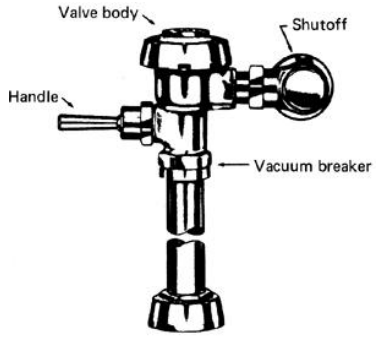
Model Answer: Summer 2017

Subject: Plumbing Services | **Sub. Code: - 17607**

Important Instructions to examiners:

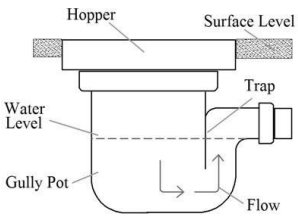
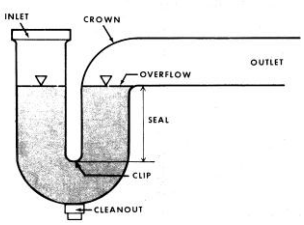
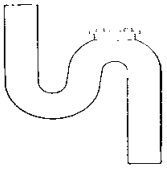
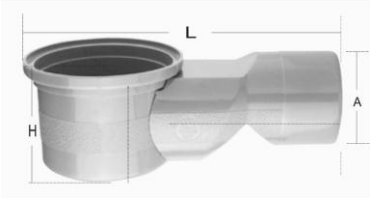
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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 the candidate and those in the 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 the model answer.
6) In case of some questions credit may be given by judgment 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.

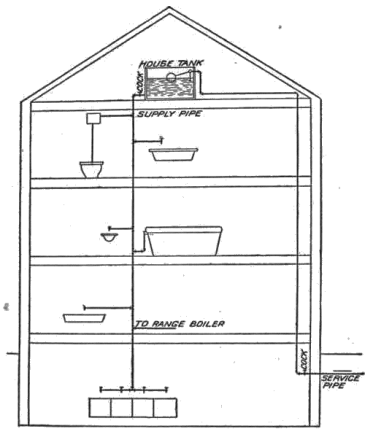
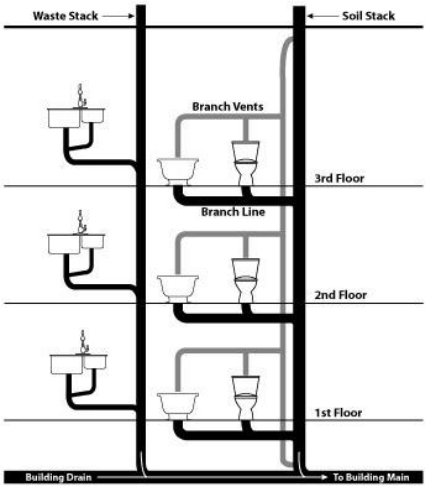
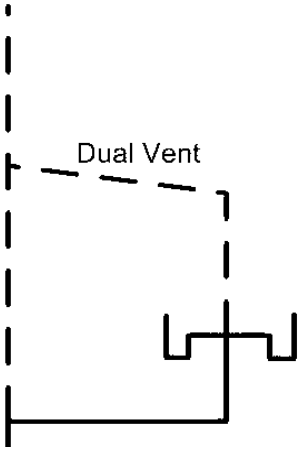
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**A**	**Attempt any three of the following:**		**12**
	a)	**State the purpose of codes in plumbing.**		
	Ans.	1. Codes provide standards in design and construction. 2. Codes protect the health, welfare and safety of public. 3. Its lowers construction cost. 4. It reduces potential hazards. Etc.	**01 mark each**	**04**
	b)	**Explain in brief 'flushometer valve' with neat sketch.**		
	Ans.	i. Flush valves and flushometer are metal water-diverting valves that use pressure from the water supply system instead of gravity to cause a urinal or toilet to flush. ii. A diaphragm separates a structure's main water supply from a narrow passageway that leads to a pressure chamber in the Flushometer. When the lever is pressed, the diaphragm allows a secondary flush valve to open. This allows water from the pressure chamber to enter into the urinal or toilet. iii. During this the main cylinder valve shoots upward, permitting the pressure chamber to refill from the water entering through the narrow passageway. During the refill, the valve cylinder is gradually pushed back down to its bottom shutoff position. Flushometer eliminated the need for raised water tanks.	**02** **04**	

