

# GOVERNMENT POLYTECHNIC, MUMBAI

(An Autonomous Institute of Govt. of Maharashtra)



*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

# **Government Polytechnic, Mumbai**

## ***Department of Civil Engineering***

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# **Government Polytechnic, Mumbai**

## ***Department of Civil Engineering***

### **INSTITUTE VISION**

- Transform knowledge into work

### **INSTITUTE MISSION**

#### **We are committed to:**

- Quality education for lifelong learning.
- Need based educational programmes through different modes.
- Outcome based curriculum implementation.
- Development and up gradation of standard laboratory practices.
- Promoting entrepreneurial programmes.
- We believe in ethical values, safety and environment friendly practices and teaching learning innovations.

### **DEPARTMENT VISION**

- To provide quality education in Civil Engineering and prepare national proactive technician in contribution towards social uplifting and national building.

### **DEPARTMENT MISSION**

- To prepare disciplined, compassionate and virtuous technician to make significant contribution to the economic development of the state and the country on a whole.

# **Government Polytechnic, Mumbai**

## ***Department of Civil Engineering***

### **PROGRAMME OUTCOMES (POs)**

1. Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.
3. Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

# **Government Polytechnic, Mumbai**

## ***Department of Civil Engineering***

### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)**

- PEO1.** Diploma graduates will establish themselves as skilled technicians and quality supervisor in solving the problems for addressing the needs of the society.
- PEO2.** Diploma graduates will be well equipped with latest technologies prevailing in the construction industries and making themselves able to stand confidently and industriously in the rapid changing scenario in India and abroad.
- PEO3.** Diploma graduates will pursue lifelong learning and will establish themselves as the leaders, both in their chosen profession and in other activities and act professionally and ethically while making decisions fulfilling the social, cultural and sustainability requirements.

### **Programme Specific Outcomes (PSOs)**

- PSO 1.** To understand, read, draw & interpret drawings of different Civil Engineering Systems.
- PSO 2.** To be able to supervise different Civil Engg. sites.
- PSO 3.** To conduct different surveying activities in Civil Engineering Practices.

# **Government Polytechnic Mumbai**



## **Curriculum Philosophy (P19 Outcome based Curriculum)**

## Preface

The quality of technical education is dependent on a well-developed curriculum. The curriculum should not focus only on technical contents but it should impart necessary skills that help students to learn how to cope with new challenges. It should prepare them for lifelong learning once they enter the workforce. It is very necessary that the diploma students should be well updated with the latest technological skills and advancements, to meet industrial demands and contribute to nation building. With this thought we have designed outcome based curriculum keeping in view the latest industry trends and market requirements. Outcome based curriculum will be offered to students 2019 onwards. Outcome based curriculum is student centric rather than teacher centric. It is comprising of basic science and engineering having focus on fundamentals, significant discipline level courses and electives. Six month Inplant training is also included in the curriculum to make the student understand industry requirements, have hands on experience and take up project work relative to industry in their final year. These features will allow the students to develop problem solving approach to face the challenges in real life.

In outcome based education, Programme Outcomes, Programme specific outcomes, Course outcomes are defined first and then course contents are designed to achieve these outcomes. During curriculum implementation the teacher will analyze the contents and then develop the learning experiences which will ensure accomplishment of outcome. The industry experts, being main stake holders are actively involved, while designing the curriculum. Outcomes are validated by industry experts, so it will produce industry ready pass outs and increase the employability of students.

Salient features of this curriculum are

- Outcome based curriculum with well defined outcomes for each course
- Incorporation of six month Inplant training
- Built in flexibility to the students in terms of elective courses
- Course on Entrepreneurship and Start-up to encourage entrepreneurial skills
- More weightage for practical's in terms of contact hours to increase skill component
- Student Centered Activity in first, second and third semester to inculcate the habit of physical and mental fitness right at the start

- One MOOC in each semester in order to inculcate self learning capability in students.
- A list of experiments with clear outcomes.

The New Curriculum has been designed to better meet the needs of the industry considering evolving technological trends and implications for the engineering workforce. This curriculum is also expected to enhance employability skills and develop well trained Diploma Engineers who have the knowledge and the skills to get engineering solutions for real-world problems.

I gratefully acknowledge the time and efforts of all those who contributed to design the curriculum, especially the contributions of chairperson and members of Board of Studies and Programmewise Board of Studies. I acknowledge all the stake holders, aluminies and subject experts.

