



WINTER- 18 EXAMINATION

Subject Name: Solid Waste Management

Model Answer

Subject Code:

17605

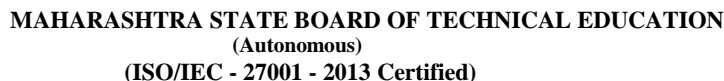
Important Instructions to examiners:

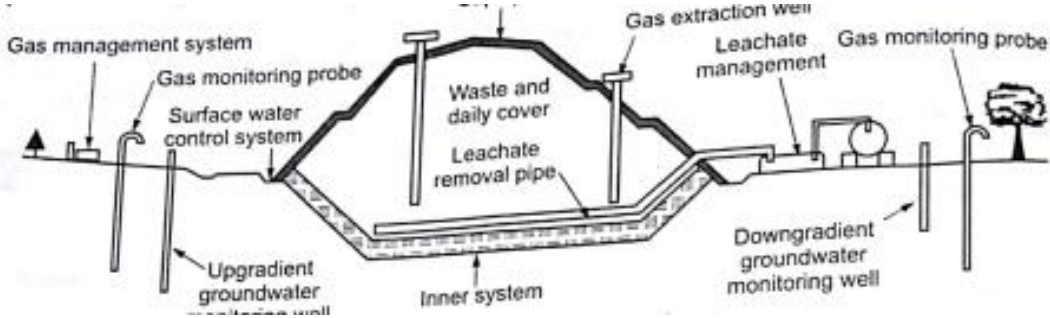
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

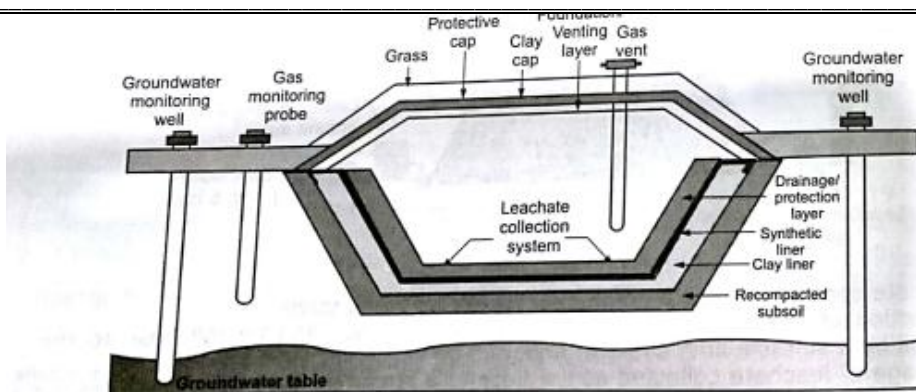
Q. No.	Sub Q.N.	Answer			Marking Scheme
Q.1		Attempt <u>any five</u> of the following:			20 Marks
Q.1	(a)	State types of solid waste and give examples of each.			(04 Marks One mark each for any four)
	Ans.	Sr.No.	Types of solid waste	Examples	
		1	Food waste	Waste from preparation, cooking and serving food, waste from vegetable market etc.	
		2	Rubbish	Paper, cardboards	
		3	Ashes and residue	Residue from fire used for cooking, thermal power plant.	
		4	Bulky waste	Large auto parts, tyres.	
		5	Street waste	Street sweeping, content of litter.	
		6	Dead animals	Cat, dog	
		7	Construction and demolition waste	Roofing scrap, broken concrete.	
		8	Industrial waste and sludge	Solid waste from industry, metal scrap.	
		9	Hazardous waste	Pathological waste, radioactive materials	
		10	Horticulture waste	Tree trimming, leaves	
Q.1	(b)	Explain impact of solid waste on environment			
	Ans.	1. Ground water contamination by the leachate generated by the waste dump Surface water contamination by the run-off from the waste dump 2. Bad odour, pests, rodents and wind-blown litter in and around the waste dump Generation of inflammable gas (e.g. methane) within the waste dump 3. Bird menace above the waste dump which affects flight of aircraft 4. Fires within the waste dump. 5. Erosion and stability problems relating to slopes of the waste dump			



