Indra Ganesan
COLLEGE OF ENGINEERING

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'B+' Grade, 2(f) & 12B Status Institution by UGC
IG Valley, Madurai Main Road, Manikandam, Tiruchirappalli - 620012

NAAC DOCUMENTS

QUALITY INDICATOR FRAME WORK

CRITERION – 1

CURRICULAR ASPECTS

SUBMITTED BY

IQAC

INTERNAL QUALITY ASSURANCE CELL

INDRA GANESAN COLLEGE OF ENGINEERING

Criteria 1	Curricular Aspects	100

1.1 Curricular Planning and Implementation (20)

1.1.1 The Institution ensures effective curriculum planning and delivery through a well-planned and documented process including Academic calendar and conduct of continuous internal Assessment

Table of Content

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF CIVIL ENGINEERING

PREFACE OF THE COURSE FILE

Batch : **2018-2022**

Academic Year : **2021-2022 / ODD**

Program : **CIVIL ENGINEERING**

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Manikandam Main Road
Manikandam, Trichy-620 012.

Year & Semester : **Final Year / 7th Semester / 'A' Section**

Course Code : **EN8591** NBA Course Code: **C404**

Name of the Course : **MUNICIPAL SOLID WASTE MANAGEMENT**

Faculty in-charge :**Ms. K.GAYATHRI**

Signature of the Faculty in-charge

HoD / CIVIL

INDRA GANESAN COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)

DEPARTMENT OF CIVIL ENGINEERING

REVIEW OF COURSE FILE

(to be pasted on the inner side of the file-backside).(#-State Yes/No.)

S.N	Details Date:	R-I-*	R-II-*&	R-III-*&	R-IV-*&$	R-V-*&$@
1.	Preface of the course file	Y				
2.	Vision, Mission, PEOs, POs, PSOs, Blooms taxonomy	Y				
3.	Subject handlers of yesteryears	Y				
4.	Timetable/Workload of the staff – Distribution of teaching load – Roles and Responsibilities	Y				
5.	Syllabus signed by staff & HoD	Y				
6.	Lecture Schedule signed by staff & HoD	Y				
7.	Course Committee meeting circular and minutes	Y				
8.	Identification of Curricular gap and Content Beyond the syllabus	Y				
9.	Self-study topics	Y				
10.	Previous AU Question papers	Y				
11.	Unit wise Q&A and Objective type questions	Y				
12.	Unit wise course material		Y	Y	Y	
13.	Assignment question paper with sample answer sheets and mark entry		Y	Y	Y	
14.	Tutorial question paper with key and mark entry		Y	Y	Y	
15.	Class test/IA test Q Paper with Key, sample answer papers and mark entry		Y	Y	Y	
16.	IA Test- result analysis-CAP-evidence-root cause analysis.		Y	Y	Y	
17.	Retest –Q paper-Attendance-marks		Y	Y	Y	
18.	AU Web portal entry sheet		Y	Y	Y	
19.	Very poor performance in first two tests-action taken.-communication to parents-evidence			Y	Y	
20.	Absence for two tests-action taken-communication to parents-evidence.			Y	Y	
21.	Indiscipline of student reported, if any					
22.	Special class/coaching class/remedial class/attendance-CAP		Y	Y	Y	
23.	Conduct of Seminar, Quizzes - proof					
24.	Content beyond the syllabus - proof					Y
25.	Student feedback on faculty					Y
26.	Course end survey					Y
27.	Internal Assessment sheet					Y
28.	AU question paper with students feedback					Y
29.	Discrepancy of the question paper and correspondence, if any					Y
30.	AU result analysis-Details of arrear students.					Y
31.	AU grade sheet					Y
32.	CO – PO & PSO attainment sheet					Y
	Signature of Course handling faculty	K.G	K.G	K.G	K.G	K.G
	Signature of HoD	Sivasay	Sivasay	Sivasay	Sivasay	Sivasay

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INDRA GANESAN COLLEGE OF ENGINEERING

Department of Civil Engineering

Work Load - Odd Semester 2021-2022

S.NO.	Teacher's Name	Course Code	Course Name	Semester	Lecture / week	Total
1	Mr.S.Ramalingam (1+0)	CE6702	Prestressed Concrete Structures	VII	4	4
2	Mr.R.Sivasankar (2+0)	CE6703	Water Resources and Irrigation Engineering.	VII	4	8
		EN8491	Water Supply Engineering	V	4	
3	Mr.K.Sengottian (2+1)	CE8301	Strength of Materials-I	III	4	12
		CE8502	Structural Analysis I	V	4	
		CE6712	Design Project	VII	4	
4	Ms.E.Vinodha (2+1)	CE8302	Fluid Mechanics	III	4	12+1
		CE6007	Housing Planning And Management	VII	4	
		CE6711	Computer Aided Design and Drafting Laboratory	VII	4	
5	Ms.G.Bharani (2+1)	CE8501	Design of Reinforced Cement Concrete Elements	V	5	13+2
		CE6704	Estimation and Quantity Surveying	VII	4	
		CE8511	Soil Mechanics Laboratory	V	4	
5	Mr.K.Saravanan (2+1)	CE6701	Structural Dynamics And Earthquake Engineering	VII	4	12+1
		CE8591	Foundation Engineering	V	4	
		CE8361	Surveying lab	III	4	
5	Mr.M.Kaliraj (2+1)	CE8391	Construction Materials	III	4	12
		ORO551	Renewable Energy Sources	V	4	
		CE8311	Construction Materials Lab	III	4	
5	Mrs.K.Gaythri (2+1)	CE8351	Surveying	III	4	12+1
		EN8591	Municipal Solid Waste Management	VII	4	
		CE8512	Water and Waste Water Analysis Laboratory	V	4	
5	Mr.S.Mohamed Bilal (2+1)	CE8392	Engineering Geology	III	4	8+1
		GE8071	Disaster Management	V	4	
		CE8513	Survey Camp	V	0	