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answers</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>Q.1</td><td></td><td> 
</td><td>02</td><td></td></tr>
<tr><td></td><td>c)

Ans.</td><td>List any four water conserving fixtures with their maximum flow rate.
<table>
<tr><th>Sr no.</th><th>Water conserving fixture</th><th>Max flow rate</th></tr>
<tr><td>1</td><td>Drinking Fountain</td><td>2 lit per min</td></tr>
<tr><td>2</td><td>Water Cooler</td><td>1 lit per min</td></tr>
<tr><td>3</td><td>Public shower heads</td><td>7 lit per min</td></tr>
<tr><td>4</td><td>Urinals with flushometer</td><td>1 lit per flush</td></tr>
<tr><td>5</td><td>Waterless urinals</td><td>No water flow</td></tr>
</table></td><td>01 mark each</td><td>04</td></tr>
<tr><td></td><td>d)

Ans.</td><td>Explain necessity of venting to traps.
1. Venting means system used to provide ventilation to trap or any drainage work. Traps are provided in drainage system to maintain water seal and to avoid blocking, backflow and odor in drainage.
2. So that, venting is necessary for traps to relieve the pressure of foul gases by mixing it with atmospheric air in the drain so that to reduce bad effect of foul gases in house through trap.
3. Also to prevent danger of air locking.
4. And to prevent siphonage of drain venting to trap is also important because traps without vent are strictly prohibited by AHJ.</td><td>01 mark each</td><td>04</td></tr>
</table>

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**B**	**Attempt Any <u>ONE</u> of the following:**		**08**
	a)	**State classification of traps with sketches.**		
	Ans.	Classification of Traps – **1. Gully Trap:** These traps are constructed outside the building to carry waste water discharge from washbasin, sinks, bathroom etc. and are connected to the nearest building drain/sewer so that foul gases from sewer do not come to the house. These are deep seal traps, the depth of water seal should be 50 mm minimum. It also prevents the entry of cockroach and other insects from sewer line to waste pipes carrying waste water. **2. P. Trap:** This trap is used with Indian water closet. The traps are made from cast iron or UPV sheet. This trap also has water seal and prevents entry of foul gases to the house. **3. S. Trap:** This trap is similar to P. trap and is used for fixing water closets in toilets. The only difference between P trap and S trap is that P. trap is used for outlet through the wall whereas S. trap is used for outlet through the floor. **4. Floor Trap or Nahni Trap:** This trap is provided in the floor to collect waste water from washbasin, shower, sink and bathroom etc. These are available in cast iron or UPVC material and have removable grating (JALI) on the top of the trap. The minimum depth of water seal should be 50 mm. <u>Sketches</u> –  1. Gully trap  2. 'P' trap  3. 'S' trap  4. Nahni / floor trap	**01 mark each** **01 mark each**	**08**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
	b)	**Explain different types of plumbing systems with sketch.**		
	Ans.	Plumbing Systems – 1. The water supply and water distribution system. It carries water from the water sources, street main or a pump to the building at which water is used. 2. The plumbing fixtures. The receptacles that receive the supplied water and allow the occupants of the building to use that water. Also it produces waste water and soil waste after using it. 3. The drainage system. The piping network within the building which convey from the plumbing fixture all waste as well as rain water (storm drain) to a point of disposal or treatment facility. 4. Vent system. A system which provides ventilation to the drainage system for proper flow of drain without odor, backflow and contamination is called as vent system. Plumbing Systems sketches –	**01 mark each**	**08**
		 1. Water supply system		
		 2. Plumbing fixture system (any fixture dia. Ex. Water closet)		
		 3. Drainage system	**01 mark each**	
		 4. Vent system		

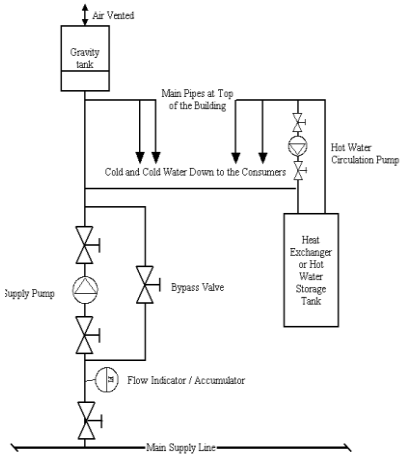
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2		**Attempt any four of the following:**		**16**
	a)	**Differentiate between gray and reclaimed water with four points.**		
	Ans.		**01 mark each**	**04**

