

MARKING SCHEME / उत्तर कुंजी

CLASS: 12th (Senior Secondary) - PLUMBING (ADVANCE PLUMBING TECHNICIAN)

Session: 2026-27

Max Marks: 60

Time Allowed: 2.30 Hours

SECTION - A: Long Answer Type Questions (3 × 5 = 15 Marks)

Q. 1. Infrared Sensor-based Faucet Components & Principle

[5 Marks]

Definition: An Infrared (IR) sensor faucet is an automatic touchless tap that detects human hands using invisible infrared light beam and turns water flow on/off without physical contact.

Major Components:

- **IR Sensor Module:** Emits and detects reflected infrared rays from hands.
- **Solenoid Valve:** Electrically driven valve that opens/closes water flow.
- **Control Box / Circuit Board:** Processes sensor signal and triggers the valve.
- **Power Source:** Battery pack (AA/AAA) or AC adapter.
- **Mixer/Spout Assembly:** Body structure with aerator for water delivery.

Working Principle: When a user brings hands near the spout, IR rays bounce back to the receiver. The controller signals the solenoid valve to open. Once hands are removed, the signal stops and the valve closes automatically.

--- OR / अथवा ---

Q. 1 (OR). Sensor-based Urinal: Advantages & Internal Components

[5 Marks]

Definition: A sensor urinal automatically flushes water after detecting a user's presence and departure via IR or microwave sensors.

Advantages:

- High Hygiene & Touchless operation (prevents germ spread).
- Water conservation through timed optimized flushing.
- Odor reduction and automatic maintenance flush.

Internal Components: IR/Proximity Sensor, Solenoid/Latch Valve, Controller Board, Battery Pack/Power Supply, Inlet Strainer/Filter, and Flush Spout/Mechanism.

Q. 2. Solar Water Heating System: Components & Benefits

[5 Marks]

Definition: A system that absorbs solar radiation energy to heat water for household or commercial use.

Main Components:

- **Solar Collector Panels:** Flat Plate Collector (FPC) or Evacuated Tube Collector (ETC) to absorb heat.
- **Insulated Storage Tank:** Keeps water hot overnight/for extended periods.
- **Connecting Pipes:** Insulated copper or CPVC lines carrying hot water.
- **Support Frame & Mounting Structures:** Holds panels towards optimal sun exposure (South direction).

Major Advantages: Saves electricity bills (eco-friendly), continuous hot water availability, low operational cost, and zero carbon footprint.

--- OR / अथवा ---

Q. 2 (OR). Rainwater Harvesting & Simple Filter Column**[5 Marks]**

Definition: Collection, filtration, and storage of runoff rainwater from rooftops or surfaces for direct reuse or groundwater recharge.

Filter Column Structure & Layers (Top to Bottom):

1. **Top Mesh/Screen:** Blocks leaves, twigs, and large debris.
2. **Coarse Gravel Layer:** Traps medium dirt particles and suspended solids.
3. **Fine Sand Layer:** Filters out fine silt and micro-particulates.
4. **Activated Charcoal Layer:** Removes odor, color, and chemical impurities.

Function: Purifies raw rooftop water mechanically and chemically before entering storage or recharge pit.

Q. 3. Standard Operating Procedure (SOP) & Pipe Installation Safety Rules**[5 Marks]**

SOP Definition: A step-by-step written set of instructions compiled by an organization to help workers carry out complex routine operations safely and efficiently.

5 Safety Rules for Pipe Installation:

1. Wear prescribed PPE (Safety goggles, hard hat, gloves, safety boots).
2. Inspect all cutting, threading, and power tools before use.
3. Ensure proper ventilation while applying solvent cements/glues.
4. Secure scaffolding and ladders firmly during elevated pipe installations.
5. Depressurize and isolate main water/gas valves before cutting existing lines.

--- OR / अथवा ---

Q. 3 (OR). OHS in Plumbing, Daily Log & Incident Reports**[5 Marks]**

Occupational Health and Safety (OHS): A multidisciplinary concept aimed at protecting health, safety, and welfare of workers at workplace site from hazards and injuries.

