

P.G.DIPLOMA IN PLUMBING  
ENGINEERING

**Submitted By**

Department of Technology,  
Shivaji University,  
Kolhapur.

ACADEMIC YEAR

2013-2014

**A) Preamble:**

Shivaji University, Kolhapur's Dept. of Technology has been involved with research and action research in various aspects of technological development. A long time deal with different research problems for betterment of the society has enabled the University to produce eminent professionals engaged in different Governmental and Non Governmental organization in the country.

The department is manned with scientists, technologists and social scientists and have well-developed infrastructure to facilitate different experiments in relevant areas. It now ventures in running a 1-year part-time (2-semester) P.G.diploma on plumbing Engineering . The diploma is designed by qualified personalities not only from Shivaji University but also by leading professionals and expert faculties from various noted institutions and industries of the country

**B) Academic Duration of Course:**

The duration of the course is 1 year Two Semesters Semesters in same academic year. Curriculum of first semester consists of five theory (4core and 1 elective) subjects and four theory (3core and 1 elective), and project in the last semester. and the lectures will be delivered, two hours per day from 5 pm to 7pm

OR

two full week days (Saturday & Sunday) . Theses timings will be suitable for students and workings employees from industry

**c) Course structure:**

Candidates will be required to undergo learning in theory, project development and workshop subjects during the academic year. Candidates also will be exposed to industrial exposure through Industrial visits to get familiar with Piping Design and Plumbing Engineering.

## P.G Diploma in Plumbing Engineering

### Course Structure: Semester I

Sr · N o.	Subject	Instructional Hours		Examination			
		Theor y	Practical / Drawing	marks		Oral Exam	Total Marks
				Theory exam.	Internal assessment		
1.	Line sizing and optimization	20	25	50	25	25	125
2.	Materials of construction and corrosion	20		50	25		75
3.	Introduction to Code and Standards	20	25	50	25	25	100
4.	Architectural and Structural coordination	20		50	50		100
5.	Elective – I	20		50	50		100
	<b>Grant total</b>	<b>100</b>	<b>50</b>	<b>250</b>	<b>175</b>	<b>50</b>	<b>475</b>

### Elective – I

1. Online instrumentation
2. Oil & Gas Supply System Design
3. Costing and piping systems
4. Plumbing Terminology

### Course Structure: Semester II

Sr. No	Subject	Instructional Hours		Examination			
				marks		Oral Exam	Total Marks
		Theory	Practical / Drawing	Theory exam	Internal assessmet		
1.	Pumps and HPS Midterm	20		50	25		75
2.	Strom Drainage and water supply	20	25	50	25		75
3.	Pipe supports and stress analysis	20		50	25		75
4.	Elective – II	20		50	50		100
5.	Project work	20	25		100	50	150
	<b>Grant total</b>	<b>100</b>	<b>50</b>	<b>200</b>	<b>225</b>	<b>50</b>	<b>475</b>

### Elective – II

1. Statutory regulations and safety aspects
- 2 Constriction management
3. Piping layout Engineering

**D) Expertise Available:**

Implementation of this type of course is new to the university; therefore very few experts from various departments of University are available to teach such course. But the experts from industrial sector, labor institute and engineering colleges can be invited for lectures. Also, some experts from National and International Institutes related to Piping Design and Plumbing Engineering can be invited to deliver lectures and monitor the activities.

**E) Space Required:**

The course includes theory papers and industrial training. The theory part can be taught in the Department of Technology, Shivaji University, Kolhapur. The remaining part of industrial training can be completed in the industry as the project is based on industrial Piping Design and Plumbing Engineering,. The students have to complete it in the industry and therefore, laboratory space is not required for the one year project. The department has well equipped teaching classrooms and Laboratories for the practical.

**F) Eligibility for admission:**

The students having science and engineering background will be eligible i.e. any graduate from Science, Engineering and Technology. Priority will be given to students from Shivaji University (60%) and others (40%). In case applicant number is more, the entrance test will be conducted.

- B.E /B.Tech. in Civil/Mechanical/Chemical Engineering/Architecture approved by BTE, Maharashtra or equivalent

**G) Examination :**

The students will be undergoing continuous assessment throughout the academic year through seminars, tests, tutorials etc. The evaluation will consist of internal assessment, external assessment and viva voce for the project. Passing will be as per university rules.