Sr no.	Gray water	Reclaimed water
1	Gary water is all wastewater generated in households or office buildings without fecal contamination.	Reclaimed water is a waste water that can be reuse instead of fresh water.
2	It is suitable for reuse in domestic work and other non-potable uses	It is the water is not suitable for drinking and domestic purpose.
3	Gray water is suitable for irrigation lawn, trees, ornaments and food crops.	Reclaimed water systems may supply the reclaimed water only to waste closets, urinals and trap primers for floor drains and floor sinks.
4	Precaution- Untreated gray water should not be kept for longer than one day.	Precaution- A reclaimed water system is prohibited from being connected to the potable water system with or without mechanical backflow prevention devices.

b) Explain hot and cold water distribution system. — **03**

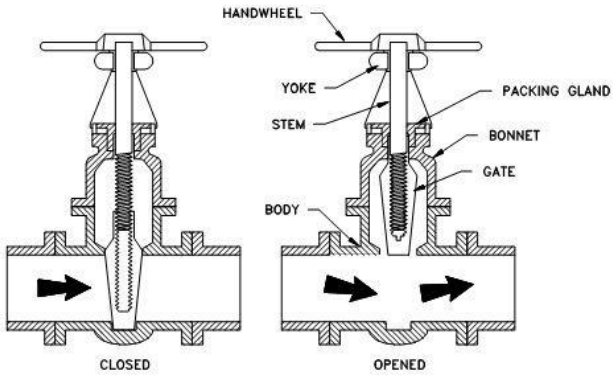
Ans.

1. In occupancies where plumbing fixtures are installed for private use, hot and cold water shall be required for bathing, laundry, cooking purpose, dishwashing or cleaning.
2. In occupancies where plumbing fixtures are installed for public use, hot and cold water shall be required for bathing and washing purposes.
3. Water closets and urinals shall flush by means of an approved flush tank or flush meter valve. Reclaimed water should be used in buildings for water closet, urinals and trap primers.
4. Cold water is stored in tank above the building or within highest upper floor of building and supply to fixtures by means of gravity flow.
5. Hot water is generated and stored within water heater and hot water storage tank.
6. Pipe connections for cold and hot water are separately provided. Fitting, valve system also differ in some manner.



04

01

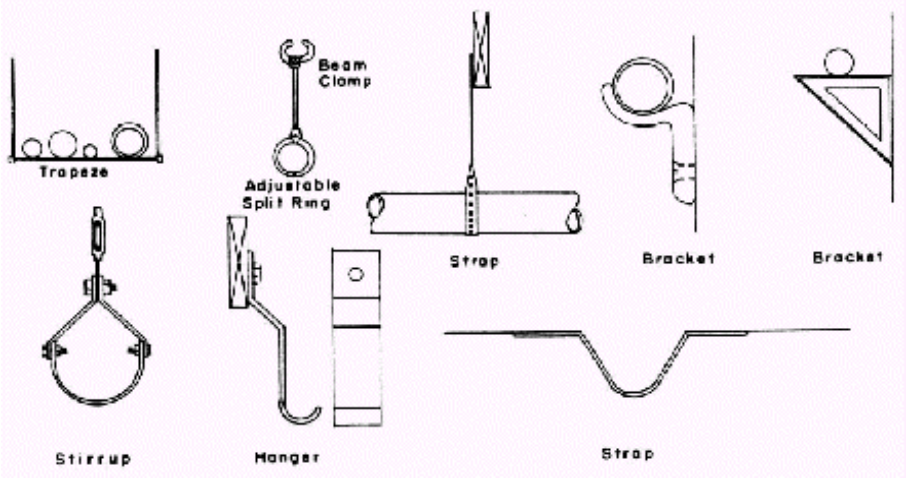
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2	c) Ans.	**List any eight types of pipe material.** 1. Cast iron 2. Stainless steel 3. Copper 4. PVC (Poly-Vinyl Chloride) 5. UPVC (Un Plasticized Poly-Vinyl Chloride) 6. Plastic ABS 7. Vitrified Clay 8. Chromed Brass	½ mark each	04
	d) Ans.	**List any four plumbing appurtenances and explain any one with sketch.** List- 1. Valve 2. Trap 3. Vent 4. Service connection	01	
		Valve – it is used in plumbing system to regulate and control flow of water and drain. There are various types of valves are used such as tipping valve, stop valve, pressure relief valve , gate valve and check valve etc. Gate valve is full way valve which is inserted into a pipeline for controlling or stopping the flow of water. This valve offers low resistance to the flow of water. The valve is closed by turning hand wheel into clock wise direction. Nominal sizes of valves are 15 mm to 100 mm.	1 ½	04
			1 ½	
	e) Ans.	**State any four minimum standards for plumbing.** 1. Water and sewer system. Each kitchen sink, lavatory basin, bathtub, shower, and water closet required under the provisions of this section shall be properly connected to either the public water or sewer system or to a private water or sewer system which meets the requirements. And all sinks, lavatories, bathtubs and showers must be supplied with hot and cold running water.	1 mark each	

