



SUMMER -2019 EXAMINATION

Subject code: 17605

Model Answer

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Important Instructions to examiners:

- 1) The answer should be examined by keywords 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 error such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and communication skill).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure 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 the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding

Q. No.	Question and Model Answers	Marks
1.(A)	Attempt any THREE	3 x 4 = 12M
a)	Enlist eight types of Solid Waste.	
Ans:	Types of Solid Waste – 1) Domestic waste 2) Commercial waste 3) Industrial waste 4) Market waste 5) Agricultural waste 6) Biomedical waste 7) E-waste 8) Hazardous waste 9) Institutional waste 10) Construction and demolition waste	1/2M each (for any eight)
b)	State the various factors affecting solid waste generation.	
Ans:	Factors affecting solid waste generation - 1) Living standard of people 2) Awareness of people 3) Collection frequency 4) Source reduction/ recycling 5) Geographic location 6) Per person income	1/2M each (for any eight)

	<ul style="list-style-type: none"> 7) Public attitude 8) Size of households 9) Population density 10) Population increase 11) Habits and culture of people 12) Industries in the vicinity 	
c)	What are the measures to be taken towards the segregation of recyclable waste?	
Ans:	<p>Measures to be taken towards the segregation of recyclable waste-</p> <ul style="list-style-type: none"> 1) The local body may mobilize NGO's or co-operatives to take up the work of organizing street rag-pickers and convert them to door-step waste collectors by motivating them. 2) The Local Bodies may actively associate resident associations, trade & industry associations and NGO's in creating awareness among the people to segregate recyclable material at source and hand it over to a designated identified waste collector. 3) The local body may give priority to the source segregation of recyclable waste by shops and establishments and later concentrate on segregation at the household level. 4) The upgraded rag-pickers on becoming door-step waste-collectors, may be given an identity card by the NGO's organizing them so that they may have acceptability in society. 5) Keep separate large bins for recyclables near the society. 6) Products and packaging materials should be conspicuously labelled to indicate recycled content, including post-consumer content, recyclability, toxicity and appropriate disposal. 7) The establishment of stable markets for recycled materials is essential. Awareness should be created to promote procurement of products containing a high content of recycled and recyclable materials. 	1M* Each (for any four <u>similar</u> measures)
d)	State the measures to be taken to improve the collection services of municipal waste.	
Ans:	<p>Measures to be taken to improve the collection services of municipal waste-</p> <ul style="list-style-type: none"> 1) Awareness regarding segregation of degradable and non degradable solid waste. 2) Distribution of free colour coded bins to consumers for solid waste storage. 3) Timely and regular service for door to door collection of waste. 4) Participation of rag-pickers in waste collection. 5) Separate bins of larger size for commercial shops and hotels, etc. 6) Separate collection system for waste food from marriage halls, hotels, etc. 	1M Each (for any four <u>similar</u> measures)
e)	State any two advantages and disadvantages of incineration process.	
Ans:	<p>Advantages of Incineration process-</p> <ul style="list-style-type: none"> 1) It is capable of producing energy. 2) It requires minimum land. 3) It can be operated in any weather. 4) It produces stable odour free residue. 	1M each (for any two)