Time Table Co-ordinator

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HoD/CIVIL

EN8591 **MUNICIPAL SOLID WASTE MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVE:

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND CHARACTERISTICS **9**

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 - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) — Role of public and NGO"s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION , WASTE STORAGE AND RECYCLING **8**

Waste Management Hierarchy - 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**

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**

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and bio methanation; Thermal processing options – case studies under Indian conditions.

UNIT V WASTE DISPOSAL **8**

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 – Dump site Rehabilitation

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will demonstrate

- Understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- Reduction, reuse and recycling of waste.

- ability to plan and design systems for storage, collection, transport,processing and disposal of municipal solid waste.
- knowledge on the issues on solid waste management from anintegrated and holistic
- perspective, as well as in the local and international context.
- Design and operation of sanitary landfill.

TEXTBOOKS:

1.William A. Worrell, P. Aarne Vesilind (2012) Solid Waste Engineering,Cengage Learning,2012.

2.John Pitchel (2014), Waste Management Practices-Municipal, Hazardousand industrial –CRC Press, Taylor and Francis, New York.

REFERENCES:

1. CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Healthand Environmental Engineering Organisation , Government of India, New Delhi.
2 George Tchobanoglous and FrankKreith (2002).Handbook of Solid waste management,McGraw Hill, New York.

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45	07.10.2021	4	Management of leachate and landfill gas	T2.R3/BB
46	08.10.2021	3	Landfill bioreactor	T2,R3/BB
47	11.10.2021	4	Dump site Rehabilitation	T2,R3/BB
48	12.10.2021	1,2	Dump site Rehabilitation	T2,R3/BB
49	13.10.2021	6	Waste disposals	T2,R3/BB
50	14.10.2021	4	Quiz	

Book Reference - Text Books

Sl.	Title of the Book	Author	Publisher	Year
1	Solid Waste Engineering	William A. Worrell, P. Aarne Vesilind	Cengage Learning	2012
2	Waste Management Practices-Municipal, Hazardous and industrial	John Pitchel	CRC Press	2014

Book Reference – References

Sl	Title of the Book	Author	Publisher	Year
1.	Manual on Municipal Solid waste management, Central Public Healthand Environmental Engineering Organisation	CPHEEO	Government of India, New Delhi.	2014
2.	Handbook of Solid waste management	George Tchobanoglous and FrankKreith	McGraw Hill	2002

Signature of the Faculty in-charge

HoD / Civil

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DEPARTMENT OF CIVIL ENGINEERING

Identification of Curricular Gap & Content Beyond Syllabus(CBS)

Name of the Faculty : K.Gayathiri

Course Code & Name: EN8591&MUNICIPAL SOLID WASTE MANAGEMENT

Degree & Program: B.E. CIVIL **Semester & Section: VII / A** **Academic Year: 2021 -2022 /ODD**

I.Mapping of Course Outcomes with POs & PSOs.(before CBS)

Table.1 Mapping of COs, C, PSOs with POs - before CBS.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C404.1	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.2	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.3	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.4	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.5	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.6	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404	1	2	-	3	-	2	-	3	1	-	1	1	2	2

II. Identification of content beyond syllabus.

Table.2 Identification of content beyond syllabus

Details of Content Beyond Syllabus(CBS) added	POs strengthened/ vacant filled	CO/Unit
SOILD WASTE MANAGEMENT	PO4,PO8 Vacant filled	C404.3 & C404.4/ III & IV

III. Mapping of Course Outcomes with POs & PSOs. (After CBS)

Table.3 Mapping of COs, C, PSOs with POs- after CBS.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C404.1	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.2	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.3	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.4	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.5	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404.6	1	2	-	3	-	2	-	3	1	-	1	1	2	2
C404	1	2	-	3	-	2	-	3	1	-	1	1	2	2

