

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION (MSBTE)**I – Scheme****II – Semester Course Curriculum**Course Title: **Civil Engineering Workshop and Practice**

(Course Code:)

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering	Second

1. RATIONALE

General Civil Engineering Practices is a basic engineering course. The knowledge of basics of civil Engineering operations like masonry, mixing, concreting, finishing works is essential for technician to perform his/her duties in industries. Therefore, an opportunity is created through this course to develop basic skills with the safety aspects required for the same. Students should be able to supervise construction activities and use quality control techniques and maintain tools and equipments with safety to self, co-workers and the constructed components of the building. Working in field develops the attitude of team working and safety awareness. This course provides the unique experience of field work

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Perform basic civil engineering jobs using relevant tools.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify the various construction activities at site.
- Perform masonry job activities.
- Perform plumbing job activities.
- Identify finishing jobs related to building construction.
- Identify the various components of typical civil structures like road, culvert/bridges.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P) C	Examination Scheme				Total liforn
L	T	P		Theory Marks		Practical Marks		
ESE	PA	ESE	PA					
-	-	4	4	-	-	50	50~ ²	100

(~²): For the *practical only courses*, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

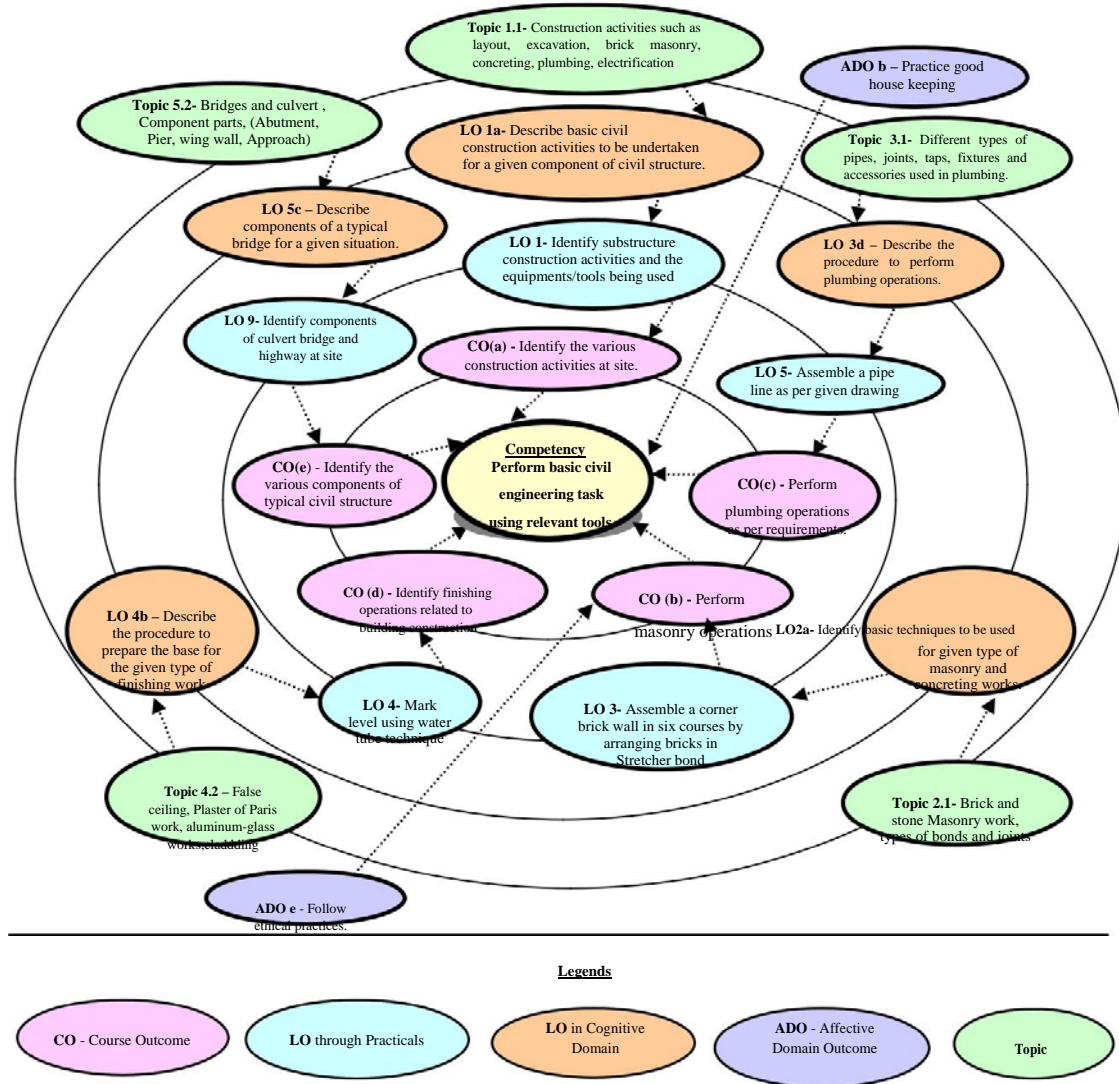


Figure 1 - Course Map

6. SUGGESTED PRACTICAL LEARNING OUTCOMES/TUTORIALS

The practical learning outcomes/tutorials in this section are psychomotor domain LOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part I	I, II	02*
2	Identify the substructure construction activities and the	I, II	02