	<p>II) Bangalore method</p> <ol style="list-style-type: none"> 1) In this method underground earthen trench is excavated and alternate layer of waste and soil is filled in trench or pit to control odour. 2) Final layer of soil is provided at top. The soil cover not only prevent odour but also prevents breeding of flies. 3) Within 2-3 days of burial intensive biological action starts taking place and organic matter beings to be destroyed. After 4-5 months complete stabilization of waste takes place. 4) During biological action head is evolved which rises temperature of decomposing mass. <p>Main difference between above methods - is that Indore method is aerobic method while Bangalore method is anaerobic method.</p>	<p>2M</p> <p>2M</p>
Q.2.	Attempt any <u>FOUR</u>:	4 x 4 = 16M
a)	State two physical characteristics and two chemical characteristics of solid waste.	
Ans:	<p>Physical characteristics of solid waste-</p> <ol style="list-style-type: none"> 1) Density – 50-290 kg/m³. Knowledge of the density of waste i.e. mass per unit volume is essential for the design of all elements of the solid waste management system. 2) Moisture content – 05-60%. Moisture content is a critical determinant in the economic feasibility of waste treatment by incineration since energy must be supplied for evaporation of water and in raising the temperature of the water vapour. 3) Size distribution - 1 cm to 50 cm. The measurement of the size distribution of particles in the waste stream is important because of its significance in the design of mechanical separators and shredders 4) Field capacity - Field capacity of solid waste is total amount of moisture that can be retained in waste sample subject to downward pull of gravity. 5) Permeability of compacted waste - The Hydraulic conductivity of compacted waste is an important physical property to a large extent governs movement of liquid and gases in landfill. 6) Porosity – It represents the amount of voids per unit overall volume of material. <p>Chemical characteristics of solid waste-</p> <ol style="list-style-type: none"> 1) pH - The pH of fresh solid waste is normally around 7. During decomposition it tends to become acidic and stabilized solid waste has an alkaline pH. 2) Organic content - The knowledge of organic content helps assess the feasibility of biological processing-composting and anaerobic digestion. 3) Carbon content - The carbon is determined by using the New Zealand formula in which the percent organic matter is divided by 1.724. 4) Nitrogen content - Nitrogen, phosphorous and potash values are important in composting. 5) Toxicity - Toxicity characteristics include heavy metals, pesticides, insecticides etc. 	<p>2M (for any two)</p> <p>2M (for any two)</p>

b)	Define solid waste. What is its impact on environment	
Ans:	<p>Solid waste- It is defined as the unwanted or useless solid materials generated from human activities in residential, industrial or commercial areas.</p> <p>Impact of solid waste on environment-</p> <ol style="list-style-type: none"> 1) Major adverse impact is attraction to rodents and insects. 2) Degrade the environmental quality due to foul odours and unsightliness. 3) Large amount of land utilized for disposing the waste, which affects the land. 4) Leachate in landfill poses a threat of ground water and local sources of water. 5) Air pollution from incineration plant. 6) Hazardous waste may poses health hazard if improperly handled. 7) E-waste may cause the acidification of soil. 8) Choking of drains and gully pits. 9) Fires within the open waste dump causes air pollution and choking. 10) Epidemics through stray animals. 	<p>1M</p> <p>3M (for any three)</p>
c)	Explain the meaning of transfer station, its necessity and location.	
Ans:	<p>Meaning of Transfer Station- It is a processing site for temporary deposition of waste prior to loading in to larger vehicles, from this site larger vehicles transport the municipal solid waste to disposal site for landfilling.</p> <p>Necessity of transfer station-</p> <ol style="list-style-type: none"> 1) Larger volume of municipal solid waste from urban market is not possible to transport directly to disposal sites for land filling, etc. from collection points. 2) Hence waste is temporarily deposited at some distance away from generation points. At these sites waste is accepted from small collection vehicles. 3) The waste is compacted and loaded into larger vehicles for long haul transports up to disposal site. Thus transfer station results in improvement in collection equipment by minimizing transportation cost, time and reduction in volume. <p>Location of transfer station-</p> <ol style="list-style-type: none"> 1) It should be centrally located. 2) It should not be far away from disposal sites. 3) It should be in areas where traffic flow is smooth. 4) It should not be in densely populated residential areas. 	<p>1M</p> <p>2M (any two points)</p> <p>1M (any two points)</p>
d)	How is the leachate management done?	
Ans:	<p>Leachate management is done by -</p> <ol style="list-style-type: none"> 1) Keep the waste as dry as possible, and do not introduce any liquid wastes to minimize leachate. 2) Leachate is carefully collected and shall be treated before its release on ground if possible. 3) Prevention of migration of leachate from landfill sides and landfill base to the sub-soil by a suitable liner system should be provided. 4) Using leachate treatment methods like Natural system, Biological treatment & Using Physicochemical treatment <p>Note- If student write the methods of leachate control methods give credit of 2M.</p>	<p>1M (for each)</p>