(Mrs. Swati Deshpande)  
Principal  
Government Polytechnic Mumbai



## Outcome Based Education Philosophy

As the National Board of Accreditation (NBA) is focusing on the adoption of Outcome Based Education (OBE) approach, Government Polytechnic, Mumbai has adopted the OBE approach for design of curriculum P19 to all programmes. NBA adopted Outcome based Model because, OBE is “Student Centric” rather than “Teacher Centric”. OBE focuses on the graduate attributes or outcomes after completing an academic programme. Outcome based approach means knowing what you want to achieve and then taking the steps to do so. Starting with a clear picture of what is important for students to be able to do and then organizing the curriculum delivery and assessment to make sure learning happens.

### Some Benefits of OBE are

1. Satisfying the need of stake holders
2. More specific and coherent curriculum
3. Student centric

### Components of the OBE are

1. Outcome based curriculum: What students should be able to do after learning the curriculum?
2. Outcome based Teaching Learning: Prepare and train the students to achieve the outcomes.
3. Outcome based assessment: Measure what the student has achieved? Identify which outcome has not attained by the students.
4. Remedial measures: Take the remedial measures so that student can achieve that outcome.



Fig1. Outcome Based Education Philosophy

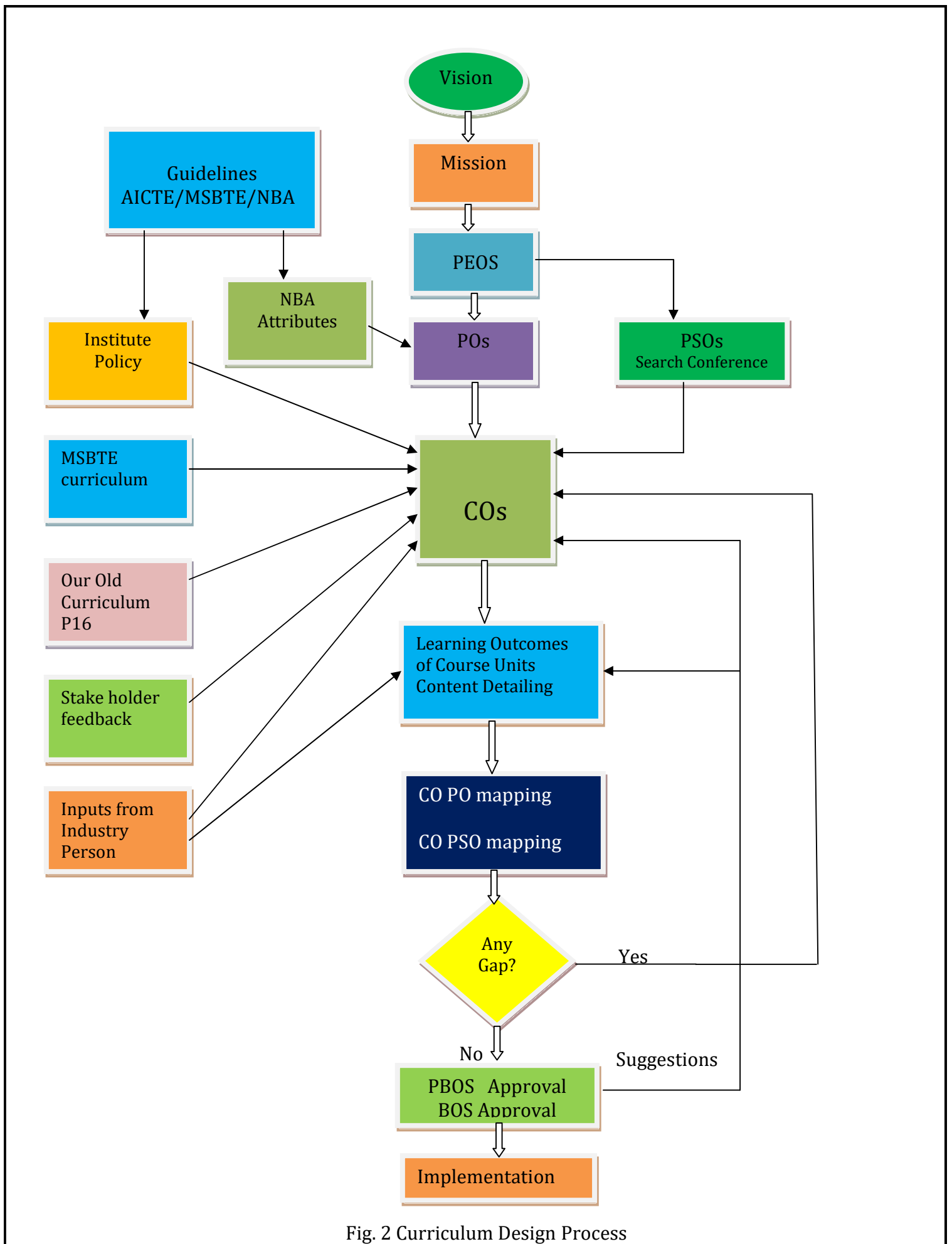


Fig. 2 Curriculum Design Process

Figure 1 shows outcome based education philosophy. Vision and mission statements will be finalized first, and then each programme will finalize Programme educational objectives (PEOs). Programme outcomes (POs) are given by NBA. Each programme will finalize their Programme Specific Outcomes (PSOs). Then course outcomes (COs) are finalized and then content detailing of each course will be carried out.

Figure 2 shows our curriculum design process/philosophy. Figure is self explanatory. Important steps are given below. Process starts with formulation of vision mission statements of the institute.

### **1. Formulation of Vision Mission Statements**

Vision Mission statements of the institute are finalized using following steps.

- Bottoms up approach
- Involvement all stakeholders
- Discussion, Brain storming sessions among all stake holders
- Gap analysis or SWOT analysis
- Challenges before the institute
- What are the immediate and long term goals

After following these steps vision and mission statements of the institute is finalized as

#### **Institute Vision**

Transform Knowledge into Work

#### **Institute Mission**

We are committed for

- Quality education for life long learning
- Need based educational programmes through different modes.
- Outcome based curriculum implementation
- Development and up gradation of standard laboratory practices
- Promoting entrepreneurial programmes