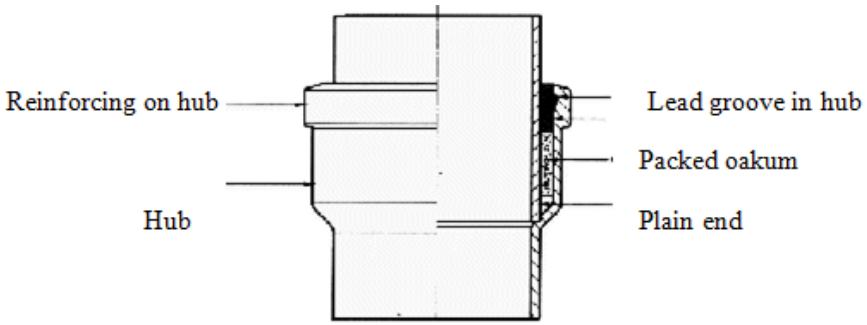
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2		2. A commode or urinal and tub or shower if provided shall be located in an enclosed room. 3. Any plumbing fixture shall be so constructed and installed that it will function safely and effectively and shall be maintained in good repair capable of performing the function for which it was originally intended. 4. Whenever all or any part of the existing plumbing system or fixtures shall be replaced, modified, altered or expanded, such new installation shall be made in accordance with the code.		**04**
	f) **Ans.**	**Explain colour codes and marking in plumbing.** 1. The color codes are the important part of the plumbing. Color is one of the most effective means of communicating. The color code for pipe marking identification of water supply system is critical to the safe functioning of the building and the protection of the occupants of that building. 2. It is provided for identifies the general type of material in the pipe and the potential hazard of presented by the pipe contents. 3. Identification of water supply system is critical to the safe functioning of the building and the protection of the occupants of that building. The system cannot be compromise in any fashion. 4. The first step-in the protection of a safe and pure water supply is the correct labeling of various water systems in the building. This is important not only during construction but especially after the building is occupied when it is subjected to maintenance and possible when added to or altered or altered to layer on. 5. Color codes for different types of water are as follows:- a) Potable water- Green background with white lettering. b) Non-Potable water- Yellow background with black lettering. c) Reclaimed water-Red background with black lettering.	**01 mark each (any four)**	**04**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3		**Attempt any four of the following**		**16**
	a)	**Explain with sketch shielded coupling method of plumbing joint.**		
	Ans.	An approved elastomeric sealing gasket with an approved outer shield and a tightening mechanism. EPDM Rubber Shielded Coupling provides a quick and easy connection. It can be used with cast-iron, plastic, steel and copper drain, waste and vent systems. The coupling is rated for underground use.	**02**	
			**04**	
			02	
	b)	**Explain prohibited traps in plumbing.**		
	Ans.	Following are the prohibited traps -		
		i. No forms of trap that depends for its seal upon the action of movable parts shall be used.		
		ii. No trap that has concealed interior partitions except those of plastic, glass or similar corrosion resistant material shall be used 'S' traps less than 80 mm, bell traps & Crown-vented traps shall be prohibited.	**02**	
		iii. Drum & bottle trap shall be installed only when permitted by AHJ.		
		iv. No trap shall be provided without vent.		**04**
		 	**01 mark each**	