(b)	Enumerate various sources of solid waste.	
	<p>Following are the sources of solid waste</p> <ul style="list-style-type: none"> i) Residential: This includes wastes from residential houses like dwellings; apartments etc., and consisting of leftover food, vegetables peels, plastic, clothes, ashes etc. ii) Commercial: This refers to waste generated from restaurants, hotels, motels, stores, markets, auto-repair shops, medical facilities etc., and consisting of leftover food, glasses, metals, ashes etc. iii) Institutional: This includes waste coming from educational, administrative and public buildings like prisons etc., and consisting of paper, plastic, glasses etc. iv) Municipal: This mainly refers to waste from various municipal activities like construction and demolition, street cleaning, landscaping etc., and consisting of leaf matter, dust, building debris, waste water treatment plant residual sludge etc. v) Industrial: This mainly consists of waste generated from various industrial activities and consisting of process wastes, ashes, construction and demolition wastes, hazardous wastes etc. vi) Agricultural: This includes wastes coming from fields, orchards, vineyards, farms etc., and consisting of agricultural remains, spoiled vegetables and grains, litter etc. vii) Open areas: This mainly refers to waste from streets, alleys, parks, playgrounds, beaches, highways, recreational areas etc. 	01 mark each (any Four)
(c)	Describe the organization pattern of solid waste management.	
	<div style="text-align: center;"> <pre> graph TD LB[Legislative Body] --> ME[Ministry of Environment and forest] ME --> SG[State Government] ME --> CPC[Central pollution control] SG --> CC[City Corporation] CPC --> SPCB[State pollution control board] SPCB --> CC CC --> PFS[Private formal sector] CC --> PIS[Private informal sector] PFS <--> PIS </pre> <p>Organization pattern of solid waste management</p> <p>OR</p> </div>	2M for all units 2M for correct sequence

	<p>i) Ministry of Environment and Forests:Ministry of Environment and Forests is responsible for all of the environmental policy at the national level, including the management of waste. The Ministry has an overview of all the activities of the MSWM sector and makes sure that it is performed well.</p> <p>ii) Central Pollution Control Board: Central Pollution Control Board keeps a check on all the activities that have potential to pollute the environment, which includes the monitoring of the municipal solid waste management in the country. It has divisions in each state that report to CPCB on the environmentally hazardous activities in the state, the actions taken towards them and the improvements made by the industries and public towards a cleaner environment.</p> <p>iii) State Pollution Control Board:State Pollution Control Board keeps a check on all the activities that have potential to pollute the environment, which includes the monitoring of the municipal solid waste management in the state. It reviews the Environmental Impact Assessment carried out by the agencies prior to the construction of a landfill site, installation of an incinerator or any other processing plant. It carries out public participation meeting to make the public aware of the proposed project and its benefits. Public participation is especially important so that once the project is started there should not be any agitation against the project.</p> <p>iv) City Corporation:City Corporation is responsible for the making of the solid waste management policy, setting up the targets and objectives. They are responsible for managing the solid waste in the city and are answerable to the State Board and central pollution control Board. They also have the authority to privatize the solid waste management sector.</p> <p>v) Private formal sector:Their functions include the collection of waste, transfer of waste to trucks, transport of waste to the specified dump yard. They have the responsibility of disposing of the waste by alternative layering of waste and soil, spraying it with EM solution and water.</p> <p>vi) Private informal sector:The informal sector in the city is very large and plays a very vital role in the MSWM. It comprises of the rag pickers who retrieve recyclable waste from the community bins and landfills, and sell it to either bigger dealers or to recycling factories.</p>	<p>OR</p> <p>1M each (any Four)</p>
(d)	Describe the principles of composting.	
	<p>Decomposition and stabilization of organic waste matter is a natural phenomenon. Composting can be carried out in two ways i.e. aerobic composting and anaerobic composting.</p> <p>1. Aerobic Composting- In an aerobic composting aerobic micro-organism oxidize organic compounds to Carbon dioxide, Nitrite and Nitrate.</p> <p>2. Anaerobic composting- In an anaerobic composting the anaerobic micro-organisms while metabolizing the nutrients, break down the organic compounds through a process of reduction. A very small amount of energy is released during the process. The end result of composting is an accumulation of partially decayed organic matter called humus.</p>	<p>02 marks</p> <p>02 marks</p>