		<p>6. Epidemics through stray animals.</p> <p>7. Acidity to surrounding soil and Release of green house gas.</p> <p>8. Waste breaks down in landfills to form methane, which causes greenhouse gas. Carbon dioxide and Methane produced from solid waste are extremely harmful to the environment.</p> <p>9. Change in climate and destruction of ozone layer due to waste biodegradable</p> <p>10. Due to waste pollutions, illegal dumping, Leaching: is a process by which solid waste enter soil and ground water and contaminating them and Pollute water bodies.</p> <p>11. Open air dumping creates unhygienic and poses enormous threat to the people. Causes aesthetic problem and nuisance due to nauseating pungent odor.</p> <p>12. Promotes spreading of diseases.</p> <p>13. The situation further aggravated by the indiscriminate disposal of Hospital and Clinical Waste.</p> <p>14. Presence of extremely high level of total and Facial E-coli form.</p>	<p>(04 Marks One mark each for any four)</p>
Q.1	(c) Ans.	<p>Explain the methods of collection of municipal solid waste.</p> <p>(A) Collection system Based on the availability of service</p> <p>1. Curb (Kerb-side) Kerb side collection, or curbside collection, is a service provided to households, typically in urban and suburban areas, of removing household waste. House owner is responsible for placing solid waste containers at the curb on scheduled day. The work man come, collect and empty the container and put back at the curb. House owner is required to take back the empty containers from the curb to his house.</p> <p>2. Alley Service The containers are placed at the alley line from where they are picked up by workmen from refuse vehicle who deposit back the empty container.</p> <p>3. Set out Set Back Service Set out man go to the house collect containers and empty them in the refuse vehicle. Another group of persons return them to the house owner's yard.</p> <p>4. Backyard Service The workers with the vehicles carry a bin, wheel-barrow or sack or cloth to the yard and empty the solid waste container in it. The wheel barrow or bin is then taken to solid waste vehicle where it is emptied.</p> <p>B) Collection Method Based on mode of operation</p> <p>1. Hauled Container System An empty storage container (Known as a drop- off box) is hauled to the storage site to replace the container that is full of waste, which is then hauled to the processing point, transfer station or disposal site.</p> <p>2. Stationary Container System In this system, containers used for the storage of waste remain at the point of collection. The collection vehicles generally stop alongside the storage containers, and collection crews load the waste from the storage containers into the collection vehicles and then transport the waste to the processing, transfer or disposal site.</p>	<p>(04 Marks Two marks each for any two)</p>

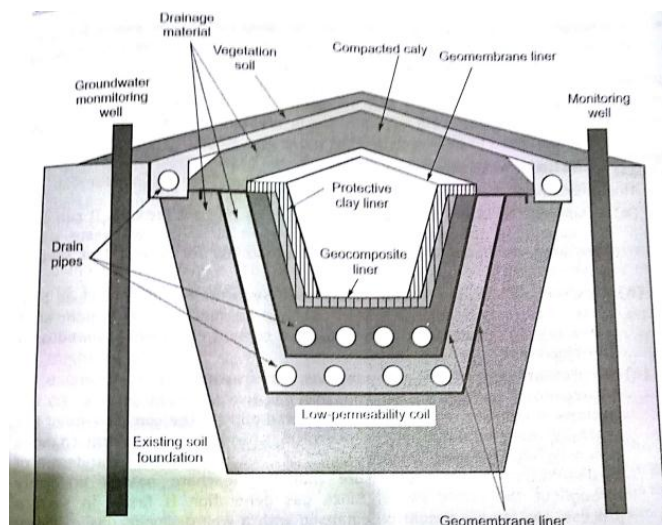
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Q.1	(g)	State the status of recycling of solid waste in India	
	Ans.	<ul style="list-style-type: none"> The rules in India require municipalities to ensure community participation in waste segregation and to promote recycling of segregated materials. In India there is no formal recycling system but informal recyclers are there and play an important role in SWM. These comprise of unorganized and unrecognized establishments which are difficult to be monitored by government agencies. However resource recovery through material recycling is taking place in India in a big way, through unorganized ways. 	(04 Marks for any four points)
Q.2		Attempt <u>any four</u> of the following	16 Marks
Q.2	(a)	Explain any one leachate control system with neat sketch. 1. Single liner system Such system comprises a single primary barrier overlain by leachate collection system with appropriate separation/ protection layer.	(04 Marks for any one system)
			
		2. Single composite Liner system A composite liner comprises two barriers, made of different materials, placed in intimate contact with each other to provide a beneficial combined effect of both the barriers. Usually a flexible geo membrane is placed over a clay or soil barrier.	