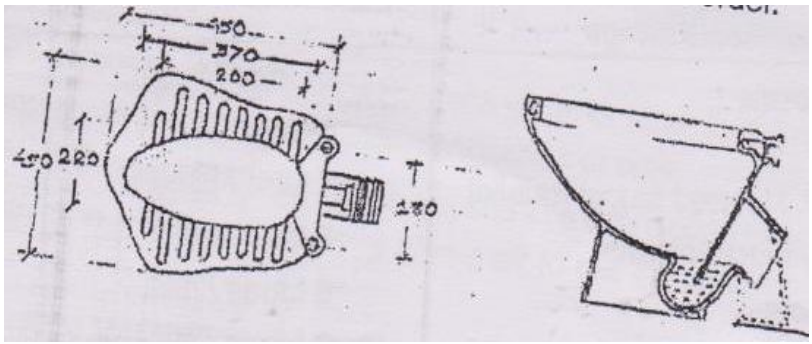
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3	c) Ans.	**List types of urinals & explain any one with sketch.** Types of Urinals - i. Bowl or basin type Urinal a. Flat back b. Angle back ii. Slab iii. Stall iv. Squatting plate Bowl or Basin type Urinal –  The Bowl urinal is the most common type and it has been around for hundred years. Bowl urinals are available in many shapes and styles, and they are popular for their versatility. Most are made of porcelain, but they are also available in metal, plastic or polished wood.	**01 mark each (any three)** **01**	**04**
	d) Ans.	**Explain with sketch necessity of AAV.** Necessity of AAV (Air Admittance Valve) - i. These are the one way valves designed to allow air or fresh gas to enter the drainage system & to restrict the inner foul gases to come out. ii. The AAV can be used inside the building also. iii. The purpose of an AAV is to provide entry air in drainage system & to prevent siphonage to trap.	**01 mark each**	**04**

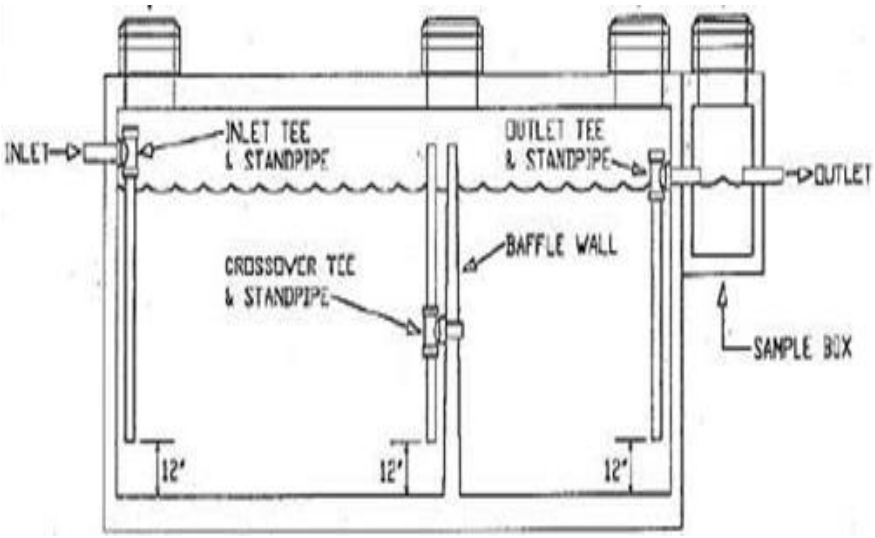
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3			01	
	e)	**What do you mean by 'Gray-water approval'? State specification of gray water.**		
	Ans.	Gray water is defined as the waste water produced from baths and showers, clothes washers and lavatories.	01	
		Specifications of gray water - i. Grey water contains fewer pathogens than domestic waste water. ii. It is generally safer to handle and easier to treat and reuse onsite for toilet flushing, landscape or crop irrigation, and other non-potable uses. iii. It does not include the discharge of toilets or highly contaminated waste water.	01 mark each	04
	f)	**List any eight types of hangers and supports with sketch.**		
	Ans.	Types of hangers:- i. Rod hanger ii) Trapeze hanger iii) Spring hanger iv) Wall bracket v) Strap hanger vi) Spit ring hanger A) Spring Supports – i. Variable spring hanger ii. Constant spring hanger B) Rigid Support – i. Pipe shoe ii. Rod hanger iii. Rigid Strut	½ each (with sketch)	04