(e)	<p>(i) What is vermi composting? (ii) State the various methods of pyrolysis</p>	
	<p>i) Vermi composting is the process of composting using worms. it involves the stabilization of organic solid waste through earthworms, which converts the organic material into worm casting.</p> <p>ii) Following methods of pyrolysis</p> <p>i) Garrets Flash pyrolysis ii) Pyrolysis developed by Energy research center of Bureau of Mines Pittsburg. iii.) Destrugas Gasification system iii) Slurry carb process iv.) Plasma pyrolysis</p>	<p>02 marks</p> <p>02 marks (any two)</p>
4	(A) Attempt any THREE:	3× 4=12
(a)	<p>How are the following recycled?</p> <p>(i) Fly ash ii) Blast furnace slags iii) Pulp and paper iv) Chromium Sludge</p>	
	<p>(i) Fly ash: Fly ash waste from thermal plants is recycled for manufacturing of cement, light weight aggregate, insulating bricks, precast concrete, soil stabilization, land reclamation etc.</p> <p>(ii) Blast furnace slags: Blast furnace slag from steel plants is recycled for manufacturing of cement, refractory, ceramic material, aggregates etc.</p> <p>(iii) Pulp and paper: Pulp and paper from paper industry are recycled and again used for manufacturing new paper and paper products.</p> <p>(iii) Chromium Sludge: Chromium sludge are recycled for manufacturing of ordinary cement, Coloured cement etc.</p>	01 mark each
(b)	Define E-waste. State the composition of E-waste.	
	<p>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.</p> <p>Many varieties includes in the E waste</p> <p>i) Telecommunication waste- mobile, Telephones, Monitors and laptops, Mouse, keyboards and other electronic devices, telephone exchange wireless cables and related scrap, Televisions</p> <p>ii) Electrical Waste – Switches, relays, connectors and related scrap material</p> <p>iii) Electronic waste- Electronic metal waste, Printed Circuits Boards, E – equipment and Machinery, IC, Sockets Connectors</p> <p>iv) Cable waste- PVC, Pre insulated Copper and Aluminium Cable waste</p>	<p>2M</p> <p>2M (any two)</p>
(c)	Describe the provisions in law for safe disposal of bio-medical waste in India.	
	<p>Following are the provisions in law for safe disposal of bio-medical waste in India</p> <p>As per the Bio-medical waste (Management & Handling) Rules 1998-</p> <p>i) It is the duty of every occupier i.e. a person who has the control over the institution or its premises, to take all steps to ensure that waste generated is handled without any adverse effect to human health and environment.</p>	01 marks for each provision