3. Double Liner system

In an double liner system a single liner system is placed twice, one beneath other. The top barrier (primary barrier) is overlaid by a leachate system. Beneath the primary barrier another leachate collection system (leak collection layer) is placed by second barrier (secondary barrier). This type of system offers double safety and used for industrial waste landfill.



Q.2 (b) State the advantages and disadvantages of incineration process.

Ans.

Advantages of incineration:

- i) Capable of producing energy.
- ii) Requires minimum land.
- iii) Can be operated in any weather.
- iv) Produces stable odour free residue.

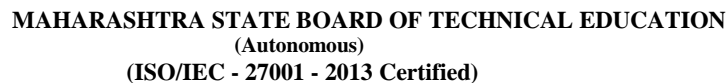
Dis-advantages of incineration:

- i) Causes air pollution.
- Expensive to build and operate.
- iii) High energy requirement.
- iv) Require skilled personnel and continuous maintenance.

(02 marks)

(02 marks)

Q.2 (c) State the types of incinerator and explain any one.

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depend on the fluctuation of waste generation for the service area and the anticipated maintenance cycle of the units.

iv) Fluidised-bed incinerators

Fluidised-bed incineration of MSW is typically medium scale, with processing capacity from 50 to 150 tonnes per day. In this system, a bed of limestone or sand that can withstand high temperatures, fed by an air distribution system, replaces the grate. The heating of the bed and an increase in the air velocities cause the bed to bubble, which gives rise to the term fluidised. There are two types of fluidised-bed technologies, viz., bubbling bed and circulating bed. The differences are reflected in the relationship between air flow and bed material, and have implications for the type of wastes that can be burned, as well as the heat transfer to the energy recovery system. Unlike mass-burn incinerators, fluidised-bed incinerators require front-end preprocessing, also called fuel preparation. They are generally associated with source separation because glass and metals do not fare well in these systems and also they can successfully burn wastes of widely varying moisture and heat content, so that the inclusion of paper and wood, which are both recyclable and burnable, is not a crucial factor in their operation (and thus paper can be extracted for higher-value recycling).

Q.2 (d) State sources of bio-medical waste and give average BMW generation rate.

Ans.

Following are the sources of biomedical waste.

- 1) Hospitals
- 2) Health Clinics
- 3) Nursing Homes
- 4) Medical Research Laboratories
- 5) Pharmacies
- 6) Blood Banks
- 7) Funeral Homes
- 8) Veterinary Homes

BMW generation rate.

Biomedical Waste	Non Hazardous (75-90%)		
	Hazardous (10 -25%)	Infectious (15-18%) <ul style="list-style-type: none"> • Non Sharp • Sharp • Liquid waste 	Other Hazardous (05-07%) <ul style="list-style-type: none"> • Radioactive waste • Discarded glass • Chemical waste • Cytotoxic waste

(02 Marks for any four)

(02 Marks)

Q.2 (e) State benefits of recycling of E-waste.

Ans.

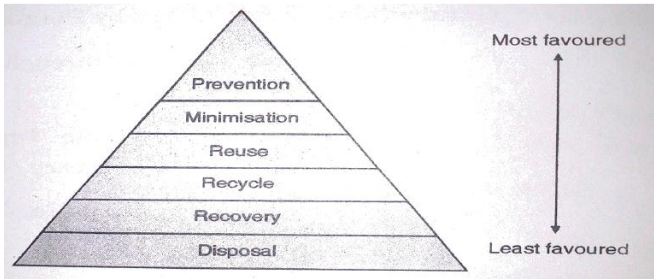
Following are the benefits of E-waste

- i) To save raw material resources in production

(04 Marks for any)