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3				
4		**Attempt any four of the following**		**16**
	a)	**State the factors necessity for use of alternative materials in plumbing.**		
	Ans.	Factors necessity for use of alternative materials in plumbing is 1. Quality. 2. Strength. 3. Fire resistance. 4. Effectiveness. 5. Durability and safety	**01 mark each (any four)**	**04**
	b)	**State the important points to be considered while planning plumbing on terrace.**		
	Ans.	Important points to be considered while planning plumbing on terrace are i. Climatic condition ii. Rain fall intensity iii. Rain water inlets iv. Water proofing to slabs.	**½ each**	**04**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4		v. Solar hot water system vi. Overhead tanks with access vii. Water supply mains with valves. viii. Location of vent pipe.		
	c)	**Explain with neat sketch bell & spigot joint.** Bell & Spigot Joint - i. This is the commonly used joint in C.I. pipes. ii. Each piece is made with an enlarged diameter or bell at one end into which the plain or spigot end of another piece is inserted when installed. iii. The joint is then made tight by lead, caulked into the bell around the Spigot or by listed molded rubber ring inserted in the bell.	**01 mark each**	**04**
			**01**	
	d) **Ans.**	**List various types of water closet explain any one in detail.** Types of water closet - i. Indian type water closet. ii. European type water closet.	**01**	
		i. Indian type water closet – This type of water closet is two different piece supporting pan & trap. The pan is provided with an integral flushing rim of suitable type. They are made of white glazed earthenware or white vitreous china. Colored Indian water closets are made available on order.	**02**	**04**

Que.	Sub.	Model Answers	Marks	Total

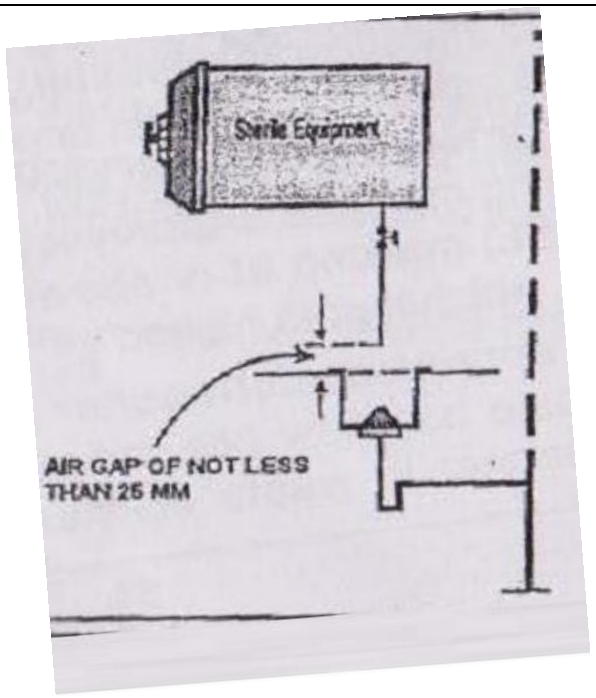
No.	Que.			Marks
4		ii. European type water closed – European water closed comprises of pan & integral trap. They are generally made of vitreous china. They are available in white and as well as in colors. It pans with trap having single seal are known as wash down and one with double seal are known as symphonic pattern. 	**01**	
	e) **Ans.**	**Explain working of drinking fountains.** A drinking fountain, also called a water fountain or bubbler, is a fountain designed to provide drinking water. Working - It consists of a basin with either continuously running water or a tap. The drinker bends down to the stream of water and swallows water directly from the stream. Modern indoor drinking fountains may incorporate filters to remove impurities from the water and chillers to lower its temperature. Drinking fountains are usually found in public places, like schools, rest areas, libraries, and grocery stores. Many jurisdictions require drinking fountains to be wheelchair accessible (by sticking out horizontally from the wall), and to include an additional unit of a lower height for children and short adults. The design that this replaced often had one spout atop a refrigeration unit	**04**	**04**