## H) Intake Capacity :

Maximum 60 students in which priority will be given to the university students (60%) and others (40%).

## I) Fee Structure:

Particulars	Rupees Annual Fee
Tuition Fee	60000=00
Laboratory Fee	4000=00
<b>Annual Fee : per student</b>	<b>Total : 64,000=00</b>

Other fee will be applicable as per university rules / norms.

## Annexure – I

### Budget : Non-recurring (e.g. Equipments, Accessories etc.)

Sr.No.	Item	First Year	Total in Rs.
1.	Models and Charts	2,00000=00	2,000000=00
2.	Equipments/ <b>Softwares</b>	5,00000=00	5,000000=00
<b>Total Rs.</b>			<b>7,000000=00</b>

## Annexure – II

### Man Power :

Sr.No.	Item	Consolidated Emolument	Total in Rs.
1.	Teaching Assistance	6,00000=00	6,00000=00
2.	Course Co-ordinator	50,000=00	50,000=00
3.	Honorarium to contributory teachers, Industrial experts and T.A. (Rs.300 x 300 lectures and demonstrations, visit to industry)	90,000=00	90,000=00
<b>Total Rs.</b>			<b>7,40,000=00</b>

### **Annexure - III**

#### **Miscellaneous :**

<b>Sr.No.</b>	<b>Budget Head</b>	<b>Total in Rs.</b>
1.	Stationary	20,000=00
2.	Miscellaneous	10,000=00
	<b>Total Rs.</b>	<b>30,000=00</b>

**Total Budgetary provisions for the first year will be**

<b>Sr.No.</b>	<b>Budget Head</b>	<b>Total in Rs.</b>
1.	Total of Annexure - I	7,00000=00
2.	Total of Annexure - II	7,50,000=00
3.	Total of Annexure - III	30,000=00
	<b>Total Rs.</b>	<b>14,80,000=00</b>

Note : Draft syllabus attached

## Course Structure and Scheme of Evaluation

### Course Structure: Semester I

#### SYLLABUS

##### 1. Line sizing and optimization

**Theory-20 Hrs**

**Theory Exam. - 50 Marks**

**Internal Assessment- 25 Marks**

**Oral Exam - 25 Marks**

A brief revision covering friction factor, pressure drop for flow of non-compressible and compressible fluids (Newtonian Fluids), pipe line sizing, economic velocity.

Pipeline networks and their analysis for flow in branches, restriction orifice sizing.

Non-Newtonian fluids – types with examples, pressure drop calculations for Non-Newtonian fluids.

**Assignment** : Numerical exercise in line sizing.

##### 2. Materials of construction and corrosion

**Theory-20 Hrs**

**Theory Exam.- 50 Marks**

**Internal Assessment- 25 Marks**

Desirable properties of piping materials, materials for low, normal and high temperatures services, materials for corrosion resistance. Common ASTM and IS specifications for :Seamless/ ERW pipes, pipe fittings, flanges, and fasteners, materials for valves.

**Gaskets** : Function and properties, types of gaskets and their selection. Polymeric materials (Plastics), important considerations for plastic pipelines (HDPE, PP, PVCetc.)Joining methods for plastic pipes and fittings. Valves made out of plastics, constructional features, and limitations.



**Corrosion** : Types of corrosion, methods of preventing corrosion, coating of pipelines for underground and long distance services, cathodic protection of pipelines.

**Painting of Pipelines** : Common paints for corrosion protection, abrasive cleaning and painting of pipelines. Pickling and passivation of S.S. piping.

### **3. Introduction to Code and Standards**

**Theory-20 Hrs**

**Theory Exam.- 50 Marks**

#### **Internal Assessment- 25 Marks**

. This topic will provide the student with a better understanding of the development, roles and uses of codes and standards in the construction industry. Source material for this course is chapter 3 of the UPC-1 code and the UPC-1 Illustrated Training Manual.

Approvals Authority Having Jurisdiction (AHJ) alternative materials minimum standards, sewers required, industrial wastes, workman, prohibited fittings and practices, water convention, protection of pipes and structure, waterproofing, rat proofing, Hangers and supports trenching, types of joints

### **4. Architectural and Structural coordination**

**Theory-20 Hrs**

**Theory Exam.- 50 Marks**

#### **Internal Assessment- 50 Marks**

This topic deals with various architectural and structural provisions to be made during the planning stage. Few selected cases shall be discussed. Many standard textbooks in architecture and engineering by reputed author are available as source material Specific focus on plumbing activities is required. A site visit with the faculty is essential.