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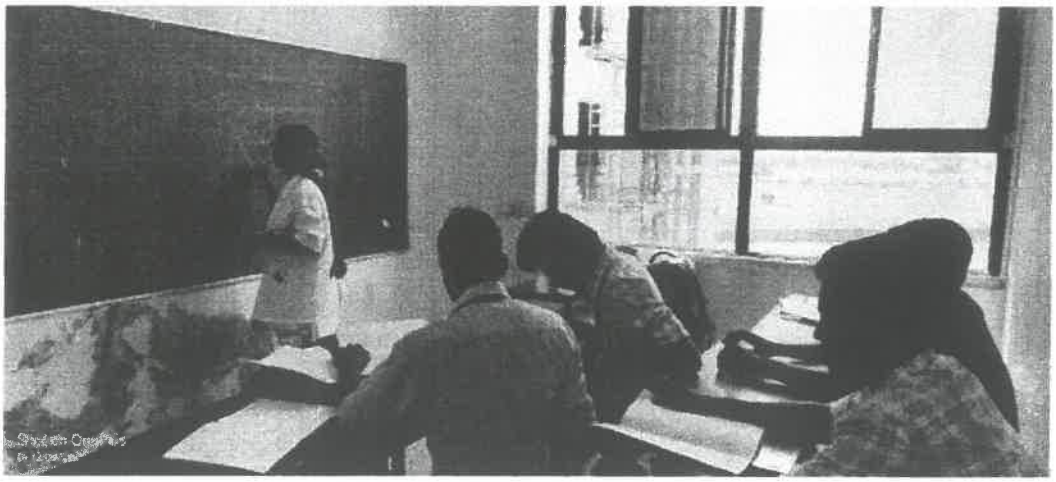
DEPARTMENT OF CIVIL ENGINEERING

CBS- PROOF

ACADEMIC YEAR: 2021-2022 (ODD) **SEM: 07 REGULATION: 2017**

PROGRAM: CIVIL **NAME OF THE FACULTY: K.GAYATHRI(AP)**

TOPIC: REDUCTION, REUSE AND RECYCLING



BLACK BOARD CLASS

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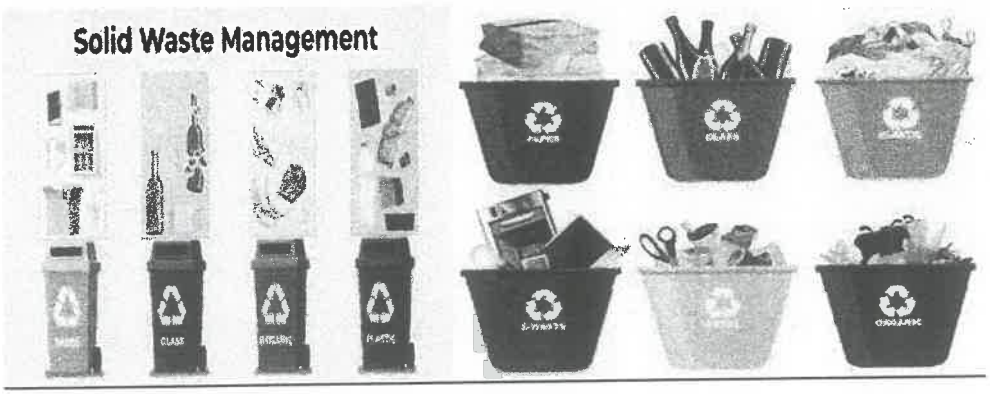
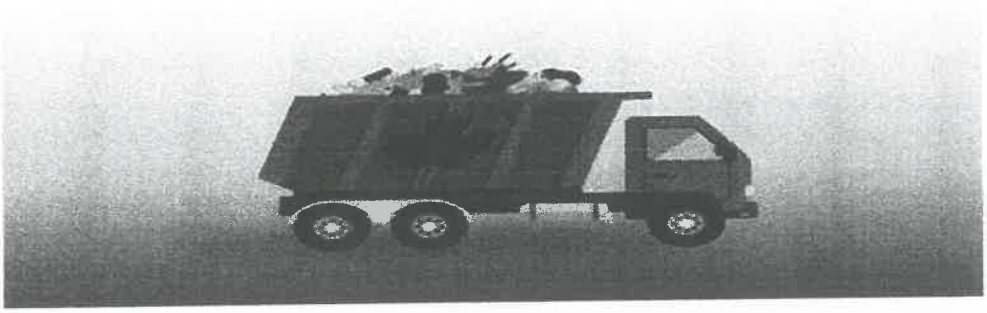
PPT PRESENTATION





WASTE COLLECTION VEHICLE

Signature of the Faculty

HoD/Civil

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Assignment Question Paper

Assignment – 01			Date of Issue:	6.09.21	Marks	10
Course code	EN8591	Course Title	MUNICIPAL SOLID WASTE MANAGEMENT			
Year	IV	Semester/Section	VII/ A	Date of Submission:	20.09.21	

Q.No	Questions	CO
1	Explain the Collection of Routing Methods?	C404.3
2	What are the Factors affecting Transfer Stations?	C404.3

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K. GAYATHIRI

Name and Signature of the Faculty In charge

HoD/CIVIL

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DEPARTMENT OF CIVIL ENGINEERING

Assignment Answer Sheet

Name of the Student : Musaraf Ali. S

AU Register Number: 811218103003

Assignment – 01			Date of Issue:	04.09.2021	Marks	10
Course code	EN8591	Course Title	Municipal Solid Waste Management			
Year	IV	Semester/Section	VII / A	Date of Submission:	18.09.2021	

Q.No	Questions	CO
1	Explain the Collection of Routing Methods?	C404.3
2	What are the Factors affecting Transfer Stations?	C404.3

Mark Allocation

Rubrics	Marks Allocated	Marks obtained
Content Quality	6	5
Presentation Quality	2	2
Timely submission	2	2
Total marks	10	9

GAYATHRI. K 18/9/21

Name and Signature of the Faculty Incharge

18/9/21

HoD/Civil

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Register Number:												