	<p>ii) The hospitals, nursing homes, clinics, dispensaries, pathological laboratories etc. are therefore required to set in places the biomedical waste disposal and treatment facilities as per schedule V and VI respectively.</p> <p>iii) Segregation, packaging, transportation and storage of BMW according to schedule 1, schedule 2 and 3, schedule 4 respectively.</p> <p>v) For the effective bio-medical waste management the state government shall establish prescribed authority for granting authorization to concern occupier/operator; who are required to maintain the annual and accident records of the facility.</p>													
(d)	State different methods of communication for mass education.													
	<p>Following are the methods of communication for mass education</p> <p>i) Use of print media</p> <p>ii) Use of TV/Cable TV/ Radio</p> <p>iii) Street plays, puppet show</p> <p>iv) Posters</p> <p>v) Pamphlets</p> <p>vi) Use of hoarding</p> <p>vii) Use of public transport system</p> <p>viii) Web site/smart phones</p>	½ marks each												
Q.4	(B) Attempt any ONE:	1× 6=6												
(a)	Describe the area method of landfilling. Write its advantages and disadvantages.													
	<p>Area method of landfilling means wastes are disposed on ground. This method is adopted when natural depressions are not available and it is very difficult to excavate land. It is best suited for flat or gently sloping areas. Waste is pushed into layers, compacted, and adequately covered. Covered materials which may need to be hauled from adjacent areas.</p> <p>Advantages:</p> <p>i) It is cheapest waste disposal method</p> <p>ii) Verity of solid waste can be disposed off</p> <p>iii) Jobs will be created for local people</p> <p>Disadvantages:</p> <p>i) The site will look ugly when it is being used</p> <p>ii) Dangerous gases are generated</p> <p>iii) Local streams can be polluted since excessive leachate generated</p>	<p>02 M</p> <p>2M (any two)</p> <p>2M (any two)</p>												
(b)	Describe the hazardous and non-hazardous substances, their origin and their health effects.													
	<table border="1"> <thead> <tr> <th>Hazardous Substances</th> <th>Origin</th> <th>Health effects</th> </tr> </thead> <tbody> <tr> <td>Lead</td> <td>Solder in PCB (printed circuit board)</td> <td>Damage to nervous system, kidney, Brain development of children</td> </tr> <tr> <td>Mercury</td> <td>Tubes, PCB, Thermostats</td> <td>Chronic damage to brain, skin disorder, memory loss, muscle weakness.</td> </tr> <tr> <td>Cadmium</td> <td>Chip resistor & semiconductor</td> <td>Kidney & lever damage, Neural damage</td> </tr> </tbody> </table>	Hazardous Substances	Origin	Health effects	Lead	Solder in PCB (printed circuit board)	Damage to nervous system, kidney, Brain development of children	Mercury	Tubes, PCB, Thermostats	Chronic damage to brain, skin disorder, memory loss, muscle weakness.	Cadmium	Chip resistor & semiconductor	Kidney & lever damage, Neural damage	3M (any two)
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	<p>Non Hazardous substances- Tin, Copper, Aluminium, Iron, Germanium, Silicon, Nickel, Lithium, Zinc, Gold. Tin -obtained from the mineral cassiterite. Tin dust can irritate the skin and delicate tissue, Copper- Ore of Cuprite. Long-term exposure to copper can cause irritation of the nose, mouth and eyes and it causes headaches, stomachaches, dizziness, vomiting and diarrhea.</p>	<p>2M (any two)</p>												
Q.5	Attempt any FOUR:	4x4=16												
a)	Describe ‘Waste Minimization Approach’.													
	<ul style="list-style-type: none"> ➤ Optimization of resources: waste reduction at individual and institutional level goes side by side with the utilization of raw materials. ➤ Using again the Scrap Material: this is the process in which individual and industry reuse the waste material as soon as it is produced. This keeps it from becoming a waste material. ➤ Quality control improvement and process monitoring: this technique is to ensure that products produced are kept from rejection and this is increased by the inspection of frequency and monitoring point’s inspection. ➤ Exchanging Waste: this is the technique in which the waste product, which comes out of a process, becomes a raw material for another process. This is another way for reducing waste. ➤ Point of use from ship: to maintain and making deliveries for the raw materials to be used with the manufacturing process, at the point of assembly with fewer packages and wrappings can save from the waste production. ➤ Zero waste: this is a whole systems approach that aims to eliminate waste at the source and at all points down the supply chain, with the intention of producing no waste. It is a design philosophy which emphasizes waste prevention as opposed to end of pipe waste management. 	<p>1M each</p>												
b)	What is waste segregation? Explain its importance.													
	<p>Waste segregation means separation of waste at source so that it can reduce following problems –</p> <p>Waste segregation is included because it is much easier to recycle. Effective segregation of wastes means that less waste goes to landfill, which makes it cheaper and better for people and the environment. It is also important to segregate for public health. In particular, hazardous wastes can cause long-term health problems, so it is very important that they are disposed of correctly and safely and not mixed in with the normal waste coming out of your home or office.</p>	<p>2M</p>												