Local municipal laws relating to plumbing and basic information on fire static water requirements, for various sanitary facilities, plumbing shafts water tanks and pumps room, centralized hot water system coordination with the architects. Structural parameters such as sunken toilets location of columns and beams post – tension slabs, importance of ledge walls.

## Elective – I

**Theory-20 Hrs**

**Theory Exam. - 50 Marks**

**Internal Assessment- 50 Marks**

### **1. Plumbing Terminology**

This topic covers the terminology of trade. Definitions for most word words can be found in a dictionary, but there are technical or trade terms which take on specific meaning when used in relation to plumbing. The purpose of this course is to define those terms for the student. Source materials for this course is chapter 2 of the UPC - 1 Code and UPC-1 Illustrated training manual. Understanding of plumbing terminology will provide the student with insight in to the development of the art of plumbing. A list of abbreviations associated with the trade is included in this course.

### **2. Online instruments**

Instruments for online measurement and or contact such as flow (orifice meter, rotameter)pressure, pH, conductivity, temperature, flow switch, PID symbols for these instruments. Briefreview of principle of operation and constructional features, typical end connections and otherinterfacing connections, hook-up diagrams.Piping requirements for installation of line instruments (typically straight runs of piperequired) and control valve.

Components of typical closed loop control system (sensing element, controller, I/P converter,control valve).Introduction to control valve, characteristics, actuator, valve positioner.Interfacing of piping and instruments scope of work. Pneumatic tubing and cabling forinstrumentation.SCADA, Telemetry, fiber optics with reference to cross country pipelines.

### **3. Costing of piping system**

Direct and indirect costs associated with piping, estimating requirement of consumables and man hours, relative economics of various materials of construction, relative economics for different systems, concept of economic pipe diameter.

Case study in optimizing pipe size and estimating cost of piping for yard piping and ISBL piping.

Direct and indirect costs associated with piping fabrication and installation and testing inch-dia, inch- m concepts.

## **Assignment :**

Estimation of material cost, inch-m, inch-dia, cost of fabrication, installation of one pipeline isometric.

## **Semester II**

### **1. Pumps and Hydro –Pneumatic System**

**Theory-20 Hrs**

**Theory Exam. - 50 Marks**

**Internal Assessment- 50 Marks**

This topic covers various types of pumps for water supply, heat exchangers, wastewater dewatering and sewage. Pressure boosting and hydro-pneumatic systems shall be elaborated along with the accessories and controls. Design of Pumps, calculating pump capacities will be studied refer Part II of chapter 6 of UPC-I and ITM. Expert guest speaker can be requested to cover this topic.

### **2. Storm Drainage and water supply**

**Theory-20 Hrs**

**Theory Exam.- 50 Marks**

**Internal Assessment- 25 Marks**

This topic provides the guidelines to collect/ capture the storm water and discharge it in a safe and efficient manner. Source material for this course is chapter 11 of the UPC-1 Code and UPC-1 Illustrated Training Manual. Storm Drains required, prohibited connection, subsoil drains, sub-drains, sizing of gutters/ channels/ scuppers, window areaway drains, roof drains, strainers, leaders, conductors and connections, siphonic drains, under-ground drains, materials, traps required, prohibited installations, sizing, testing, introduction to rain water harvesting

This topic will introduce students to the regulation related to potable and non-potable water supply and distribution systems. Topics discussed include potable water storage, sizing of portable water piping, and drinking water treatment units. Source material for this course is chapter 6 of the UPC-1 code and the UPC-1

Illustrated Training Manual. Demonstration of various pipe manufacturers could be part of practicals.

Preamble, source of water, potable and non-potable and non-portable water, reclaimed water, water storage, treatment, hot and cold water distribution system, backflow prevention, air gap, cross connection control, pipe materials and jointing methods, pressure control, pipe materials and jointing method, pressure controls unions, thermal expansion, type of valves, installation and testing disinfection, water supply fixture Units (WSFU), sizing, protection of underground pipes, color codes and arrow making.

