changed the scope of Civil Engineering curriculum.</p> <p>Sanitation generally refers to hygiene and deals with the provision of facilities for the safe disposal of human waste. Sanitary engineering is a sub branch of environmental engineering dealing with matters affecting public health and methods to improve sanitation of human communities, primarily by providing the removal and disposal of human waste, and in addition to the supply of safe potable water.</p> <p>Rate of urbanization in the developing countries as elsewhere has increased in the recent decades. This has resulted in mega cities in these countries having a staggering share of 80% in world's megacities in recent decades. Population is expected to double in next two decades resulting in high concentration of people in urban areas. This will place enormous pressure on local environment and resources, requiring high demands on clean water and sanitation.</p> <p>The explosive growth in urbanization and the massive rural to urban migration necessitated the requirement of rational approaches towards sustainable management of urban drainage, sanitation provision to urban poor, waste collection and its treatment for proper disposal or reclamation / reuse. Services and programmes that include proper waste disposal methods for management of hazardous biological and chemical wastes, minimization and recycling will be needed.</p> <p>Developing countries are still in the transition towards better waste management but they currently have insufficient collection and improper disposal of wastes. The authorities in the developing countries are crippled by the lack of proper and scientific approach towards the waste management mainly due to the increasing generation of waste. In this scenario, most acute and relevant issues related to sanitation and waste management require special attention so that innovative and sustainable solutions can be formulated.</p> <p>With a lot of stress on reducing carbon emission and interdependencies between resources, an Engineer needs world-class skill base coupled with flair for innovation and understanding of the interdependencies between resources and infrastructural demands. This can be done only by inculcating multidisciplinary skills in water supply, sanitary, environmental and public health aspects.</p> <p>Even though there are a large number of institutions in India producing Engineers, there is a shortage of quality multidisciplinary Engineering graduates. The FET at MSRUAS would</p>

	<p>like to offer interdisciplinary postgraduate Engineering programmes to produce imaginative, creative and innovative Engineers.</p> <p>MSRUAS is offering Environmental sanitation and waste management programme at the post graduate level. The graduates will get opportunities in water supply and waste-water companies, municipal assemblies, government ministries and consulting companies dealing with water supply, sanitation and municipal infrastructure. They will be effective and efficient problem solvers providing economical and sustainable infrastructure solutions in India and abroad.</p>
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### 15. Programme Aim

The aim of the programme is to produce postgraduates with advanced knowledge and understanding of Sanitation Engineering and Waste Management; higher order critical, analytical, problem solving and transferable skills; ability to think rigorously and independently to meet higher level expectations of industry, academics, research or take up entrepreneurial route.

Students will be able to apply the knowledge, understanding and skills acquired to carry sustainable Solid Waste and Wastewater Management through Research and Technological Inputs. Students also will be capable to carry out engineering design, simulation, analysis, synthesis and evaluation of Waste treatment processes and equipment. Curriculum also Emphasises on adopting imaginative and creative approach in resource conservation and resource efficiency through waste prevention and by recovering valuable material and/or energy from waste.

### 16. Programme Objectives

The objectives of the programme are to train and educate the students on the following:

1. Explain the role of sanitation in the urban water cycle and its relation to public health and environment
2. Critically analyse, assess and evaluate various urban drainage and sewerage schemes, and wastewater, sludge and solid waste treatment process technologies
3. Suggest options for waste reduction at source so as to reduce quantities of wastegenerated
4. Develop rational approaches towards sustainable wastewater management via pollution prevention
5. Design Sewage and solid waste treatment plant
6. Choose from an array of options to turn waste into economic goods
7. Develop a solid waste management scheme for an urban area
8. Planning and controlling a waste treatment project cost including cost estimating, risk analysis, determination of contingencies, progress reporting and value engineering
9. Knowledge of IT tools and Apply modern tools for technology selection and to model sanitation components
10. Teamwork, lifelong learning and continuous improvement