	<p>If proper waste segregation is not done then following bad effects will happens-</p> <ol style="list-style-type: none"> 1) For public, health problems arise from the breeding of diseases due to flies, insects & Rats. 2) The health problems are more serious when transfer of pollution to water, ground water & air takes place. 3) Air pollution causes due to insufficient burning of wastes in open or in plants due to improper gaseous effluent removal devices. 4) Mixing of hazardous wastes from industries with municipal wastes create risks to human health. 5) Danger of concentration of heavy metals in the food chain due to industrial effluent discharges into drainage system creates danger to public health. 6) Sanitary workers dealing with municipal solid waste are infected with gastrointestinal parasites, worms etc. 7) 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 <p>(Note: Student may Write any appropriate explanation for Any factor so credit may be Given accordingly.)</p>	<p>2M (any four points)</p>
c)	<p>State how enforcement can help in stopping littering in the street.</p>	
	<ol style="list-style-type: none"> 1) Penalty provisions for littering and non-compliance in the door to door collection system through Bye laws 2) The first solution to littering is to always make sure you properly dispose of your garbage. 3) Recycle all that can be recycled and put all other garbage in the proper containers. 4) If someone throwing something on the ground, ask them nicely to put in the trash receptacle instead of on the ground. 5) Responsibilities of resident and businesses for setting out trash in a responsible manner such that trash/ recyclables do not become littered. 6) Responsibility of haulers to collect with care and ensure loads are properly covered to avoid scattering of materials 7) Responsibility of residents and businesses to ensure loads are properly covered. 8) Property owners must ensure that waste is not stored /stock piled on property for more than a specified period. <p>(Note: Student may Write any appropriate explanation for Any factor so credit may be Given accordingly.)</p>	<p>½ Marks each</p>
d)	<p>Describe the importance of public participation in solid waste management.</p>	
	<p>Public participation in SWM is very important because of following points:</p> <ol style="list-style-type: none"> 1. To increase the awareness of solid waste management among the people. 2. To increase the efficiency and effectiveness of planning process and Implementation of solid waste management. 3. To understand the planning importance and significance. 4. To play an important role in the permitting process in case of hazardous waste as well as municipal waste facilities. 5. To improve the waste management strategies, negotiations with municipal authorities for better involvement in decision making. 6. To achieve the 3R principles. 7. To reduce littering of waste on streets and into drains, open spaces, etc. 8. To encourage and assists the local composting and recycling initiatives. 	<p>½ M For Each</p>

e)	How is the resources recovery through waste processing done?	
	<p>Biological and thermal treatment of waste can result in recovery of useful product such as energy or compost.</p> <p>A) Biological Processes: In this treatment involves using micro-organisms to decompose the biodegradable components of waste. Two types of process are use: i) Aerobic processes: Windrow composting, aerated static pile composting and in vessel composting, vermiculture etc. Utilizable product is compost. ii) Anaerobic processes: Low solids anaerobic digestion, high solids anaerobic digestion. Utilizable product is methane gas. In India, aerobic composting plants have been used to process up to 500 tons per day of waste.</p> <p>B) Thermal processes: Thermal treatment involves conversion of waste into gaseous, solids and liquid conversion products with subsequent release of heat energy. Three types of systems are as follows: i) Combustion systems: Thermal processing with excess amounts of air. ii) Pyrolysis systems: Thermal processing in complete absences of oxygen. iii) Gasification systems: Thermal processing with less amounts of air.</p> <p><i>Note:- (Resource recovering is nothing but recycling practice so if student write about recycling appropriate credit may be given accordingly.)</i></p>	<p>2M</p> <p>2M</p>
f)	Define recycling. What are the purpose of recycling?	
	<p>Definition:- The action or process of converting waste into reusable material.</p> <p>Purpose of recycling: i) To save raw material resources in production ii) To save energy in production iii) To reduce solid waste in landfills iv) To minimize environmental pollution v) To reduce the consumption of conventional raw materials. vi) To reduce air pollution from incinerations.</p>	<p>1 M</p> <p>3 M (any three)</p>
Q. 6	Attempt any FOUR:	4x4=16
a)	State different components of biomedical waste.	
	<p>Following are the components of biomedical waste:</p> <ol style="list-style-type: none"> 1) Human anatomical waste (tissues, organ, body parts etc) 2) Animal waste (as above, generated during research/ experimentation, from veterinary hospital etc) 3) Microbiological and biotechnological waste such as laboratory cultures, Microorganisms, human and animal cell cultures, toxins etc. 4) Waste sharps, such as hypodermic needles, syringes, scalpels, broken glass 5) Discarded medicines and cyto-toxic drugs. 6) Soiled waste such as dressing, bandages, plaster casts, material contaminated with blood etc. 7) Solid waste (disposal items like tubes, catheters etc excluding sharps) 8) Liquid waste generated from any of the infected area. 9) Incineration ash 10) Chemical waste 	<p>½ M each (any Eight)</p>