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IA Exam - I			**Date/Session**	**20.09.21/FN**	**Marks**	**50**
Course code	**EN8591**	**Course Title**	**SURVEYING AND LEVELLING**			
Regulation	**2017**	**Duration**	**90 min**	**Academic Year**		**2021-22**
Year	**IV**	**Semester**	**III**	**Department**		**CIVIL**

COURSE OUTCOMES	
C404.1	Comprihenced of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
C404.2	Reduction, reuse and recycling of waste.
C404.3	ability to plan and design systems for storage, collection, transport, processing anddisposal of municipal solid waste.
C404.4	knowledge on the issues on solid waste management from an integrated and holistic
C404.5	perspective, as well as in the local and international context
C404.6	Design and operation of sanitary landfill

Q.No.	Question	CO	BTS
	PART A **(Answer all the Questions 10 x 2 = 20 Marks)**		
1	Define waste minimization	1	K2
2	what is the purpose of onsite processing?	1	K1
3	What is the legal requirement in India regarding onsite storage and collection of MSW?	1	K2
4	What is meant by transfer station?	1	K1
5	What are the factors to be considered during onsite storage of solid wastes?	1	K1
6	Name any two disease transmitted through improper storage of MSW.	2	K2
7	What are the 4 R 's in waste hierarchy?	2	K2
8	List the various advantages of waste segregation.	2	K1
9	What are the qualities of materials used for the containers?	2	K2
10	List out the materials used for containers of municipal solid waste.	2	K1
	PART B **(Answer all the Questions 2 x 10 = 20 Marks)**		
11a	Describe possibilities in solid waste management with respect to reduction,reuse,and recovery.	1	K2
	OR		
11b	Explain briefly about the onsite storage methods	1	K2
12a	Explain different operation of onsite segregation of solid waste keeping public health in mind	2	K3
	OR		

12b	Explain the various issues related to public health and economic aspect of open storage of msw	2	K3
	PART C **(Answer all the Questions 1 x 10 = 10 Marks)**		
13a	What is the magnetic separation of solid waste? Explain process for magnetic separation. What are the factors influencing effectiveness of magnetic separation?	1	K2
	OR		
13b	Discuss strategies of source reduction, reduction, recycling and reuse of solid waste	1	K2

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Course Faculty

Name /Sign / Date)

HoD/ CIVIL

(Name /Sign / Date)

Q.No.	Question	CO	BTS
	PART A **(Answer all the Questions 10 x 2 = 20 Marks)**		
1	**Define waste minimization ?** Waste minimization or waste minimisation can be defined as "systematically reducing waste at source".It means:Prevention and/or reduction of waste generated.Efficient use of raw materials and packaging	1	K2
2	**what is the purpose of onsite processing?** reduce volume of waste generated alter physical form recover usable materials	1	K1
3	**What is the legal requirement in India regarding onsite storage and collection of MSW?** The 2000 rules were applicable on "every municipal authority responsible for the collection, segregation, storage, transportation, processing, and disposal of municipal solid wastes". It fixed certain responsibility for municipal authorities, State Governments, and UT Administrations as well as Central Pollution Control Board and the State Board or the Committees in infrastructure development, setting up landfills and other waste processing and disposal facilities, monitoring and ensuring eco-friendly compliance and submitting Annual Reports	1	K2
4	**What is meant by transfer station?** A transfer station is a facility where municipal solid waste (MSW) is unloaded from collection vehicles and briefly held while it is reloaded onto larger long-distance transport vehicles.	1	K1
5	**What are the factors to be considered during onsite storage of solid wastes?** There are four factors that should be considered in the on-site storage of solid waste. The type of container to be used, the location where the containers to be kept, public health, the collection method and time.	1	K1
6	**Name any disease transmitted through improper storage of MSW.** Hepatitis – Hepatitis B is transmitted in the same way as the AIDS virus. Risks of exposure increase from needlestick injury scenarios. Hepatitis B can lead to both acute and chronic hepatitis, cirrhosis of the liver, and even liver cancer.	2	K2
7	**What are the 4 R 's in waste hierarchy?** Reduce Reuse Recycling Recovery	2	K2
8	**List the various advantages of waste segregation.** 1. Increase the efficiency of waste management 2. Save money on garbage disposal costs 3. Reduce our carbon footprint and help save the planet 4. Lessen health risks by reducing the proliferation of pests and rodents	2	K1
9	**What are the qualities of materials used for the containers?** Suitable container should be water tight, rust resistant, with tight fitting covers, fire resistant, adequate in size ,light in weight, with side handles and washable.	2	K2
10	**List out the materials used for containers of municipal solid waste.** Containers and packaging products in MSW are made of several materials: paper and paperboard, glass, steel, aluminum, plastics, wood, and small amounts of other materials.	2	K1

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PART B
(Answer all the Questions 2 x 10 = 20 Marks)

11a	**Describe possibilities in solid waste management with respect to reduction,reuse,and recovery.**	1	K2

Resource recovery is a partial solid waste disposal and reclamation process. It can be expectedto achieve about 60% reductions in future landfill volume requirements. Resource recovery must recognize what is worth recovering and the environmental benefits

Resource recovery and processing is a complex, economical and technical system with social and political implications, all of which require critical analysis and evaluation before a commitment is made. They demand capital cost, operating cost, market value of reclaimed materials and material quality, potential minimum reliable energy sales, assured quantity of solid wastes, continued need for a sanitary landfill for the disposal of excess and remaining unwanted materials and incinerator residue, a site location close to the center of the generators of solid wastes.