### 17. Intended Learning Outcomes of the Programme

The Intended Learning Outcomes (ILOs) are listed under four headings:

1. Knowledge and Understanding, 2. Cognitive Skills 3. Practical Skills and 4. Capability / Transferable Skills.

#### 1. Knowledge and Understanding

After undergoing this programme, a student will be able to:

KU1: Understand and explain the role of sanitation in the urban water cycle and its relation to public health and environment; Understand the relevant physical, chemical and

- biological processes and their mutual relationships within various sanitation components
- KU2: Describe the factors critical in planning and designing a Sanitation and waste management system to achieve needed safety, quality, durability, sustainability, and economic objectives
- KU3: Explain formulation, planning, scheduling, cost and quality control, safety, environmental factors, services, maintenance and safety systems in Sanitation Engineering and Waste Management
- KU4: Discuss advantages, disadvantages and limitations of various treatment, disposal and energy recovery technologies

## 2. Cognitive Skills

After undergoing this programme, a student will be able to:

- CS1: Design and develop rational approaches towards sustainable wastewater management via pollution prevention and processes of sub systems/components of a project to meet the overall specifications of the project
- CS2: Analyse and propose Holistic approach to waste management changes essential for solving a broad set of engineering problems in sanitation considering societal and economic impacts to achieve needed safety, quality, sustainability, and economic objectives
- CS3: Critically analyse, assess and evaluate various waste treatment and disposal processes, systems, services and schemes
- CS4: Apply modern tools for technology selection and to model sanitation components.

## 3. Practical Skills

After undergoing this programme, a student will be able to:

- PS1: Produce tender and contract documents along with the ability to carry out estimation of costs and expenditures during all stages of a sanitation project
- PS2: Use appropriate software packages relevant to Sanitation Engineering and Waste Management
- PS3: Conduct physical tests to evaluate performance of materials and equipment
- PS4: Conduct independent research including field work, and laboratory research;

## 4. Capability / Transferable Skills

After undergoing this programme, a student will be able to:

- TS1: Manage information, develop technical reports and make presentations
- TS2: Build, Manage and Lead a team to successfully complete a project and communicate across teams and organizations to achieve professional objectives
- TS3: Work under various constraints to meet project targets
- TS4: Adopt to the chosen profession by continuously upgrading his/her knowledge and understanding through Life-long Learning philosophy

**18. Programme Structure**

The Programme consists of four terms as shown below. A student is required to successfully complete the following courses and earn credits for the award of the degree.

Complete details of each of the courses such as ILO's, content, resources, teaching-learning processes and other related information are outlined in Course Specification of the respective programme.

**( Please add course and credit details accordingly : Total 42 credits : 06 core courses total 26 credits and 4 elective courses total 16 credits spread in first two semesters)**  
**SEMESTER 1**

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	20ESC501A	Public Health Engineering	3	1	2	5	100
2	20ESC502A	Modern Methods of Waste Characterization	3	1	-	4	100
3	20ESC503A	Waste Water Treatment Plant Design	4	1	--	5	100
4	20ESE51XA	<i>Refer Elective Course Table</i>	4	--	--	4	100
5	20ESE52XA	<i>Refer Elective Course Table</i>	4	--	--	4	100
6	20FET508A	Research Methodology & IPR	2	--	--	2	50
7	20FET509A	Professional Communication	1	--	--	0	
<b>Total</b>			<b>20</b>	<b>3</b>	<b>2</b>	<b>24</b>	<b>550</b>
<b>Total number of contact hours per week</b>			<b>25 hours</b>				
<b>Number of credits can be registered</b>			<b>Minimum</b>	<b>19</b>	<b>Maximum</b>	<b>24</b>	