b)	Describe the biomedical waste management techniques.	
	<p>Biomedical waste management technologies are as follows.</p> <ol style="list-style-type: none"> 1. Deep Burial 2. Autoclaving 3. Microwaving 4. Chemical disinfection 5. Mutilation/Shredding 6. Incineration 7. Secured Sanitary landfills 8. Encapsulation <p>Deep Burial: 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.</p> <p>Autoclaving: It involves sterilization with steam at 120 degree Celsius temp under 15 psi pressure for 60 to 90 min. Autoclaves are used for disinfection of surgical instruments. Infectious waste can be autoclaved by exposing it to 160 degree Celsius temp at 6 bars pressure for about 20 min.</p>	<p>2M (any four)</p> <p>2M (any two)</p>
c)	Describe the health aspect during handling and processing of waste.	
	<p>➤ Health aspects involved in handling and processing of solid waste:</p> <ul style="list-style-type: none"> ➤ There is potential risk to environment and health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with waste. ➤ Traffic accidents can result from toxic spilled wastes. ➤ Air pollution can be caused from the inefficient burning of wastes, either in open air, or in plants that lack effective treatment facilities from the gaseous effluents. ➤ Uncontrolled hazardous wastes from industries mixing up with municipal wastes create potential risk to human health. ➤ The most obvious environmental damage caused by municipal solid wastes is aesthetic, the ugliness of street litter and degradation of urban environment and beauty of city. ➤ There is specific danger of concentration of heavy metals in the food chain, a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/ sewerage system and/ or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle. ➤ Municipal Solid Wastes Management Systems involves various activities like storage, collection, transportation, disposal etc. These activities even if properly controlled and with proper precautionary measures adopted, may have adverse impact on land, water and air environment, human and environmental health aesthetics and quality of life. ➤ The main risk to health is indirect and arises from the breeding of disease vectors, primarily flies and rats. ➤ Biodegradation of organic matter may pose health problems. ➤ Mixing of Bio medical waste , Industrial waste in Municipal waste causes health hazards. 	<p>1 M each (any Four)</p>

d)	Enlist the common product that can be made with recycled contents.	
	<p>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.</p> <p>2. Blast furnace slag from steel plants is recycled for manufacture of cement, refractory, ceramic material, aggregates etc.</p> <p>3. Phosphogypsum waste from Chemical plants is recycled for manufacture of gypsum plaster, boards, tiles, cement products etc.</p> <p>4. Nonferrous metal industry waste is recycled for manufacture of binder material, construction blocks, heavy clay products, colored concrete, floor tiles, polymer doors etc.</p> <p>5. Lime sludge from paper allied industries is recycled for manufacturing of building materials lime, masonry cement, lime bricks, binder materials etc.</p> <p>Note- (Students may write similar products, credit may be given accordingly)</p>	01 M each (any four)
e)	Explain sorting prior to waste processing or land filling.	
	<p>A SWM, depending on the level of complexity, will consist of a combination of unit processes in varying degrees of mechanization:</p> <p>1) Pre-Sorting: Bulky and contaminated wastes hamper further sorting/processing in the facility; mechanical or manual pre-sorting is essential to separate out these wastes.</p> <p>2) Mechanical Sorting: Mechanical processes based on principles of electro-magnetics, fluid mechanics, pneumatics etc. are used to segregate the different waste streams in the pre-sorted waste. Mechanical processes require specialized equipment for segregation of co-mingled municipal waste. Mechanical sorting typically employs the following processes.</p> <p>a. Screening: Screening segregates waste into two or more size distributions. Two types of screens are used in SWM centres; 1) Disc screens 2) Trommels (Rotary screen).</p> <p>b. Ferrous Metal separation: In the second stage, electromagnets are used for separating heavy ferrous metals from mixed waste.</p> <p>c. Air Classification: The residual waste stream is passed through an air stream with sufficient velocity to separate light materials from heavy material.</p> <p>d. Non-ferrous metal separation: An eddy current segregates zinc, aluminum, copper, lead, nickel and other precious metal from commingled waste.</p> <p>e. Detect and Route system: This system separates out various grades of paper, plastics and glass, which are not sorted out in the air classifier</p> <p>f. Size reduction: Sorted materials after segregation are usually too large for further use or processing, they should be reduced to smaller sizes.</p> <p>g. Baling: Sorted and sized material is baled for further processing/use.</p>	2M 2M (any two)