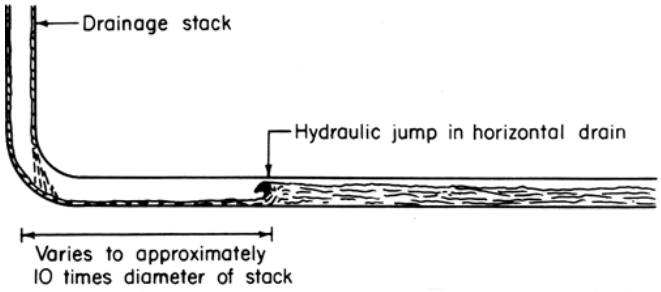
No.	Que.			Marks
4	**f)**	**Explain working of interceptor with sketch.**		
	Ans.	Grease Interceptor - 1. A plumbing appurtenance or appliance installed in a sanitary drainage system to intercept FOG from a waste water discharge. 2. It is identified by volume, 30 min retention time. 3. Minimum of two compartments. 4. Minimum total volume of 1136 liters & gravity separation. 5. Gravity grease interceptors are generally installed outside.  	**02** **02**	**04**

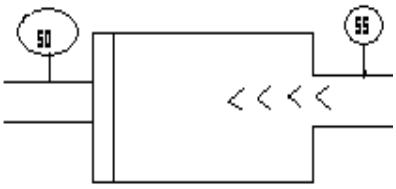
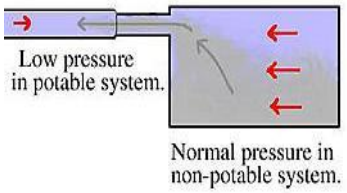
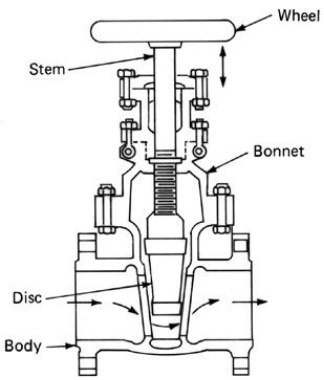
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5		**Attempt any four of the following**		**16**
	a)	**Explain with sketch necessity of unions in plumbing.** Following are necessity of Unions- 1. Unions are the fixtures installed in the water supply piping to the equipment's that requires services by removal or replacement. 2. Unions shall be installed in water supply piping not more than 300 mm away from the regulating equipment that requires services by removal or replacement. It consists of three parts: a nut, a female end and a male end. When the female and male ends are joined, the nut seals the joint by pressing the two ends tightly together. 	**02** **04** **02**	
	b) **Ans.**	**State the methods of cross-connection control in plumbing.** Points at which a potable water system connects with a non-potable water system are called cross connections. Following are the two methods of cross-connection control- 1. Direct cross-connections Back-pressure occurs for example when air is blown through the straw and bubbles begin to erupt at the submerged end. If instead of air, natural gas had been forced into a potable water tank, the gas in turn could be carried to a kitchen faucet. This is an example of a direct cross-connection, with undesirable material being pushed into the system.	**02** **04**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5		2. Indirect cross-connections For example, when a drinking straw is used to consume a beverage, suction reduces the pressure of fluid inside the straw, causing liquid to move from the cup to inside the straw and then into the drinker's mouth. This is an example of an indirect cross-connection, undesirable material being pulled into the system.	**02**	
	c)	**Explain importance of pipe grading in plumbing.**		
	Ans.	Pipe Grading - i. Horizontal drainage piping of 100 mm diameter and smaller shall be installed in alignment and a uniform shape of not less than 1:50 i.e. 2% towards the point of disposal shall be maintained, ii. Pipe size less than 10 mm may not be run at 1:100 i.e. 1% slope. Pipe sizes 100 mm and above may be run at 1:100 i.e. 1% slope but not only if job site conditions preclude the installation of drainage piping a 1:50 i.e. 2% slope & if approved by the AHJ. iii. Flatter slopes may be permitted for pipes with smooth interior min. no of joint and installation of high workmanship. iv. Slope is not required for the vent pipes except in case of peninsula sink.	**01 mark each**	**04**
	d)	**Explain the various tests necessary for plumbing drainage system.**		
	Ans.	Following are the test necessary for plumbing drainage system. i. Water test ii. Air test		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5		i. **Water Test –** The water test shall be applied to the drainage & vent systems either in its entirety or in sections. If the tests are applied to entire system, openings in pipin shall be tightly closed. Except the highest opening and system filled with water to the point of overflow. If the system is tested in sections each opening shall be tightly plugged, except the highest opening of section under test and each section shall be filled with water but no section shall be tested less than 1800 mm head of water. The water shall be kept in system or in the portion under test for not less than 15 minutes before inspection starts. The system shall be water tight at joint.	**02**	**04**
		ii. **Air Test-** The air test is made by attaching an air compressor testing apparatus to any suitable opening & after closing all other inlet & outlet to the system. For air into the system until there is a uniform gauge pressure of 0.3s bar to balance a column of mercury 250 mm in height. The pressure shall be held without any additional air for a period of not less than 15 minutes.	**02**	
	e)	**Explain with sketch working of sterile equipment.**		
	Ans.	Working of sterile equipment - i. The sterile equipment shall be indirectly connected by means of a water distribution air gap. ii. Each device shall be separately piped and the developed length shall not exceed 1500 mm. iii. Take care while installing the discharge line from sterilization equipment.	**02**	**04**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5			02	
	f) Ans.	**Define vent, branch vent, stack vent and continuous vent.** i. Vent- Any pipe provided to ventilate a plumbing system to prevent trap siphonage & back pressure or to equalize the air pressure within the drainage system. ii. Branch Vent- A vents connecting one or more individual vents with vent stack or stack vent. iii. Stack Vent- The extension of a soil or waste stack above the highest horizontal drain connected to the stack. iv. Continuous Vent- A vertical vent that is continuation of drain to which it connects.	01 mark each	04