**SEMESTER 2**

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	20ESC511A	Solid waste and hazardous waste management	3	1	--	4	100
2	20ESC512A	Solid waste and hazardous waste treatment plant design	3	1	--	4	100
3	20ESC513A	Environmental biotechnology	3	1	--	4	100
4	20ESE53XA	<i>Refer Elective Course Table / MOOC</i>	4	--	--	4	100
5	20ESE54XA	<i>Refer Elective Course Table / MOOC</i>	4	--	--	4	100
6	20FET510A	Value Education	1	--	--	0	
7	20ESP502A	Group Project (Start)	--	--	3	--	--

	<b>Total</b>	<b>18</b>	<b>3</b>	<b>3</b>	<b>20</b>	<b>500</b>
	<b>Total number of contact hours per week</b>	<b>24 hours</b>				
	<b>Number of credits can be registered</b>	<b>Minimum</b>	<b>16</b>	<b>Maximum</b>	<b>20</b>	

**SEMESTER 3**

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
3	20ESP501A	Internship / Other activities as specified	--	--	10	4	100
4	20ESP502A	Group project	--	--	12	8	200
<b>Total</b>					<b>22</b>	<b>12</b>	<b>300</b>
<b>Total number of contact hours per week</b>			<b>22 hours</b>				
<b>Number of credits can be registered</b>			<b>Minimum</b>	<b>12</b>	<b>Maximum</b>	<b>12</b>	

**SEMESTER 4**

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	20ESP511A	Dissertation and Publication			24	24	400
<b>Total</b>					<b>24</b>	<b>24</b>	<b>400</b>
<b>Total number of contact hours per week</b>			<b>24 hours</b>				
<b>Number of credits can be registered</b>			<b>Minimum</b>	<b>24</b>	<b>Maximum</b>	<b>24</b>	

Elective Courses List			
Stream / Specialization	S. No.	Course Code	Course Title
Stream -1: Environmental pollution and control	E11	20ESE511A	Air pollution and Control
	E12	20ESE512A	Toxicology and environmental risk assessment
	E13	20ESE513A	Environmental remediation of contaminated sites
	E14	20ESE514A	Aquatic biodiversity and environmental pollution
Stream-2: energy efficiency	E21	20ESE521A	Energy in built environment
	E22	20ESE522A	Renewable energy sources and environmental Impact
	E23	20ESE523A	Alternative fuels
	E24	20ESE524A	Industrial and commercial applications of renewable energy sources
Stream-3: Waste management	E31	20ESE531A	Rural water supply and sanitation
	E32	20ESE532A	Integrated waste management in smart cities
	E33	20ESE533A	Entrepreneurship in waste management
	E34	20ESE534A	Transport process and modeling of aquatic system
	E41	20ESE541A	Geo-environmental engineering

Stream-4: Interdisciplinary	E42	20ESE542A	Remote sensing and GIS in environmental engineering
	E43	20ESE543A	Treatment Plants Operations and Maintenance
	E44	20ESE544A	Environmental policies and legislation

### 19. Programme Delivery Structure

A Programme is delivered from Monday to Saturday of the week as per the Time-Table for every batch.

### 20. Teaching and Learning Methods

The course delivery comprises of a combination of few or all of the following:

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory/Field work/Workshop
6. Industry Visit
7. Seminars
8. Group Exercises
9. Project Exhibitions
10. Technical Festivals

### 21. Courses

Programme has six Professional core courses (PM1- PM6), four Professional elective courses (PE1 – PE4), two audit courses (NC), and one compulsory course (CC) followed by Group Project, Internship and Dissertation & Publication courses.

Core courses (PC1- PC6) are Programme Specialization courses which normally include both theory and laboratory sessions. Alternate activities are planned in case of laboratory sessions do not exist in a course.

Compulsory course (CM) is Research Methodology and IPR course which is mandatory.

All courses of the programmes are categorized as indicated in the **Annexure I**.

### 22. Electives

### Electives

There are 4 electives (PE1 – PE4) in the programme. The electives are grouped such a way that a student can choose a set of electives to specialize in a chosen field/stream. However, if the student wishes to opt for elective course that spans multiple streams, the case may be considered subject to the affordability of academic logistics and approval by the course leader, HODs and Deans.