		ii) To save energy in production iii) To reduce solid waste in landfills iv) To minimize environmental pollution	four)
Q.2	(f)	Define: i) Biomedical waste ii) E-waste i) Biomedical waste Any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities or in the production or testing of biological, and including categories mentioned in schedule I. ii) E-waste E-waste is any refuse created by discarded electronic and electrical devices and components as well as substances involved in their manufacture and repair process.	
Q.3		Attempt <u>any four</u> of the following	16 Marks
Q.3	(a) Ans.	Explain chemical characteristics of solid waste. Chemical characteristics <ul style="list-style-type: none">• Lipids• Carbohydrates• Proteins• Heating value• Natural fibres Lipids: This class of compounds includes fats, oils and grease, and the principal sources of lipids are garbage, cooking oils and fats. Lipids have high heating values, about 38,000 kJ/kg(kilojoules per kilogram), which makes waste with high lipid content suitable for energy recovery. Since lipids become liquid at temperatures slightly above ambient, they add to the liquid content during waste decomposition. Though they are biodegradable, the rate of biodegradation is relatively slow because lipids have a low solubility in water. Carbohydrates: These are found primarily in food and yard wastes, which encompass sugar and polymer of sugars (e.g., starch, cellulose, etc.) with general formula (CH ₂ O) _x . Carbohydrates are readily biodegraded to products such as carbon dioxide, water and methane. Decomposing carbohydrates attract flies and rats, and therefore, should not be left exposed for long duration. Proteins: These are compounds containing carbon, hydrogen, oxygen and nitrogen, and consist of an organic acid with a substituted amine group (NH ₂). They are mainly found in food and garden wastes. The partial decomposition of these compounds can result in the production of amines that have unpleasant odours. Heating value: An evaluation of the potential of waste material for use as fuel for incineration requires a determination of its heating value, expressed as kilojoules per kilogram (kJ/kg). The heating value is determined experimentally using the Bomb calorimeter test, in which the	(04 Marks for any four)

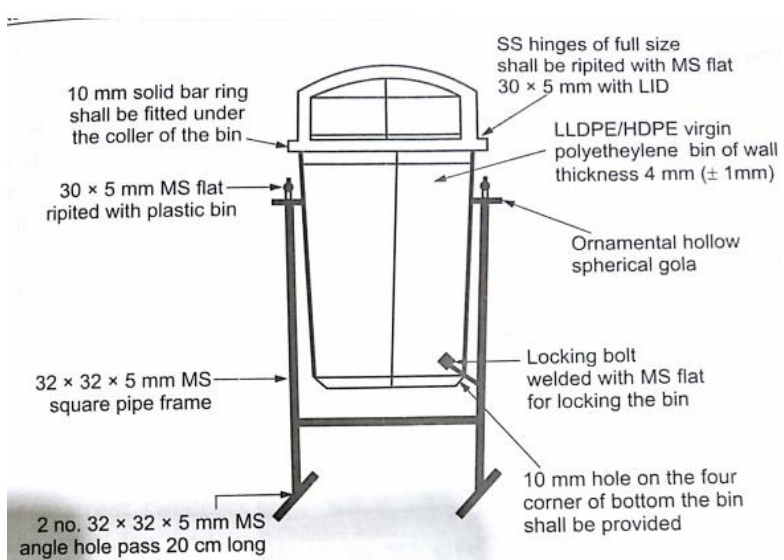
		<p>heat generated, at a constant temperature of 25°C from the combustion of a dry sample is measured. Since the test temperature is below the boiling point of water (100°C), the combustion water remains in the liquid state. However, during combustion, the temperature of the combustion gases reaches above 100°C, and the resultant water is in the vapour form.</p> <p>Natural fibres: These are found in paper products, food and yard wastes and include the natural compounds, cellulose and lignin, that are resistant to biodegradation. (Note that paper is almost 100% cellulose, cotton over 95% and wood products over 40%.) Because they are a highly combustible solid waste, having a high proportion of paper and wood products, they are suitable for incineration. Calorific values of oven-dried paper products are in the range of 12,000 -18,000 kJ/kg and of wood about 20,000 kJ/kg, i.e., about half that for fuel oil, which is 44,200 kJ/kg.</p>	
Q.3	(b) Ans.	<p>Enlist sources of solid waste.</p> <p>Sources of solid wastes in the community are:</p> <ol style="list-style-type: none"> 1. Residential 2. Commercial 3. Institutional 4. Construction and demolition 5. Municipal services 6. Treatment plant sites 7. Industrial 8. Agricultural 9. Bio medical waste 	(04 Marks for any eight)
Q.3	(c) Ans.	<p>Explain solid waste management techniques hierarchy.</p> <div style="text-align: center;">  <p>The diagram shows a pyramid divided into six horizontal layers. From top to bottom, the layers are labeled: Prevention, Minimisation, Reuse, Recycle, Recovery, and Disposal. To the right of the pyramid, a vertical double-headed arrow indicates a scale from 'Most favoured' at the top to 'Least favoured' at the bottom.</p> </div> <p>Following are the various stages in SWM Hierarchy:</p> <ol style="list-style-type: none"> 1. Prevention: preventing the use of such raw material in production which produces maximum solid waste and selecting the alternative raw materials. 2. Minimization: if such alternative raw materials are less possible then minimize the use of raw materials producing more waste by implementing different techniques. 3. Reuse: it is the next desirable option in which materials some materials are repeatedly used again and again for same purpose. <p>The following measures are therefore proposed to be taken to Reduce, Re-use and Recycling of waste by all concerned:</p> <ul style="list-style-type: none"> • All manufacturers producing a variety of domestic and non-domestic products, food as well as non-food should be persuaded to seriously endeavour to use re-usable packaging materials so that after the delivery of goods, the packaging 	<p>(01 Mark)</p> <p>(03 Marks)</p>