Importance of Daily Log Reports:

- Tracks daily work progress, manpower, tools used, and material consumption.
- Helps identify potential site delays and maintains operational accountability.

Importance of Incident Reports:

- Documents detailed facts of any workplace accident, near-miss, or injury.
- Helps investigate root causes to prevent future recurring safety hazards and ensures legal compliance.

SECTION - B: Short Answer Type Questions (6 × 3 = 18 Marks)

Q. 4. Differences Between PVC and CPVC Pipes

[3 Marks]

Feature	PVC (Polyvinyl Chloride)	CPVC (Chlorinated Polyvinyl Chloride)
Temperature Capacity	Suitable only for cold water supply (< 60°C).	Suitable for hot and cold water supply (up to 93°C).
Chemical Composition	Standard unchlorinated polymer.	Extra chlorination gives higher thermal stability.
Primary Application	Drainage, cold water lines, agriculture.	Hot water plumbing in kitchens, bathrooms & industries.

--- OR / अथवा ---

Q. 4 (OR). Manifold Water Distribution System & Advantages

[3 Marks]

Definition: A central distribution hub consisting of a main header pipe with individual dedicated lines supplying water directly to each plumbing fixture.

Key Advantages:

1. Equalized water pressure across multiple fixtures (no pressure drop when using multiple taps).
2. Individual shut-off control for easy maintenance without turning off water for the whole house.

Q. 5. Solenoid Valve & Function in Automatic Taps

[3 Marks]

Solenoid Valve: An electromechanical valve controlled by an electrical current through a solenoid coil.

Function in Automatic Taps: Acts as the main electronic switch for water. When the controller sends a electrical pulse signal, the electromagnetic coil lifts the plunger to open water flow; when the signal stops, an internal spring pushes the plunger down to shut off water.

--- OR / अथवा ---

Q. 5 (OR). Master Chamber in House Drainage & Primary Purpose

[3 Marks]

Master Chamber (Inspection Chamber): A main masonry or plastic junction box constructed at the outlet of the house drainage system before connecting to the public sewer line.

Primary Purpose:

- Provides access for routine inspection, cleaning, and clearing sewer blockages.
- Prevents foul gases from municipal sewer line from entering building via non-return/trap arrangements.

Q. 6. Points to Consider While Choosing Sensor Tap for Commercial Buildings

[3 Marks]

1. **Power Source & Battery Life:** High duty cycle require long-life lithium battery or dual AC/DC power options.
2. **Durability & Vandal Resistance:** Brass heavy-duty body to withstand frequent public usage.
3. **Sensing Distance & Response Time:** Adjustable detection range and fast auto shut-off.
4. **Water Flow Rate & Aerator Efficiency:** Low GPM (Gallons Per Minute) rating to maximize water savings.

Q. 7. Difference Between Overhead Tank (ESR) & Underground Storage (GSR)**[3 Marks]**

Parameter	Overhead Water Tank (ESR)	Underground Reservoir (GSR)
Location	Built on rooftop or elevated staging tower.	Constructed at or below ground level.
Flow Mechanism	Distributes water via gravity pressure.	Requires electric pump to lift water upwards.
Primary Function	Immediate supply to user fixtures.	Bulk water storage from municipal mains.

Q. 8. Fire Sprinkler System & Installation Purpose**[3 Marks]**

Fire Sprinkler System: An active fire protection system consisting of overhead water pipe network fitted with heat-sensitive automatic sprinkler heads.

Why Installed in Modern Buildings:

- Detects and extinguishes/controls fire automatically at an early stage without human intervention.
- Prevents major loss of life and structural building damage by providing 24/7 protection.

Q. 9. Steps for Replacing Battery in Automatic Sensor Tap**[3 Marks]**

1. **Turn Off Water Supply:** Close the angle stop valves beneath the sink for safety.
2. **Locate & Open Control Box:** Unscrew the battery compartment cover under the counter.
3. **Replace Batteries:** Remove old depleted batteries and insert new ones respecting proper +/- polarity.
4. **Seal & Test:** Secure battery cover, reopen water supply valve, and test hand detection.