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6		**Attempt any four of the following:**		**16**
	a)	**Explain the phenomena of water curtain hydraulic jump.**		
	Ans.	Hydraulic jump -		
		Hydraulic jump is the jump or standing wave from when the depth of flow of water changes from supercritical to subcritical state.		
		When liquid at high velocity discharges into a zone of lower velocity a rather abrupt into rise occurs in the liquid surface the rapidly flowing liquid is abruptly slowed & increase in height converting same of the flows initial kinetic energy into an increase potential energy.	**03**	
		The phenomenon is dependent upon the initial speed of the fluid is below the critical speed then no jump is possible.		**04**
			**01**	
	b)	**State the necessity of trap seal protection.**		
	Ans.	Necessity of trap seal protection -		
		i. To stop the entry of foul gases into the home.	**01 mark each**	**04**
		ii. To maintain the water seal.		
		iii. To constantly hold some water & that water keeps the sewer gas smells from escaping the drain.		
		iv. To prevent drainage from forming a clock deep within the plumbing system.		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6	c)	**Define with sketch back pressure & back siphonage.** i) Back pressure :- Back pressure is caused due to increase of pressure above the supply pressure  ii) Back siphonage – Back siphonage is caused due to negative pressure.  	02 02	04
	d) Ans.	**Explain with sketch working of gate valve.** Gate valve - i. It is a device in which the flow of water is controlled by circular disk fitting against & sliding on machine smooth faces the motion of disk being at right angles to the direction of flow. ii. The straight opening of the valve is as large as the full bore of the pipe.  	02 02 02	04

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6	e) Ans.	**State the importance of strainers in plumbing.** Following are the importance of strainers in plumbing - i. Strainers provide protection for the drainage system from solids that should not be placed in the system. ii. Plumbing fixtures other than water closet & urinals shall be equipped with approved strainer having on approved waterway area. iii. Strainer is provided to avoid stone, wood, hair etc. in drainage system. iv. Strainers are used in ventilated pipes in order to avoid any other matter in this pipe. v. Strainers are used to convey rain water to the tank.	**01 mark each (any four)**	
	f) Ans.	**State the necessity of back flow protecting fixtures in plumbing.** Necessity of back flow protecting fixtures - i. A backflow prevention device is used to protect potable water supplies from contamination or pollution due to backflow. ii. Water pressure may fail or be reduced when a water main bursts, pipes freeze, or there is unexpectedly high demand on the water system. iii. Reduced pressure in the pipe may allow contaminated water from the soil, from storage, or from other sources to be drawn up into the system. iv. A backflow preventer is also important when potentially toxic chemicals are used.		