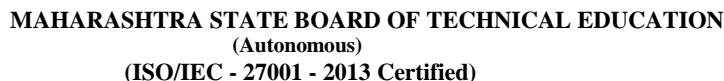


		<p>materials could be collected back and used over and over again.</p> <ul style="list-style-type: none">• Incentives and product discount should be given to consumers for the return of packaging or bottling materials in good condition, to the waste producers or retailers to promote re-use.• The cost of packed articles and article without the packaging material could be kept different with a choice to the consumers to take the article without the packaging material at low cost. <p>4. Recycle: In this stage collection, sorting of recyclable products is done and then they are manufactured into new products.</p> <p>5. Recovery: in this stage the recoverable materials are processed which includes activities like recycling and composting.</p> <p>6. Disposal: It is the last option and should be considered after all other possible actions to recover that waste matter. It may includes incineration, dumping.</p>	
Q.3	(d) Ans.	<p>Explain importance of solid waste management in making any city as smart city.</p> <p>1. Environmentally friendly: a. Correct ways of waste management especially industrial waste can keep our environment from pollution. Example: i. Heavy metal such as mercury which can harm to our ecosystem. Proper disposal required. ii. Nuclear waste to prevent radiation to our natural environment.</p> <p>2. Waste causes resource depletion: This is due to the common buying pattern: buy, throw, and then buy again. As the waste piles up high, the demand for more products also rises, almost exhausting the natural resources. This has a spiral effect, mainly involving threats to biodiversity, deforestation, pollution, and other environmental problems.</p> <p>3. Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each (Note: Marks should be given to other appropriate points also)</p>	(04 Marks for any two points)
Q.3	(e) Ans.	<p>Explain transportation system for municipal solid waste.</p> <ul style="list-style-type: none">• Transportation of the waste stored at waste storage depots at regular intervals is essential to ensure no garbage bins / containers overflow and waste is not seen littered on the street.• Hygienic conditions can be maintained in cities / towns only if regular clearance of waste from temporary waste storage bin is ensured.• Transportation system has to be so designed that it is efficient and cost effective.• Following are the main issues to be addressed for effective transportation system.	(04 Marks)



		<p>i) Irregular transportation. ii) Underutilization of fleet of vehicle. iii) Open trucks iv) Non-routing vehicle</p>	
Q.3	(f) Ans.	<p>Draw the organization pattern of solid waste management.</p> <pre>graph TD; LB[Legislative Body] <--> ME[Ministry of Environment and forest]; ME <--> SG[State Government]; ME <--> CPCB[Central pollution control board]; SG <--> SPCB[State pollution control board]; SPCB <--> CC[City Corporation]; CC <--> PFS[Private formal sector]; CC <--> PIS[Private informal sector]; PFS <--> PIS;</pre>	(04 Marks)
Q.4		Attempt <u>any four</u> of the following	16 Marks
Q.4	(a) Ans.	<p>State requirements of location of transfer station.</p> <p>Factors affecting selection of site for transfer station:</p> <ol style="list-style-type: none">1. Waste scattering / Pollution: It should be selected such that it should not create nuisance to nearby areas.2. Haul Distance: It should be constructed at suitable locations so as to minimize haul distances.3. Heritage place: It should be away from heritage place.4. Traffic flow: It should be located in area where traffic flow is smooth.5. Electricity: Electricity should be available.6. Rate of land: It should be located in area where rates of land and property are cheap.	(04 Marks One mark each for any four)
Q.4	(b) Ans.	Draw neat labeled sketch of Litter Bin.	(04 Marks)