We believe in ethical, safety, environmental friendly practices and teaching learning innovations.

Once, the vision mission statements are finalized. Using the same procedure vision mission statements of each programmes are finalized.

## **2. Programme Educational Objectives (PEOs)**

The Programme educational objectives of a diploma program are the statements that describe the expected achievements of diploma holders in their career, and also in particular, what they are expected to perform and achieve during the first few years after diploma. The PEOs, may be guided by global and local needs, vision of the Institution, long term goals etc. For defining the PEOs the faculty members of the program have continuously worked with all Stakeholders: Local Employers, Industry, Students and the Alumni

## **3. Programme Outcomes (POs)**

Programme outcomes are given by NBA. They are

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyze well defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering tools experimentation and testing:** Apply modern engineering tools and appropriate technique to conduct standard test and measurements.
5. **Engineering practices for society sustainability and environment:** apply appropriate technology in context of society sustainability environment and ethical practices
6. **Project management:** Use Engineering Management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes

#### **4. Programme Specific Outcomes (PSOs)**

These outcomes are specific to a program in addition to NBA defined POs, namely, Civil, Computer, Electrical, Electronics, Mechanical, Information Technology, Instrumentation, Rubber Technology, Leather Technology, and Leather Goods and Footwear technology.

#### **5. Course Outcomes (COs) and Content detailing**

“Statements of observable student actions that serve as evidence of the Knowledge, Skills and Attitudes acquired in a course”. Each course is designed to meet (about 4 to 6) Course Outcomes. The Course Outcomes are stated in such a way that they can be actually measured. “Blooms Taxonomy” is used for framing course outcomes.

Course Outcome statements are broken down into two main components:

- **An action word** that identifies the performance to be demonstrated;
- **Learning statement** that specifies what learning will be demonstrated in the performance;

Once the COs are finalized, content detailing of each course is done as per the course outcomes. For content detailing inputs are taken from stake holders, MSBTE curriculum and industry persons.

#### **6. CO-PO and CO-PSO mapping**

When all COs are finalized, COs are mapped with POs and PSOs. During mapping if it is found that particular PO or PSO has not been addressed by any CO, then it is considered as gap. To remove this gap, again COs are modified. This process will repeat till all POs and PSOs are mapped by COs.