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	equipments/tools being used at site during the visit. Part II		
3	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part III	I, II	02
4	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part IV	I, II	02
5	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students)	II	02*
6	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part I	II	02
7	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part II	II	02
8	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part III	II	02
9	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students) Part IV	II	02
10	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part I	III, IV	02*
11	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part II	III, IV	02
12	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part III	III, IV	02
13	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part IV	III, IV	02
14	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part I (Group of 10 students)	II, IV	02*
15	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part II (Group of 10 students)	II, IV	02
16	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part III (Group of 10 students)	II, IV	02
17	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part IV (Group of 10 students)	II, IV	02
18	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then disassemble this pipe line. Part I	III	02*
19	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple,	III	02

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	reducer, union, valves T, elbow and then disassemble this pipe line. Part II		
20	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then disassemble this pipe line. Part III	III	02
21	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then disassemble this pipe line. Part IV	III	02
22	Test the quality of cement on site/Laboratory. Part I	IV	02*
23	Test the quality of cement on site/Laboratory. Part II	IV	02
24	Test the quality of cement on site/Laboratory. Part III	IV	02
25	Identify types of bent up bar and stirrups at site during the field visit for the reinforcement for beams, column and slab. Part I	IV	02*
26	Identify types of bent up bar and stirrups at site during the field visit for the reinforcement for beams, column and slab. Part II	IV	02
27	Carry out field test on bricks at site. Part I	IV	02*
28	Carry out field test on bricks at site. Part II	IV	02
29	Carry out field test on bricks at site. Part III	IV	02
30	Identify the various components of the culvert at site	V	08*
31	Identify the various components of the bridge at site	V	08
32	Identify the various components of the highways at site	V	08
	Total		64

Note

- i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of **minimum 24 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as ‘*’ are compulsory**, so that the student reaches the ‘Precision Level’ of Dave’s ‘Psychomotor Domain Taxonomy’ as generally required by the industry.
- ii. Hence, the ‘Process’ and ‘Product’ related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	100

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Demonstrate working as a leader/a team member.
- d. Maintain tools and equipment.
- e. Follow ethical practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Raw material such as bricks of standard size 230 mm x 115 mm x 75 mm,	3,8
2	Trowels (Brick, Buttering, Pointing) , triangular, ranging in size up to about 11 inches (279.40 mm) long and from 101.6 mm to 203.2 mm wide i.e. (4 to 8 inches wide).	3
3	Portable Hammer , Spade, Pans (ghamela), Thread, lime	3
4	Square, mason's level, and straightedge 28.57 mm to 38.10 mm and the middle portion of the top edge from 152.40 mm to 254 mm wide	3
5	Levels and mason's line, brushes.	3
6	String, Level / Water tube, Plumb bob, Right Angle	4
7	The mason's level to establish "plumb" and "level" lines	4
8	Plumbing materials such as pipes and accessories for different sizes and materials, pipe wrench	5
9	Pipe Bending Machine	5
10	Pipe Vice – 100 mm	5
11	Pipe Cutter- 50 mm	5
12	Ordinary Portland Cement	3.6
13	Reinforcement bar, 10 mm dia. , binding wire and bending tool	7
14	Bricks of standard size 230 mm x 115 mm x 75 mm,	3.8

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Constructi on activities	1a. Describe basic construction activities to be undertaken for the given component of civil structure. 1b. Identify the construction activities at the given site. 1c. Identify the tools used for the given type of foundation layout. 1d. Describe different safety precautions to be taken at the given construction site.	1.1. Construction activities such as layout, excavation, brick masonry, concreting, plumbing, electrification, Interdependency of various activities 1.2. Workmanship and Safety precautions
Unit – II Masonry and Concreting	2a. Identify the basic techniques to be used for the given type of masonry and concreting works with justification. 2b. Identify the relevant quality control measures to be adopted in operations related to the given type of masonry and concreting with justification. 2c. Describe the methods of plastering and pointing to be undertaken in the given situation. 2d. Describe the methods of the formwork for the given type of building. 2e. Identify type of bonds in the given type of brickwork.	2.1 Brick and stone Masonry work, Types of bonds and joints (vertical and horizontal). 2.2 Line dori, plumb bob, right angle and water level tube. 2.3 Plastering, Pointing. 2.4 Proper mixing of concrete, concrete laying. 2.5 Use of concrete Mixtures and Vibrators, different types of Vibrators. 2.6 Formwork, Scaffolding. 2.7 Centring and Shuttering.
Unit- III Plumbing Services	3a Identify the plumbing tools and fixtures in the given situation with justification. 3b Select the pipe fittings, hand tools and machinery for the given type of work with justification. 3c Select the type of plumbing tools and machinery for the given situation with justification. 3d Describe the procedure to perform plumbing operations for the given condition. 3e Describe the safety precautions to be undertaken for the given site.	3.1 Different types of pipes, joints, taps, fixtures and accessories used in plumbing. 3.2 Components (pipes, valves, bends,) used in water supply/sanitary/sewerage lines.
Unit– IV Finishing Works	4a. Describe the operations to be undertaken related to the given situation of false ceiling, aluminum partitions, plastering work. 4b. Describe the procedure to prepare the	4.1 Flooring, skirting and dado. 4.2 False ceiling, Plaster of Paris (POP) work, aluminum – glass works, cladding. 4.3 Whitewash and painting:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	base for the given type of finishing /painting work. 4c. Choose the relevant aluminum section for the given type of work with justification. 4d. Describe whitewashing and Painting procedure for the given type of walls/steel frames/wooden structure.	Tools required, brush, roller and spray painting, preparation of surface for timber and steel members for painting.
Unit– V Constructi on of Road, culverts/ bridges	5a. Identify relevant materials for the given type of road construction with justification. 5b. Describe the types and components of road for the given situation. 5c. Describe the components of typical bridge for the given situation. 5d. Describe the components of a typical Culvert in the given situation. 5e. Identify relevant materials for construction of given type of bridge/culvert.	5.1 Types of road, components of road, (carriage way, shoulder, camber, gradient). 5.2 Bridges and Culvert, component parts, (Abutment, Pier, Wing wall, Approach).

Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- b. Undertake a market survey of local dealers for procurement of civil engineering materials, plumbing materials and finishing items
- c. Organize a visit to Construction sites of different types such as simple residential buildings, malls, multistoried buildings. Observe the course/topic based practices on the field.
- d. Teacher guided self-learning activities
- e. Course/ library /internet based mini-projects.
- f. Develop Power point presentation or animation for activities seen during field visit.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- b. '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
 - a. Guide student(s) in undertaking micro-projects.
 - b. Arrange visit to nearby construction sites for understanding various construction stages and construction activities.
 - c. Show video/animation films to explain various processes like, excavation, foundation, brickwork, plastering, laying water supply and sewer pipe line.
 - d. Prepare construction activity chart for various civil engineering stages..

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Bill Preparation** (Group of 4-5 students) – Prepare bill of materials for given pipeline layout
- b. **Masonry and concreting** - Each student will collect the information regarding the IS provisions for the construction materials like cement, bricks, reinforcement and sand.
- a. **Finishing Work** – Collect the information from local market regarding the types, thickness, manufacturer, cost of various brands and make of aluminum extruded sections along with its specifications laid in IS code.(Individual activity)
- b. **Plumbing** – Download the specifications for plumbing tools such as bench vice, hammers, pipe wrench and pipe accessories.
- c. **Masonry and concreting** – Undertake a market survey of cement aggregate and sand of various specifications from local dealers (Group of five students)
- d. **Plumbing** – Collect the technical information for various plumbing accessories such as GI/PVC pipes, bend, union, couplings of various dimensions and write a brief reports.(Individual activity)
- e. **Masonry and concreting (Individual activity)** –
 - i. Collect five samples of bricks from different suppliers and test them in field to assess its quality and write a report on it with reference to its constituents and process of manufacturing.
 - ii. Prepare a mud /cement mortar of various proportions 1:3 and apply plaster on a plain wall of 120 mm X 90 mm and observe the line, level and plumb
 - iii. Prepare a cement concrete of proportion 1:2:4, 1:3:6 and 1:4:8 and prepare a cubical block of it to determine its strength. (Individual activity)

- iv. Masonry and concreting –Collect the list of available brand of flooring tiles with their IS specifications and make a report of it.
- f. **Masonry and concreting** (Group of five students) – Undertake the local survey for various shuttering material along with its specifications.
- g. **Masonry and concreting** .(Group of ten students) – Assemble and dissemble the shuttering material for a beam of given dimension using appropriate material as directed by concern teacher
- h. **Finishing Work** (Individual activity) - Undertake the survey for different brands of paint, painting tools and prepare a report with reference to the following points:
 - i. Constituents of paint material
 - ii. Coverage area of finishing surface.
 - iii. Cost.
 - iv. Durability and aesthetic features.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	PWD- Standard Data Book for Building Work	PWD	PWD, Government of Maharashtra, Mumbai.
2	CPWD Specifications (Vol.-I and II)	CPWD	CPWD, Govt. of India, New Delhi.
3	The Practical design of Structural Elements in Timber	Bull, J.W.	Gower Press, London, 1989, ISBN: 9780566090288
4	Basic Plumbing With Illustrations	Massey, Howard C.	Craftsman Book Co; California, ISBN: 9780934041997
5	Modern Plumbing	Baker, E.Keith Blanken	Goodheart-Willcox Co ISBN: 978-1590703502
6	District Schedule of rates(DSR)	PWD	PWD, Government of Maharashtra, Mumbai.
7	A To Z Of Practical Building Construction & its Management	Mantri Sandeep	Satya Prakashan New Delhi, ISBN : 9788176842051

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.asnu.com.au>
- b. <http://www.iamcivilengineer.com/-building-design-and.html>
- c. www.mahapwd.com/
- d. cpwd.gov.in/
- e. <https://wrd.maharashtra.gov.in/>