			
Q.4	(c) Ans.	<p>State the parameters to be taken into account while making storage facility for solid waste.</p> <p>Following parameters to be taken into account while making storage facility for solid waste.</p> <ul style="list-style-type: none"> i) Efficiency, i.e., the containers should help maximize the overall collection efficiency. ii) Convenience, i.e., the containers must be easily manageable both for residents and collection crew. iii) Compatibility, i.e., the containers must be compatible with collection equipment. iv) Public health and safety, i.e., the containers should be securely covered and stored. v) Ownership, i.e., the municipal ownership must guarantee compatibility with collection equipment. 	(04 Marks One mark each for any four)
Q.4	(d) Ans.	<p>Describe factor affecting composting process.</p> <p>1. Organisms Composting of organic waste depends upon the type of bacteria involve in composting process.</p> <p>2. Moisture Moisture tends to occupy the free air space between the particles, hence when the moisture content is very high anaerobic conditions set in. Optimum moisture content is between 50 to 60%.</p> <p>3. Temperature Activities of organism depends upon the temperature, so for efficient composting process optimum temperature need to be maintained.</p> <p>4. Aeration It is necessary to ensure that oxygen is supplied throught the mass and aerobic activity is maintained.</p> <p>5. Addition of sewage and sludge To maintain optimum C/N ratio addition of sewage is done as it also bring down the cost of sewage sludge treatment.</p> <p>6. C/N ratio Optimum range of C/N ratio is 26-31 depending upon other environmental conditions.</p>	(04 Marks One mark each for any four)

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		decomposition result ineffective vermicompostig. Hence preprocessing of waste and maintaining favorable environmental condition is necessary for vermicomposting. Earthworms acts as turners, mixers, accelerators, screeners, aerators and pathogen controllers. Vermicomposting can be done in small scale in worm bins and traditionally on large scale. The product obtained at the end is a nutrient rich manure which is ecologically safe.	
Q.5	b) Ans.	Explain collection and disposal of industrial waste. The collection of industrial waste should be regular and frequent from various industries. The storage of hazardous industrial waste should be in a separate covered shed having proper fencing and restricted access. Technically competent contractors should be allowed to handle industrial waste with environmental awareness. Labeling ,coding of hazardous waste with assurance of emergency services in case of spillage during collection and transportation should be made mandatory. The most predominant and practiced methods for industrial waste disposal are Secure Landfill, Incineration and Recycling. The disposal of industrial wastes can be used depending upon the characteristics of industrial wastes. The industrial wastes can be categorized as hazardous and non hazardous waste. Recycling method used for disposal of ash in the manufacture of cement, construction materials. Incineration with off gas monitoring method is used for industrial wastes such as solvents, Residues etc. Secured land filling method is used for STP sludge, plant sludge etc.	04 M
Q.5	c) Ans.	State biomedical waste management technologies and explain any one. Biomedical waste management technologies are as follows. 1.Deep Burrial 2. Autoclaving 3. Microwaving 4. Chemical disinfection 5.Mutilation/Shredding 6. Incineration 7. Secured Sanitary landfills 8. Encapsulation Deep Burrial: It is a pit 2 m deep half filled with waste and remaining with lime within 50 cm of the surface before filling the rest with soil. On each time when biomedical wastes are added to the pit a layer of 10 cm of soil should be added to cover the waste. The deep burial site should be relatively impermeable, away from residential area, vicinity of drinking water to avoid risk of pollution. The institute should maintain the record of all sites of deep burial. Autoclaving: It involves sterilization with steam at 120 degree Celsius temp under 15 psi pressure fo 60 to 90 min. Autoclaves are used for disinfection of surgical instruments. Infectious wast can be autoclaved by exposing it to 160 degree Celsius temp at 6 bars pressure for about 20 min. (Any one explanation of above methods)	01 Any one 03 M for each
Q.5	d) Ans.	State hazardous substances in E-waste and its health effects on health and environment. The hazardous substances in E waste and its ill effects on health and environment are as follows.	