Products That Can Be Recycled

1. Plastic

Plastic is not a natural material. It is synthesized from petrochemicals to create a long, complicated chain of atoms called polymers. Bacteria and fungi that would usually live on the decaying waste of natural food, fauna, and flora cannot digest these recovery polymers.

Instead, toxic cadmium and lead compounds used as binders can leach out of plastics and ooze into groundwater and surface water in unlined or failed landfills. Unfortunately, plastic is one of the most common non-biodegradable wastes deposited in landfills There are a number of plastic items that create great decomposition problems. Among them are diapers, grocery bags and balloons. Today only 3% of all plastic containers are recycled. Plastic threatens the lives of millions of marine animals who get entangled in plastic netting. Autopsied marine animals have revealed that their intestines were full of no biodegradable plastic. Marine mammals and birds have suffocated, strangled, and been poisoned by the plastic waste such as can rings or balloons that have been expelled into the oceans and into the air.

Fishermen currently dump around 175,000 tons of plastic into the oceans each year. It is thought that as many as a million sea birds and100,000 marine mammals in the Northern Pacific Ocean die each year from eating or becoming entangled in plastic waste. Many more marine lives are poisoned in the Atlantic Ocean by raw sewage, chemical waste, and pesticide waste flowing from rivers into these water bodies.

2. Tires

Discarded tires pose two particular vector health threats to a community: rats and mosquitoes. Tires create an excellent breeding place for rats and mosquitoes, which in turn carry diseases to humans. An automobile tire contains about 10 liters of oil, which has the potential to produce enough electricity to serve a small town.

1. Paper

Paper is the single most frequently seen item in most landfills, taking up more land space. It accounts for more than 40% of a landfill's contents. Newspapers alone may take up as much as 13 to 30% of the space in landfills. It is not enough to just change from paper grocery bags to recyclable cloth bags. Garbage archeologists from the University of Arizona have discovered that most materials buried deep in a landfill change very little. Newspapers from the 1950s could still be read in 1992. Paper in landfills does not biodegrade; it mummifies. Paper may be one of the most recyclable waste products. To establish a newsprint recycling mill, it takes three to five years and costs from $300 to $500 million to build. Can the capital investment be recouped if there is no community plan to market the recycled paper? If economic incentives were given to creative entrepreneurs, more products could easily be developed.

Obstacles to resource recovery

1. Heterogeneity of the waste
2. Putrescibility of the waste
3. Location of the waste
4. Low value of product
5. Un certainty of supply
6. Un provenogytechnol

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	Techniques involved in resource recovery 1. Compaction, which mechanically reduces the volume of solid waste 2. Chemical volume reduction by incineration 3. Mechanical size reduction by shredding, grinding and milling component separation by hand-sorting, air separation, magnetic separation and screening		
	OR		
11b	**Explain briefly about the onsite storage methods.(Nov/Dec 2016)** **Introduction** Aesthetics, land use, health, water pollution, air pollution, and economic considerations make proper solid waste storage, collection and disposal of solid wastes (municipal and individual) functions that must be taken seriously. Indiscriminate dumping of solid waste and failure of the collection system in a populated community would soon cause many health problems. Odors, flies, rats, roaches, crickets, wandering dogs and cats, and fires would dispel any remaining doubts of the importance of proper solid waste storage, collection and disposal. **On-Site Handling, Storage and Processing of Solid Waste. A. On-Site Handling** On-site handling methods and principles involve public attitude and individual belief, and ultimately affects the public health. It is an activity associated with the handling of solid waste until it is placed in the containers used for its storage before collection. This may take place at any time before, duringor after storage. **Importance of on-site handling of solid waste:** • reduce volume of waste generated • alter physical form • recover usable materials **On- site handling methods:** • sorting • shredding • grinding • composting Factors that should be considered in evaluation of onsite processing **B. On- Site Storage** The first phase to manage solid waste is at home level. It requires temporary storage of refuse on the premises. The individual householder or businessman has responsibility for onsite storage of solid waste. For individual homes, industries, and other commercial centers, proper on-site storage of solid waste is the beginning of disposal because unkempt or simple dumps are sources of nuisance, flies, smells and other hazards. There are four factors that should be considered in the onsite storage of solid waste. These are the type of container to be used, the location where the containers are to be kept, public health, and the collectionmethod and time. **Storage containers** Garbage and refuse generated in kitchens and other work areas should be collected and stored in properly designed and constructed water-proof garbage cans (waste bins). The cans or receptacles can be constructed from galvanized iron sheet or plastic materials. They should have tightly fitting covers. They must be of such size that, when full, they can be lifted easily by one man. They shouldbe located in a cool place on platforms at least 30 centimeters above ground level. After	1	K2