For every elective offered, there will be a minimum and a maximum number of registrations that is decided by the department.

There is also a provision for the students to choose PE3 and PE4 through on-line mode such as MOOC's, SWAYAM, NPTEL and other equivalent platforms. The guidelines prescribed by the University for such courses to be adhered to. The student can also earn 3 or 4 credits by participating in the international competitions like technical presentation/ conference/ publications in the journal etc and winning the award in that. In that case he/she can be exempted from one of the elective courses of the programme.

### 23. Group Project

The main objective of group project is to provide an ambiance to work in groups towards achieving a common goal. A group shall have up to 5 students. In case of Group Project work is based on interdisciplinary in nature, team can be constituted with members from across departments of the Faculty.

The students are required to develop a report for assessment and also need to demonstrate the working of the product. The IPR rights of all such work lies with the University only. The project should be approved by a committee constituted by respective HoDs before the start of the project. For further details related to the Group Project refer to Course Specification of the respective programmes



**24. Industry Internship/Other Activities**

A student can opt for an internship in an industry, a business or research organization during the course.

Alternately, can undertake a mini-project requiring self-directed study that can be perused within the affiliated Faculty.

Prior approval of the internship / mini-project by the HoD and Dean is mandatory. It is also necessary for the student to submit a report and make a presentation to the members of the panel constituted by the HoD for assessment.

For further details related to this course, please refer to Course Specification of the respective programmes.

**25. Dissertation and Publication**

This course has two parts – Dissertation and Publication.

Every student, has to undertake the dissertation work individually on a chosen relevant topic. The topic needs to be approved by the committee constituted by HoD.

Publication is a stage wherein dissertation work of the student is converted into a technical paper to be published in reputed conferences/journals.

For further details related to the this course refer to Course Specifications of the respective programmes

**26. Course Assessment**

1. Every course will be assessed for a weight of 100%
2. There are two components-Component-1 and Component-2
3. Component-1 carries a weight of 50% and Component -2 carries a weight of 50%
4. Component -1 (CE) is subdivided into Term Tests , Assignments and laboratory examinations/ technical presentation  
Test carry 25 Marks  
Assignment carry 50 Marks.  
Laboratory assessment/ technical presentation carry 25 Marks  
Total 100 marks will be reduced to 50 Marks.
5. Component -2 (SEE) is Written Examination for 100 Marks. It will be reduced to 50 Marks.
6. A minimum of overall 40% is required for a pass with 40% in each of the Components
7. The marks distribution for each course is given in the programme structure-section 20. Other flexibilities(exceptions) as per the programme regulations

**27. Failure in Course and Makeup Examinations**

Makeup Examinations are provided for the students who are not able to meet all pass criteria prescribed for a course during the regular term and fail in the course.

For further details related to makeup examination, please refer to M.Tech. Programme Academic Regulations document.

**28. Attendance**

Please refer to M.Tech. Programme Academic Regulations document for attendance requirements and condonation related details.

**29. Award of Grades**

As per the M.Tech. Programme Academic Regulations document.

**30. Student Support for Learning**

Students are provided with various facilities to support learning such as the following:

1. Course notes
2. Reference books in the library
3. Magazines and Journals
4. Internet facility
5. Computing facility
6. Laboratory facility
7. Workshop facility

8. Staff support
9. Lounges for discussions
10. Any other support that enhances their learning

**31. Quality Control Measures**

Following are the Quality Control Measures:

1. Review of course notes
2. Review of question papers and assignment questions
3. Student Feedback Analysis
4. Moderation of assessed work
5. Opportunities for the students to see their assessed work
6. Review by external examiners and external examiners reports
7. Staff Student Consultative Committee meetings
8. Student exit feedback analysis
9. Subject Assessment Board (SAB)
10. Programme Assessment Board (PAB)