		<table><tr><th>Sr.No.</th><th>Hazardous Substances in E waste</th><th>Ill effects on health and environment</th></tr><tr><td>1</td><td>Lead</td><td>Damage to nervous system, blood systems, Kidney & Brain growth</td></tr><tr><td>2</td><td>Cadmium</td><td>Neural Damage, Toxic effect in kidney & liver due to accumulation</td></tr><tr><td>3</td><td>Mercury</td><td>Damage to brain, Respiratory and skin disorders</td></tr><tr><td>4</td><td>Cromium</td><td>DNA damage, Asthamatic Bronities</td></tr><tr><td>5c</td><td>Barium</td><td>Damage to Heart, Liver, Spleen, Muscle Damage</td></tr><tr><td>6</td><td>Berillium</td><td>Lung Cancer, Skin Diseases</td></tr><tr><td>7</td><td>Brominated flame retarders</td><td>Damage of endocrine system</td></tr><tr><td>8</td><td>Plastic</td><td>Damage to Immune & reproductive system</td></tr></table>	Sr.No.	Hazardous Substances in E waste	Ill effects on health and environment	1	Lead	Damage to nervous system, blood systems, Kidney & Brain growth	2	Cadmium	Neural Damage, Toxic effect in kidney & liver due to accumulation	3	Mercury	Damage to brain, Respiratory and skin disorders	4	Cromium	DNA damage, Asthamatic Bronities	5c	Barium	Damage to Heart, Liver, Spleen, Muscle Damage	6	Berillium	Lung Cancer, Skin Diseases	7	Brominated flame retarders	Damage of endocrine system	8	Plastic	Damage to Immune & reproductive system	Any four 01 M for each
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Q.5	e) Ans.	Explain disposal of E-waste. The disposal of E waste is done by Land filling , Incineration & Reuse methods as follows: i) Land filling: In land filling, trenches are made on flat surfaces. Soil is excavated from the trenches and waste material is buried in it, which is covered by thick layer of soil. Secure land filling are provided with some facilities like impervious liner made up of plastic o clay, Leachate collection basin that collect and transfer the leachate to wastewater treatment plant. Environmental risk from land filling of E waste cannot be neglected because the condition of land filling site are different from a native soil, particularly concerning the leaching behavior of metals. ii) Incineration: It is controlled and complete combustion process, in which the waste material is burned in specially designed incinerators at a high temperature. Advantages of incineration of E waste are the reduction of waste volume and utilization of energy content of combustible materials. iii) Reuse: It is commonly used for electronic equipment like computers, cell phones etc. It constitutes direct second hand use or use after slight modification of original functioning equipment. This reduces E waste volume.	04 M																											
Q.5	f) Ans.	Explain the recycling of industrial waste. The recycling of various industrial wastes such as Fly ash, Blast furnace slag, lime sludge, Ferro alloy slag, Nonferrous metal waste, phosphogypsum, etc are as follows. 1. Fly ash waste from thermal plants is recycled for manufacturing of cement, light weight aggregates, insulating bricks, precast concrete, soil stabilization, land reclamation etc. 2. Blast furnace slag from steel plants is recycled for manufacture of cement, refractory, ceramic material, aggregates etc. 3. Phosphogypsum waste from Chemical plants is recycled for manufacture of gypsum plaster, boards, tiles, cement products etc. 4. Nonferrous metal industry waste is recycled for manufacture of binder material, construction blocks, heavy clay products, colored concrete, floor tiles, polymer doors etc. 5. Lime sludge from paper allied industries is recycled for manufacturing of building	Any four 01 M for each																											