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[illegible]
[illegible]

	putting in garbage, they should be kept covered. The bins must be emptied at least daily and maintained in clean conditions. A typical example of garbage can, constructed from galvanized iron sheet, dimensions: diameter 45 cm and height 75 cm, is shown in figure 1 below. An adequate number of suitable containers should be provided with proper platforms with receptacles stand. The number may depend on the amount, type and establishments where the need arises. Suitable containers should be watertight, rust- resistant, with tight-fitting covers, fire-resistant, adequate in size, light in weight, with side handles and washable. **Container Size(capacity)** Consideration should be given for the size of the loaded container that must be hauled to the collectionvehicle or to the disposal site. Therefore, container size for:- ash: up to 80 to 128 liters mixed refuse: should not exceed 120 to 128 liters rubbish up to 200 liters kitchen waste is 40 liters garbage is 48 to 80 liters Plastic liners for cans and wrapping for garbage reduce the need for cleaning of cans and bulk containers, and keep down odors, rat and fly breeding. Galvanized metal is preferable for garbage storage because it is resistant to corrosion. Plastic cans are light in weight but are easily gnawed by rats. Bulk containers are recommended where large volumes of refuse are generated, such as at hotels, restaurants, apartment houses, and shopping centers. A concrete platform provided with a drain to an approved sewer with a water faucet at the site facilitates cleaning. **On- site processing** Importance of on-site processing: reduces volume of waste generated alters physical form recovers usable materials		
12a	**Explain different operation of onsite segregation of solid waste keeping public health in mind** **SEGREGATION OF MUNICIPAL SOLID WASTE AT SOURCE** segregate and store the waste generated by them in three separate streams namely bio-degradable, non -biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time; b) wrap securely the used sanitary waste like diapers, sanitary pads etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as instructed by the local authorities and shall place the same in the bin meant for dry waste or non- bio-degradable waste. **Understanding how to segregate waste** 1. Keep separate containers for dry and wet waste in the kitchen 2. Keep two bags for dry waste collection- paper and plastic , for the rest of the household waste 3. Keep plastic from the kitchen clean and dry and drop into the dry waste bin. ... 4. Send wet waste out of the home daily. ... 5. Keep a paper bag for throwing the sanitary waste	2	K3
	OR		
12b	**Explain the various issues related to public health and economic aspect of open storage of msw.** **case studies under Indian conditions**	2	K3

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Waste quantum: The per capita waste generation rate is about 500 g/day. This along with increased population has contributed to higher total waste generation quantum.

Waste composition: Studies reveal that the percentage of the organic matter has remained almost static at 41% in the past 3 decades, but the recyclables have increased from 9.56% to 17.18%. Garbage in Indian cities is estimated to contain about 45-75% biodegradable waste (as against 25% of US city-garbage) with 5055% moisture; 35-45% being fruits; vegetable and food biomass; and 8-15% non organic materials like plastic, metal, glass, stones, etc. Refuse from Indian cities also contains high organic and low combustible matter, if the studies carried out in six cities are of any indication. Presenting the findings of these studies, Table 1.6 below shows that the highest organic content is found in Bangalore waste (75%) and the lowest in Kolkata (46%).

Waste disposal methods: Waste disposal is the final stage of the waste management cycle. About 90% of the municipal waste collected by the civic authorities in India is dumped in low-lying areas outside the city/town limits, which have no provision of leachate collection and treatment, and landfill gas collection and use.

Recycling: This involves collection of recyclables from various sources, which ultimately reach recycling units. It is estimated that about 40-80% of plastic waste gets recycled in India, as compared to 10-15% in the developed nations of the world. However, due to lack of suitable government policies, incentives, subsidies, regulations, standards, etc., related to recycling, this industry is still far behind its western counterparts in terms of technology and quality of manufactured goods. Nevertheless, recycling in India is a highly organised and profit-making venture, though informal in nature.

Health impacts: Due to the absence of standards and norms for handling municipal wastes, municipal workers suffer occupational health hazards of waste handling. At the dumpsites in the city of Mumbai, for example, 95 workers were examined and it was found that about 80% of them had eye problems, 73% respiratory ailments, 51% gastrointestinal ailments and 27% skin lesions. Also, municipal workers and rag pickers who operate informally for long hours rummaging through waste also suffer from similar occupational health diseases ranging from respiratory illnesses (from ingesting particulates and bio-aerosols), infections (direct contact with contaminated material), puncture wounds (leading to tetanus, hepatitis and HIV infection) to headaches and nausea, etc. Studies among the 180 rag pickers at open dumps of Kolkata city reveal that average quarterly incidence of diarrhoea was 85%, fever 72% and cough and cold 63%.

Environmental impacts: In addition to occupational health, injury issues and environmental health also need to be mentioned in the context of waste management. Contaminated leachate and surface run-off from land disposal facilities affects ground and surface water quality. Volatile organic compounds and dioxins in air-emissions are attributed to increasing cancer incidence and psychological stress for those living near incinerators or land disposal facilities. Drain clogging due to uncollected wastes leading to stagnant waters and subsequent mosquito vector breeding are a few of the environmental health issues, which affect the waste workers as well as the public. The pneumonic plague that broke out in November 1994 in India (Surat, Gujarat) is a typical example of solid waste mismanagement.

PART C
(Answer all the Questions 1 x 10 = 10 Marks)

13a | **What is the magnetic separation of solid waste? Explain process for magnetic separation. what are the factors influencing effectiveness of magnetic separation?** | 1 | K2

Magnetic separation is a process of separating mixtures of solids using magnetism. It works on the principle that materials with different magnetic properties will be attracted to a magnet. By passing a mixture of solids through a magnetic field, we can separate the materials based on their magnetic properties.