#### **7. Approval in PBOS and BOS meetings.**

After CO-PO and CO-PSO mapping, content detailing is done. Then the curriculum is kept for approval in Programme wise Board of studies (PBOS) meeting. Each programme has its own PBOS committee whose structure is as follows.

Head of Department concerned	Chairman
Two senior Lecturers	Members
One expert from the neighboring institute	Member

Nominee from the board of technical Education	Member
One expert from the local industry	Member
Departmental Curriculum Coordinator	Member Secretary

Suggestions given by PBOS members are incorporated in the curriculum and then it is put in front of Board of studies (BOS). Structure of BOS is as follows.

Representative from Industry	Chairman
Principal	Member
Head of All departments	Member
Local Experts of all programmes	Member
Nominee from the board of technical Education	Member
In charge CDC	Member Secretary

Suggestions given by BOS members are incorporated in the curriculum and the finalized curriculum is then offered to the students.

## **8. Institute Policies**

As per the guidelines given by All India Council of Technical Education (AICTE), Maharashtra State Board of Technical Education (MSBTE), Directorate of Technical Education (DTE) and NBA, Institute policies about curriculum design are decided in the meeting of all Heads of the departments.

Being an autonomous institute, we revise our curriculum after every 4 to 5 years. Earlier it was revised in 2016. Curriculum 2016 was outcome based curriculum. As per instructions received from AICTE and NBA, Outcome based curriculum should be offered to students, we have offered Outcome based curriculum in 2016. In 2019, we have conducted search conference in all departments to identify set of skill components that should be developed in students at the end of the diploma programme. Here we got suggestions from industry experts as well as from stakeholders about incorporation of six month Inplant training in the curriculum itself to give awareness about industry culture to students. So in 2019 we revised our curriculum. It is outcome based with six months Inplant training. We got approval from AICTE also. So now all courses are sandwich pattern. This scheme we name as P19 scheme. In 2019 it will be offered to first year and in subsequent years it will be offered to second year and third year. Once the curriculum frame work is finalized at the institute level, as per the demand of the industry, course

contents can be changed at any level without disturbing the frame work. This is necessary to satisfy the present demand of the industry and remove the curricula gaps as per the advancement in technology.

2019 curriculum is of 180 credits (215 teaching hours). As per AICTE norms given in APH 2015-16, contact hours per semester should be 525 hours and number of teaching days should be 75 in a semester (7 hours per day i.e. 35 hours per week). Total weeks for teaching are 15. One week will be for unit test exam. Total term will be of 16 week.

So we decided to design 2019 curriculum with 180 credits.

### **Definition of Credit:**

1 Hr. Lecture (L) per week 1 credit

1 Hr. Tutorial (T) per week 1 credit

2 Hours Practical (P) per week 2 credit

All programmes (Civil Engineering, Computer Engineering, Electrical Engineering, Electronics Engineering, Information Technology, Instrumentation, Mechanical Engineering, Rubber Technology, Leather Technology, Leather Goods and Footwear Technology) have incorporated six month Inplant training in their curriculum, wherein students will go for Inplant training in the industries during last semester. 20 credits (40 teaching hours per week) are allotted for Inplant training.

### **Curriculum Framework**

Semester wise Credit distribution and Mark distribution is given below.

#### **Curriculum Frame work for All Programmes**

<b>Year</b>	<b>Semester</b>	<b>Credits</b>	<b>Teaching hours</b>	<b>Marks</b>
<b>First</b>	<b>First</b>	30	35	600 to 700
	<b>Second</b>	30	35	600 to 700
<b>Second</b>	<b>Third</b>	30	35	600 to 700
	<b>Fourth</b>	35	35	700 to 800
<b>Third</b>	<b>Fifth</b>	35	35	700 to 800
	<b>Sixth</b>	20	40	200
<b>Total</b>		180	215	3400 to 3900

Apart from technical courses, in first 3 semesters, 5 teaching hours per week are allotted for Student Center Activities. Breakup of these five hours is as follows.

Library – 1 hr

Sports – 2 hrs

Creative arts – 2 hrs

In order to inculcate self learning capability in students MOOC (Massive Open Online Course) in each semester is incorporated in the curriculum of all programmes.

As per AICTE model curriculum 60% weightage is given for external examination and 40% weightage is given for internal examination as far as theory is considered. For all courses in all programmes 60+20+20 pattern of examination is followed. Two internal progressive assessment tests are conducted for theory courses in a semester having maximum marks 20. End semester examination of 60 Marks is conducted at the end of the semester. Addition of two test marks with end semester examination marks will give total marks out of 100.