		lime, masonry cement, lime bricks, binder materials etc.	
Q.6		Attempt any FOUR of the following.	(16)
Q.6	a)	Explain health problems during segregation and recycling of solid waste. Ans. During segregation and recycling of solid waste sanitary workers face to direct health risks. For public, health problems arises from the breeding of diseases due to flies, insects & Rats. The health problems are more serious when transfer of pollution to water, ground water & air takes place. Air pollution causes due to insufficient burning of wastes in open or in plants due to improper gaseous effluent removal devices. Mixing of hazardous wastes from industries with municipal wastes create risks to human health. Danger of concentration of heavy metals in the food chain due to industrial effluent discharges into drainage system creates danger to public health. Sanitary workers dealing with municipal solid waste are infected with gastrointestinal parasites, worms etc. The organic fraction of municipal solid waste provides food and shelter to insects and rodents which causes 22 human diseases due to improper solid waste management causing adverse impact upon public health and environmental quality.	04 M
Q.6	b)	State the importance of public involvement and participation in solid waste management. Ans. The importance of public involvement & participation can be described as per following points. <ol style="list-style-type: none">1. To increase the awareness of SWM among the people.2. To promote The principles of Reduction, Reuse, Recycling & Recovery.3. To reduce littering of waste on streets, drains & open spaces.4. To plan segregation oh hazardous, non-hazardous; dry wet waste, E waste, BMW & industrial waste.5. To reduce the environmental pollution.6. To increase efficiency of planning & implementation of SWM.7. To improve management strategies with local municipal authorities.8. To encourage composting & recycling initiatives in public & agencies.	Any four 01 M for each
Q.6	c)	State Do's and Don'ts to avoid health problem during solid waste management. Ans. Do's and Don'ts to avoid health problems during solid waste management are as follows. Do's: 1. Frequent and regular collection and disposal of municipal solid waste. 2. Separate collection of Non hazardous Domestic and hazardous Industrial Wastes. 3. Safety precautions including use of hand gloves, Masks Gum Boots etc during solid waste handling. 4. Regular health check up capms for workers and public residing near dumping yards. Don't's: 1. Burning of solid waste in open yards, plots. 2. Mixing of Dry and Wet solid Domestic Wastes. 3. Discharging industrial liquid waste in natural drains. 4. Mixing of recyclables in municipal solid waste. (Credit marks may be given to similar points)	02 M 02 M
Q.6	d)	Explain process of public involvement and participation in solid waste management.	



	Ans.	<p>Public involvement and participation can be achieved through following steps. Public involvement can be increased by public awareness programs, effective community participation, transparent and clean administration, introduction of citizen chapters and accountability at all levels. Public participation in solid waste management can be achieved by following steps.</p> <ol style="list-style-type: none">1. Identification of areas where public participation is essential.2. Reaching the community and seeking the cooperation for problem finding and their solution.3. Public information, Education and communication programs by group meetings, workshops, exhibitions, lectures and panel discussions.4. Use of print media, TV, Cinema, Radio, Web sites, Posters, Pamphlets, School curriculum, NGO etc.	04 M
Q.6	e) Ans.	<p>State methods of collection of recyclables and explain any one.</p> <p>The methods of collection of recyclables are as follows.</p> <ol style="list-style-type: none">1. Curbside collection2. Buy back centers3. Drop off centers4. Deposit Programs <p>Curbside collection: In this method the resident in urban or sub urban area sorts recyclable household waste according to type of material in separate bins which are placed on curb side or at collection point weekly or fortnightly which is collected by municipal workers.</p> <p>Buy back centers: Buy back centers established at central locations purchase the cleaned recyclable sorted waste from residents. These centers send this collection to recycling factories.</p> <p>Drop off centers: The collected recyclables is dropped at reprocessing plants directly.</p> <p>Deposit Programs: The resident purchases households after paying deposit amount. After use waste containers are given back to sellers getting back deposit along with bonus point for redemption for next purchase. (Explanation of any one method)</p>	02 M Any one 02 M
Q.6	f) Ans.	<p>State purpose of recycling of solid waste.</p> <p>The purposes of recycling of solid waste are as follows.</p> <ol style="list-style-type: none">i) To save raw material resources in productionii) To save energy in productioniii) To reduce solid waste in landfillsiv) To minimize environmental pollutionv) To reduce the consumption of conventional raw materials.vi) To reduce air pollution from incinerations.	Any four 01 M for each