### **3. Pipe Support and stress analysis**

**Theory-20 Hrs**

**Theory Exam.- 50 Marks**

**Term work Marks – 25 Marks**

Design of pipe wall thickness, thermal stresses due to thermal expansion of pipelines and dissimilar materials, design of miter bends, contraction of pipelines, reinforcement of branches, flexibility analysis, pipe stress analysis with reference to pipe layout. Design code ANSI B 31.1/ b31.3 requirements for thermal stresses, imposed loading on equipment nozzles and structures, concept of cold-pull and self springing, pipe stress analysis with and without expansion joints, design and selection of expansion joints bellows. Stress analysis for different configurations of pipe layout. Use of computer aided packages for stress analysis, transfer of vibration from machine, different types of pipe supports, span calculations, gravity lines, pipe rack sizing and loading data for pipe – rack. Some assignments for stress/ force calculations using tables/ nomograms/ charts.

## Elective – II

**Theory-20 Hrs**

**Theory Exam.- 50 Marks**

**Internal Assessment- 50 Marks**

### **1.Constriction management**

This topic covers various aspects of managing plumbing installations at site. Many standard text books by reputed authors are available on the topic of Constriction Management as source material. Specific focus on plumbing activities is required. A site visit with the faculty is essential.

Organization charts, inter-organization relations, coordination of other agencies role of Engineer- in-charge, safety and security, working at heights and confined spaces, accident reporting. Inventory, material ordering and stacking, testing, record keeping, measurements and billing. Time and cost analysis, specifications writing, resources planning, takeoff quantities (BOQ) and cost estimates of few plumbing items. Break down activity sequence and activity period for few selected cases.

### **2. Statutory regulations and safety aspects**

Principles, guidelines and statutory requirements such as factory's act, safety and health directorate, petroleum rules, SMPV rules, gas cylinder storage rules, TAC, IBR etc. Considerations of above statutory regulations on plant layout equipment layout and piping, colour identification code for pipelines. Factory inspector approval drawings, CCOE approval drawings, boiler inspector isometric approval drawings etc. Introduction to environmental protection and waste management. Brief reference for hazardous area classification. Specific precautions for handling flammable and hazardous substance and liquefied gases, introduction to HAZOP methodology. ISO/QA requirements.

### **Assignment :-**

Preparation of equipment layout for a given size of plot using petroleum rules.

### **3.Piping layout Engineering.**

Introduction to equipment layout

1. Typical piping systems layout considerations for following various systems.

Distillation systems and heat exchanger systems. Cooling water, process water, chilled water/ brine systems. Pumps, air compressor suction/ discharge piping. Condensate recycle, steam distribution. Gas/steam turbines, vacuum system and flare lines. Yard piping jacketed and traced lines.. Petroleum products, class A,B,C including LPG Fire fighting system. Selection and design considerations for hoses, strainers, sight glasses, TSVs, rubber and metallic expansion bellows. Information to and from piping departments with other engineering departments in reference to layouts preparation. Do's and Don'ts for routing of pipelines in consideration with operating feasibility.

## **5. Project Work**

**Theory-25 Hrs**

**Practical/Drawing – 25 Hrs**

**Oral Exam.- 50 Marks**

**Internal Assessment- – 100 Marks**

Students are allowed to select the topic of their project work subject to approval of the scope by the faculty. Maximum 4 students can work in group for a common topic. Students are expected to visit the site, shops, etc. They can discuss the topic with manufactures, owners, consultant, contractor, and plumbers. The project report comprising drawing, sketches, photographs and description must be elaborate to cover the topic in its entirety. The Drawing should specify sizing and pump capacities and the report should be hand written. The oral examination based on the project work submitted, shall be conducted in the presence of an external examiner.

### **Criteria of Passing :-**

1. A minimum of 40 % marks should be obtained to pass each to the subjects head.
2. Award of degree will be governed by the following
  - a) Gross percentage of marks 70 or above is Distinction.
  - b) Gross percentage between 60 or above and below 70 is first-class.
  - c) Gross percentage between 50 or above and below 60 is second-class.
  - d) Gross percentage between 40 and above and below 50 is pass class.

### **Nature of question Paper:-**

It will be as follows:

1. a) Duration is two hours.
  - b) Total no of questions will be five out of which three to be solved.
2. Q1 is compulsory. Total weightage of marks 20 for the question and it consists of short answers type questions covering all topics of the subject syllabus.
3. Out of remaining two questions for the weightage of thirty marks, approximately 50% questions must be of analytical nature.