



Plumbing

(Water and Sanitation)

An elective, Credit Point Course!

Proposed by
Indian Plumbing Association
New Delhi

In Collaboration with
All India Council for Technical Education (AICTE)
New Delhi

Contents

Course Name: **Plumbing (Water and Sanitation)**..... 5

Course Code: **AICTE/IPA/PWS** 5

Qualifications:..... 5

Course Structure: 5

Semester: 5

Teaching and Examination Scheme:..... 5

Lectures:..... 5

Rationale: 5

Contents (Theory):..... 7

 Reference books and codes: 10

 Course Outcome:..... 11

Course Name: **Plumbing (Water and Sanitation)**

Course Code: **AICTE/IPA/PWS**

Qualifications:

Students studying Engineering, Architecture or Interior Designs or graduates having Major degree in Civil, Environmental and Mechanical Engineering, Architecture or Interior Designing are qualified to take this course.

Course Structure:

This 4 credit course would be one part of the proposed Full MEP (Mechanical Electrical Plumbing) course as an Open Elective Course, besides having Major degree in Civil, Environmental and Mechanical Engineering, Architecture or Interior Designing. In addition to this course on Plumbing (Water and Sanitation) other courses in fire, HVAC and Electrical shall be developed by other concerned professional associations.

Semester:

Anytime during last year of graduation or after graduation in a Major course.

Teaching and Examination Scheme:

| Teaching Scheme (Credits) | | | | Examination Scheme (Marks) | | | | | |
|---------------------------|----|----|-----------|----------------------------|------|----|----|----|------------|
| TH | TU | PR | Total | TH | Test | PR | OR | TW | Total |
| 03 | 00 | 02 | 04 | 80 | - | 20 | - | - | 100 |

Lectures:

Number of lectures per day/week as decided by the education institutions offering this course.

Rationale:

As modern buildings are becoming more complex and new materials, methods and systems are available in India, Building Services are becoming very crucial. Formal training in building services such as Plumbing (Water and

Sanitation), fire, HVAC and Electrical is essential.

A properly structured course in plumbing is not available in India. Plumbing, though crucial, has so far remained as neglected subject. As a result, there is a great demand to the well trained plumbing/building professionals in the building industry.

Indian Plumbing Association (IPA) had adopted, reviewed and revised the Uniform Plumbing Code of International Association of Plumbing and Mechanical Officials to suit Indian practices, customs and laws. The code is published as 'Uniform Illustrated Plumbing Code-India' (UIPC-I). IPA has also published a book 'A Guide to Good Plumbing Practices'.

The formal education in code based plumbing will improve the plumbing system design and installation standards, thereby, ensuring health and safety of people and structures. Students who successfully attend the Plumbing (Water and Sanitation) course will have better job opportunities, improved income and prospects to become an entrepreneur.

Contents (Theory):

Unit 1: Importance of Codes, Architectural and Structural Coordination (4 Hrs. Approx.)

Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I, NBC and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, sewerage system, drainage system, workmanship, water conservation, protection of pipes and structures, waterproofing.

Architectural and Structural coordination: Provisions for plumbing systems, coordination during the planning stage, various agencies involved and their roles, space planning for plumbing systems, water tanks, pump room, centralized hot water systems, toilet locations, water treatment, sewage treatment, toilet planning, plumbing shafts, basements and terraces planning. Structural parameters, sunken toilets, location of columns and beams, post-tension slabs, importance of ledge walls, water proofing.

Unit 2: Plumbing Terminology (3 Hrs. Approx.)

Definitions, use/purpose of the following.

Plumbing Fixtures: accessible, readily accessible, aerated fittings, AHJ, bathroom group, carrier, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber.

Traps: indirect waste, vent, blow off, developed length, dirty arm, FOG, indirect waste, receptors, slip joints, trap, and vent.

Drainage: adapter fitting, adjusted roof area, AAV, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, DFU, grease interceptor, joints, roof drain, smoke test, stack.

Water supply: angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, ferrule, gate valve, gray water, joints, PRV.

Unit 3: Plumbing Fixtures and Fittings (4 Hrs. Approx.)

Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, bidets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dish washer, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor slopes, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

Unit 4: Traps, Interceptors, Indirect Waste and Vents (5 Hrs. Approx.)

Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps.

Discharge for indirect waste piping, nature of contents or systems, proper methods to install indirect waste piping, air gap and air break, sink traps, dish washers, drinking fountains, waste receptors, sterile equipment, appliances, condensers, point of discharge, venting.

Vent requirement, purpose of venting, trap seal protection, materials, vent connections, flood rim level, termination, vent stacks, water curtain and hydraulic jump, cleanouts, venting of interceptors, introduction to vent sizing.

Unit 5: Sanitary Drainage and Storm Drain (6 Hrs. Approx.)

Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices, hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, suds relief, testing, building sewers, trenching, testing, sumps and pumps, introduction to Drainage Fixture Units (DFU) and sizing of horizontal and vertical pipes.

Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters, channels or scuppers, roof drains, strainers, leaders, conductors and connections, catchment, collect/capture storm water, discharging storm water, sizing case study as per NBC, safety, traps required, prohibited installations.

Rain Water Harvesting (RWH) definition, need, catchment, conduits, settlement tanks, treatment, possible uses, recharging pits, NBC requirements, MOEF&CC requirements, and advantages of RWH.

Unit 6: Water Supply, Gray and Reclaimed Water (6 Hrs. Approx.)

Preamble, sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system, backflow prevention, air gap, cross connection control, pressure and velocity, pipematerials and jointing methods, alternative materials, hangers and supports, workmanship, prohibited fittings and practices, protection of pipes and

structures, pressure controls, unions, thermal expansion, types of valves, installation and testing, disinfection, protection of underground pipes, color codes and arrow marking, introduction to Water Supply Fixture Units (WSFU) and sizing.

Hot water systems, individual and centralized systems, geysers, heaters, heat pumps, energy sources, solar hot water systems, types, boilers, hot water generators, hot water consumption pattern, introduction to sizing of systems.

Definition of gray water, approvals, specifications and drawings, safety, total gray water discharge, holding tanks, valves and piping. Reclaimed water systems, definition of reclaimed water, pipe identification, installation, safety signs, valves, cross connection, approved uses.

Unit 7: Pumping Systems (3 Hrs. Approx.)

Terminology, pump heads, types of Pumps, applications, pump selection, pump characteristics, pumps and motors, pump efficiency, motor efficiency, Hydro Pneumatic Systems (HPS), Zoning, Storm Water and Drainage Pumps, introduction to starters and control panels.

Unit 8: Introduction to WTP and STP (4 Hrs. Approx.)

Introduction to Net Zero concept, need to reduce and reuse, rating of Water Efficient Plumbing fixtures and fittings, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project.

Sources, utility and treatment of water, parameters of water quality, parts of water treatment plant (WTP), disinfection methods, storage conditions, RO water systems, rainwater harvesting treatment, desalination.

Grey water and black water, characteristics of domestic sewage, sewage treatment methods, aerobic and anaerobic treatment, level of treatment, reclaimed water, comparison of various methods.

List of Practical (15 Hrs. Approx.):

1. Attend demonstration by a reputed manufacturer (Min. 2) of water supply pipes and fittings. Cut and joint water supply pipes and fittings as recommended, for the given dimensions. *(4 Hrs. Approx.)*
2. Measure the flow of various plumbing fixtures and fittings in residential, commercial and institutional toilets in liters per minute or liters per flush and give your comments. *(2 Hrs. Approx.)*
3. Attend demonstration by a reputed manufacturer of DWV pipes and fittings. Cut and joint a trap, drainage pipes and fittings as recommended, for the given dimensions. *(3 Hrs. Approx.)*
4. Site visit: Visit any plumbing site and submit a report on observations on plumbing system, architectural and structural provisions, pipe materials, work methods, site conditions, safety and recommendations based on the provisions of UIPC-I/ NBC. *(6 Hrs. Approx.)*

List of Mandatory Assignments:

1. Draw plan and elevation of any toilet at your residence. Give standard dimensions.
2. Refer to attached plan of the toilet and draw section of sunken toilet floor along with civil and plumbing details for two consecutive floors.
3. Prepare layout of internal water supply and drainage pipes and fittings for a public toilet.
4. Visit a plumbing shop and obtain rates of various plumbing fixtures and fittings. Prepare a list with description, brand names and prices.

Reference books and codes:

- Uniform Illustrated Plumbing Code-India (UIPC-I) published by IPA and IAPMO(India)
- National Building Code (NBC) of India
- IS 17650 Part 1 and Part 2 for Water Efficient Plumbing Products
- Water Efficient Products-India (WEP-I) published by IPA and IAPMO (India)
- Water Efficiency and Sanitation Standard (WE.Stand) published by IPA and IAPMO(India)
- Water Pollution, Berry, CBS Publishers.
- ‘A Guide to Good Plumbing Practices’, a book published by IPA.

- Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi.

Course Outcome:

At the end of the course, the students are able to:

- a. Study plumbing codes and good engineering practices.
- b. Coordinate plumbing works from inception to completion with Owners, Architects, other consultants and contractors.
- c. Select proper plumbing materials and systems.
- d. Read and interpret plumbing drawings.
- e. Supervise code based plumbing installations.
- f. Understand methods to conserve water and energy.
- g. Protect health and safety of end users.
- h. Enjoy better job opportunities and career options.