The process of magnetic separation involves passing a mixture of solids through a magnetic field. The magnetic field attracts materials that are magnetic, while non-magnetic materials are unaffected. The separated materials are then collected in separate containers.

Applications of Magnetic Separation:

Magnetic separation is widely used in a variety of industries, including:

Mineral processing: Magnetic separation is used to separate minerals from gangue in ore processing.

Recycling: Magnetic separation is used to separate ferrous materials from non-ferrous materials in recycling plants.

Food industry: Magnetic separation is used to remove metal contaminants from food products.

Factors that affect the magnetic separation process include

Feeding size

Slurry concentration

Rotation speed of magnetic separator

Magnetic system declination

Particle size of the selected ore

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Content of magnetic components in the original ore

Speed of ore passing through the working area of the magnetic separator

Speed at which the magnetic part is discharged from the working area of the magnetic separator

Effect of magnetic differences among minerals

Effect of magnetic field distribution of magnetic separator

OR

13b	**Discuss strategies of source reduction, reduction, recycling and reuse of solid waste**	1	K2

Source reduction (waste prevention) — also called — pre cycling

Definition—the reduction of the amount and/or toxicity of waste at or before the point of generation

- Reduction of waste
- Conservation of resources

Examples

- Making packaging lighter, using less materials b) use email rather than paper mail
- Keep records and store them electronically

Donation of unwanted items to charities and thrift stores e) selling unwanted items online

f) Photocopying two-sided documents

g) Product maintenance and repair rather than disposal

h) buy items with less bulkypackaging

Mulching and backyard composting of yard waste

Benefits

saves natural resources

Reduces toxicity of waste

Reduces costs to communities, businesses, schools and consumers

Prevents emissions of many GHG (Greenhouse gases)

saves energy

Reduces the need for new landfills and combustors

Source reduction and reuse facts

More than 55 million tons of MSW were soul 2000, the latest year for which these figures areavailable.

Containers and packaging represented approximately 28 percent of the materials source reduced in 2000, in addition to nondurable goods (e.g., newspapers, clothing)at 17 percent, durable goods (e.g., appliances, furniture, tires) at 10 percent, and other MSW (e.g.,yard trimmings, food scraps) at 45 percent.

Levels of recycling

a) **Primary recycling**—when the original waste material is made back into the same Material

b) **Secondary recycling**—when the original waste material is made into some other product

tertiary recycling—breaking material down to components that composed the original product; often through de-polymerization

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	Municipal recycling a)Different cities have different guidelines for pickup etc. b)characteristics ofa successful recycling program PAYT charges mandatory, with fines for violators curbside pickup with free bins a community effort—business and residential organized and clear-cut guidelines and goals recycling of paper and paper products a) **Plain paper**, envelopes, newspaper, magazines, p b) **Post-consumer waste**—paper recycled by consumers waste on the label c) **Pre-consumer waste**—scrap paper at the processing plant, not ever sent out as a product **Demand** for recycled paper fluctuates		

Course Faculty

(Name /Sign / Date)

HoD/CIVIL

(Name /Sign / Date)

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Internal Assessment Test Answer Book – Retest

Name	Prabhu JJ			Year/ Semester/Section	IV/VII/A
Batch No.	8112810 3004	Date/Session		Department	CIVIL
Course code	EN8591	Course Title	Municipal Solid waste Management		
Internal Assessment Test	IAT 1 ☑	IAT 2 ☐	IAT 3 ☐	Model ☐	
Name and Signature of the Invigilator with date	K. GP				

Instruction to the Student: Put tick mark to the question attended in the column against question.

Part A			Part B / Part C					Total Marks
Q. No.	✓	Marks	Q. NO.	✓	a Marks	✓	b Marks	
1		2	11		8		–	8
2		2	12		–		8	8
3		–	13		8		–	8
4		2	14					
5		2	15					
6		2	16					
7		2					Total	24
8		–	Grand Total			Name and Signature of the Examiner with date		
9		2	40/50			K. GP		
10		2						
Total		16						

To be filled by the examiner

Course Outcomes	1	2	3	4	5	6	Total
Marks allotted	30	20	–	–	–	–	50
Marks Obtained	25	15	–	–	–	–	40

IQAC Audit - Remarks

Name and Signature of the IQAC member

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DEPARTMENT OF AGRICULTURAL ENGINEERING

ACADEMIC YEAR 2022 – 2023 (ODD SEMESTER)

STUDENTS MARK STATEMENT- CO BASED

AIE-I

SUBJECT CODE &TITLE:EN8591 &Municipal Solid Waste Management

YEAR/SEM: IV/VII **MONTH & YEAR: SEP/2021**

S.NO	REG NO	STUDENT NAME	CO1	CO2	TOTAL (50)	TOTAL (100)
1.	811218103001	Akash J	25	17	42	84
2.	811218103002	Mahendran M	22	16	38	76
3.	811218103003	Musarf Ali S	25	17	42	82
4.	811218103004	Prabu JJ	14	AB	AB	AB

MARKS RANGE:

<20	20-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
0	0	1	0	0	0	1	2	0

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Total No.of Candidates Present	**4**
Total No.of Candidates Absent	**01**
Total No.of Students Pass	**03**
Total No. of Students Fail	**1**
Percentage of Pass	**75%**

STAFF INCHARGE **HoD/CIVIL** **PRINCIPAL**

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Register Number:												

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IA Exam - I -RETEST			Date/Session	30.09.21/AN	Marks	50
Course code	EN8591	Course Title	SURVEYING AND LEVELLING			
Regulation	2017	Duration	90 min	Academic Year	2021-22	
Year	IV	Semester	III	Department	CIVIL	

COURSE OUTCOMES

C404.1	Comprihenced of the nature and characteristics of municipal solid wastes and theregulatory requirements regarding municipal solid waste management
C404.2	Reduction, reuse and recycling of waste.
C404.3	ability to plan and design systems for storage, collection, transport, processing anddisposal of municipal solid waste.
C404.4	knowledge on the issues on solid waste management from an integrated and holistic
C404.5	perspective, as well as in the local and international context
C404.6	Design and operation of sanitary landfill

Q.No.	Question	CO	BTS
	PART A (Answer all the Questions 10 x 2 = 20 Marks)		
1	Define waste minimization	1	K2
2	what is the purpose of onsite processing?	1	K1
3	What is the legal requirement in India regarding onsite storage and collection of MSW?	1	K2
4	What is meant by transfer station?	1	K1
5	Write the Indian conditions of Municipal solids?	1	K1
6	Write any two improper disposal of solid wastes?	2	K2
7	What are the 4 R 's in waste hierarchy?	2	K2
8	List the various advantages of waste segregation.	2	K1
9	What are the methods of Seperations?	2	K2
10	What is the sizes of a solid waste container?	2	K1
	PART B (Answer all the Questions 2 x 10 = 20 Marks)		
11a	. What is the magnetic separation of solid waste? Explain process for magnetic separation. what are the factors influencing effectiveness of magnetic separation?	1	K2
	OR		
11b	Explain different operation of onsite segregation of solid waste keeping public health in mind	1	K2
12a	Explain briefly about the onsite storage methods	2	K3
	OR		
12b	Discuss strategies of source reduction, reduction, recycling and reuse of solid waste	2	K3
	PART C (Answer all the Questions 1 x 10 = 10 Marks)		
13a	.Explain the various issues related to public health and economic aspect of open storage of msw	1	K2
	OR		
13b	Describe possibilities in solid waste management with respect to reduction, reuse, and recovery	1	K2

Course Faculty
Name /Sign / Date)

HoD/CIVIL
(Name /Sign / Date)

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DEPARTMENT OF AGRICULTURAL ENGINEERING

ACADEMIC YEAR 2022 – 2023 (ODD SEMESTER)

STUDENTS MARK STATEMENT- CO BASED

RETEST-I

SUBJECT CODE &TITLE:EN8591 &Municipal Solid Waste Management

YEAR/SEM: IV/VII **MONTH & YEAR: SEP/2021**

S.NO	REG NO	STUDENT NAME	CO1	CO2	TOTAL (50)	TOTAL (100)
4.	811218103004	Prabu JJ	25	15	40	80

MARKS RANGE:

<20	20-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
0	0	0	0	0	0	1	0	0

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Total No.of Candidates Present	**01**
Total No.of Candidates Absent	**0**
Total No.of Students Pass	**01**
Total No. of Students Fail	**0**

STAFF INCHARGE **HoD/CIVIL** **PRINCIPAL**

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DEPARTMENT OF CIVIL ENGINEERING

ROOT CAUSE ANALYSIS

Name of the Faculty :K.Gayathri

Course Code & Name :EN8591& Municipal Solid waste Management

Degree & Program :BE/Civil Engineering

Semester & Section :VII/A

IA Test : I /II/III/Model

University Exam/Mouth & Year: SEP/2021

Target : 90%

Achieved : 75 %

S.NO	REGISTER NO	NAME OF THE STUDENT	CAUSES FOR FAILURE	CORRECTIVE ACTION TAKEN	PREVENTIVE ACTION TAKEN
1.	811218103003	Musaraf Ali S	Health Issue	Retest Conducted	Advised to take care of your health
2.	811218103004	Prabhu JJ	Family Function	Retest Conducted	Advised

Signature of the Faculty Member

Signature of the HoD/Civil

1

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IQAC Academic Audit Form

ACADEMIC YEAR: 2021-2022 ODD / EVEN SEMESTER

Name of Department :	CIVIL	Year / Sem / Sec :	4/ VII / A	No. of Students Registered	4

Details of Examination : IA Test -1 / IA Test -2 / IA Test -3 / Model Test

S.No	Course Code	List of Reg.No Verified	Course Log Book Verified (Y / N)	Course File Verified (Y / N)	No of students Attended	No of Absentees	No of Failures	Pass %	Remarks
1	EN8591	811218103001	y	y	4	-	1	75%	
2	EN8591	811218103002	y	y	4	-	1	75%	
3	EN8591	811218103003	y	y	4	-	1	75%	
4	EN8591	811218103004	y	y	4	-	1	75%	

Verified by

External Member Name and Signature:

Internal Member Name and Signature: [redacted]

Overall Remarks:

HoD/CIVIL IQAC Co-ordinator Principal