## 32. Curriculum Map

Course Code	Intended Learning Outcomes											
	Knowledge and Understanding				Cognitive (Thinking) Skills (Critical, Analytical, Problem Solving, Innovation)				Practical Skills			
	KU 1	KU 2	KU3	KU4	CS1	CS2	CS3	CS4	PS1	PS2	PS3	PS4
19ESC501A	X	X	X	X								
19ESC502A	X	X	X	X							X	X
19ESC503A	X	X	X	X	X	X	X	X	X	X	X	X
19ESE511A	X	X	X	X	X		X		X			
19ESE521A	X	X	X	X	X		X		X			
19ESE531A	X	X	X	X	X		X		X			
19ESE541A	X	X	X	X	X		X		X			
19ESE512A	X	X	X	X	X		X		X			
19ESE522A	X	X	X	X	X		X		X			
19ESE532A	X	X	X	X	X		X		X			
19ESE542A	X	X	X	X	X		X		X			
19FET508A	X	X	X	X	X	X	X	X	X			
19FET509A	X	X	X	X	X	X	X	X	X			
19ESC511A				X		X	X	X	X	X		
19ESC512A		X	X	X		X	X	X	X	X		
19ESC513A	X	X	X	X	X	X	X	X	X	X	X	X
19ESE513A	X	X	X	X	X		X		X			
19ESE523A	X	X	X	X	X		X		X			
19ESE533A	X				X	X	X			X	X	
19ESE543A	X	X	X	X	X		X		X			
19ESE514A	X	X	X	X	X		X		X			
19ESE524A	X	X	X	X	X		X		X			
19ESE534A	X	X	X	X	X		X		X			
19ESE544A	X				X	X	X					
19FET510A	X	X	X	X	X	X	X	X	X	X	X	X
19ESP502A	X	X	X	X	X	X	X	X	X	X	X	X
19ESP501A	X	X	X	X					X	X	X	X
19ESP511A	X	X	X	X	X	X	X	X	X	X	X	X

**33. Capability / Transferable Skills Map**

Course Code	Group work	Self-learning	Research Skills	Written Communication Skills	Verbal Communication Skills	Presentation Skills	Behavioural Skills	Information Management	Personal management/ Leadership Skills
19ESC501A		X		X	X	X	X	X	
19ESC502A		X		X	X	X	X	X	
19ESC503A		X		X	X	X	X	X	
19ESE511A		X		X	X	X	X	X	
19ESE521A		X		X	X	X	X	X	
19ESE531A		X		X	X	X	X	X	
19ESE541A		X		X	X	X	X	X	
19ESE512A		X		X	X	X	X	X	
19ESE522A		X		X	X	X	X	X	
19ESE532A		X		X	X	X	X	X	
19ESE542A		X		X	X	X	X	X	
19FET508A		X	X	X	X	X	X	X	
19FET509A		X		X	X	X	X	X	
19ESC511A		X		X	X	X	X	X	
19ESC512A		X		X	X	X	X	X	
19ESC513A		X		X	X	X	X	X	
19ESE513A		X		X	X	X	X	X	
19ESE523A		X		X	X	X	X	X	
19ESE533A		X		X	X	X	X	X	
19ESE543A		X		X	X	X	X	X	
19ESE514A		X		X	X	X	X	X	
19ESE524A		X		X	X	X	X	X	
19ESE534A		X		X	X	X	X	X	
19ESE544A		X		X	X	X	X	X	
19FET510A		X	X	X	X	X	X	X	
19ESP502A	X			X	X	X	X	X	X
19ESP501A		X		X	X	X	X	X	
19ESP511A		X	X	X	X	X	X	X	X

**34. Co-curricular Activities**

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposium, paper writing, attending industry exhibitions, project competitions and related activities to enhance their knowledge and network.

**35. Cultural and Literary Activities**

To remind and ignite the creative endeavors, annual cultural festivals are held and the students are made to plan and organize the activities.

**36. Sports and Athletics**

Students are encouraged to develop a habit of taking part in outdoor and indoor games on regular basis.