SECTION - C: Very Short Answer Type Questions (6 × 2 = 12 Marks)**Q. 10. Flow Sensor & Its Use****[2 Marks]**

Flow Sensor: A device used to measure the rate or volume of water flowing through a pipeline.

Use: Used in smart water meters or automatic billing systems to track water usage accurately.

--- OR / अथवा ---

Q. 10 (OR). Primary Function of Water Level Sensor in Tanks**[2 Marks]**

Function: Detects water levels in storage tanks to automatically switch ON the water pump when empty and switch OFF the pump when full, preventing water overflow and dry running of pump.

Q. 11. Advantages of Push-to-Connect (Push-fit) Fittings**[2 Marks]**

1. **Fast & Easy Installation:** Connects pipes instantly without requiring glue, solder, or special tools.
2. **Reusable:** Can be easily demounted using a simple release collar tool.

--- OR / अथवा ---

Q. 11 (OR). Camlock Fittings Definition**[2 Marks]**

Definition: A quick-connect hose coupling system that uses cam arms to lock a male adapter into a female coupler tightly without threading tools.

Q. 12. Necessity of Cleaning Pipe After Cutting**[2 Marks]**

Reason: Cutting creates rough burrs, sharp edges, and loose plastic/metal shavings. Cleaning and deburring ensures leak-proof solvent joints and prevents debris from clogging valves or aerators downstream.

Q. 13. Two Main Objectives of Standard Operating Procedures (SOPs)**[2 Marks]**

1. To ensure workplace safety and maintain consistent quality standards across operations.
2. To minimize operational errors, material wastage, and downtime.

Q. 14. Four Personal Protective Equipment (PPE) Items in Plumbing**[2 Marks]**

1. Safety Goggles / Glasses
2. Hand Gloves (Cut-resistant/Rubber)
3. Safety Shoes / Steel-toe Boots
4. Hard Hat / Helmet

Q. 15. Incident Report in Workplace Management**[2 Marks]**

Definition: A formal document recording details of an unexpected event, site injury, near-miss, or equipment damage occurring at a work site to analyze causes and prevent future occurrences.

SECTION - D: Objective / MCQ / Fill in Blanks (15 × 1 = 15 Marks)

Q. No.	Correct Answer / Fill-in Key	Option	Marks
Q. 16	Infrared Sensor (इन्फ्रारेड सेंसर)	(b)	1 Mark
Q. 17	Solenoid Valve (सोलेनोइड वाल्व)	(b)	1 Mark
Q. 18	Polyvinyl Chloride	(a)	1 Mark
Q. 19	CPVC/PP-R	(b)	1 Mark
Q. 20	Elevated Surface Reservoir	(a)	1 Mark
Q. 21	Coarse Gravel / Mesh (मोटा बजरी/जाली)	(b)	1 Mark
Q. 22	South (दक्षिण)	(b)	1 Mark
Q. 23	Within property boundary (संपत्ति की सीमा के भीतर)	(a)	1 Mark
Q. 24	Safety and work consistency (सुरक्षा और कार्य निरंतरता)	(a)	1 Mark
Q. 25	Quickly without complex tools (बिना जटिल औजारों के जल्दी)	(a)	1 Mark
Q. 26	Safety Goggles (सुरक्षा चश्मा)	(a)	1 Mark
Q. 27	Local community/people (स्थानीय लोगों को)	(a)	1 Mark

Q. No.	Correct Answer / Fill-in Key	Option	Marks
Q. 28	Pressure Sensor (प्रेसर सेंसर)	<i>Fill in Blank</i>	1 Mark
Q. 29	Fire Sprinkler System (फायर स्प्रिंकलर सिस्टम)	<i>Fill in Blank</i>	1 Mark
Q. 30	shuts off (बंद)	<i>Option Key</i>	1 Mark