After test as well as end term examination bitwise analysis of answer book of each student will be done in order to calculate course outcome attainment. From course attainment, PO and PSO attainment will be calculated. If attainment is not satisfactory remedial measures will be taken by respective department.

For courses, those they are having practical's, Term work is kept, where continuous assessment is made compulsory.

In the sixth semester, students are going for Inplant training. Before going into industry at least he/she should learn basic things required for his/her programme. In order to achieve this, a prerequisite of minimum 100 credits is must for registration of Inplant training. A student will be eligible for registration of Inplant training only when he/she completes minimum 100 credits.



## **Award of Diploma**

For the award of diploma in all programmes, all courses of 5<sup>th</sup> semester and Inplant training will be considered along with weightage from first semester to fourth semester courses as shown in following table.

All courses of fifth semester	700 to 800 Marks
Inplant Training	200 Marks
Consolidated marks of first to fourth semester*	400 marks
Total marks	1300 to 1400 Marks

\*Consolidated Marks of first to fourth semester – the total marks of first, second, third and fourth semesters are converted to 100 marks each. These marks are then added (1<sup>st</sup>Sem +2<sup>nd</sup>Sem +3<sup>rd</sup>Sem + 4<sup>th</sup>sem) as 100+100+100+100 = 400 marks.

## **Implementation of MOOC:**

In each semester all programmes will offer a MOOC. Programme head should see that this MOOC is freely available to all students; it should not be financial bourdon on students. Sufficient number of lectures/sessions should be available for the course which is offered through MOOC. For 1 credit per week one lecture or one session of 45 minutes to 60 minutes should be available.

For MOOC courses online examination is conducted by service provider for example spoken tutorial. Spoken tutorial will issue certificates also. Programme head should collect certificates of all students semester wise and submit to controller of examination.

As exam is conducted by some other agency, marks are not taken into consideration. They will not reflect in the result. But unless and until student complete certification, credits of MOOC will not be awarded to the students. Without completion of 180 credits diploma will not be awarded.

Student can complete MOOC at any time throughout of this tenure of diploma. Course or exam registration of student in any semester will not be blocked due to incomplection of MOOC. Whenever student completes certification, in that term, in the result of term end examination credits will be allotted.

## Course Codes:

Entire curriculum of all Programmes is divided into five levels. These levels and their percentage is given below.

Level1- Science and Humanities (10 to 15%)

Level2- Core Technology (25 to 30%)

Level3- Applied Technology (45 to 50%)

Level4- Diversified Courses (5 to 10%)

Level5- Management courses (3 to 5%)

## Course Coding Scheme:-

Course Code abbreviations	Definitions
HU	Humanities
SC	Science
MG	Management
CE	Civil
CO	Computer
EC	Electronics
EE	Electrical
IT	Information Technology
IS	Instrumentation
RT	Rubber
LT	Leather Technology
LG	Leather Goods and Footwear

Course codes are formed as:

First two letters are course code abbreviations. Then two digits “19” refers to 2019 curriculum.

Next digit is level number and last two digits are serial number from that level.

For example: HU19101 (Communication Skill)

HU- It belongs to Level 1 Science & humanities

19- 2019 curriculum

1- Level 1

01- Sr. No of Level 1 courses.

# Government Polytechnic, Mumbai

## 180 Credit Scheme P-19 Level Wise Marks Distribution

### *Department of Civil Engineering*

### *Level I Courses*

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
SC19107	Engineering Chemistry	3	2	--	5	5	60	20	20	25*	--	25	150
SC19109	Basic Mathematics	4	--	--	4	4	60	20	20	--	--		100
HU19101	Communication Skill	2	2	--	4	4	60	20	20	25*	--	25	150
SC19102	Engineering Physics	3	2	--	5	5	60	20	20	25*	--	25	150
SC19110	Engineering Mathematics	4	--	--	4	4	60	20	20	--	--		100
HU19102	Environmental Studies	--	2	--	2	2	--	--	--	--	25	25	50
CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>16</b>	<b>12</b>	<b>--</b>	<b>28</b>	<b>28</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>75</b>	<b>25</b>	<b>100</b>	<b>700</b>

# Government Polytechnic, Mumbai

## *Department of Civil Engineering*

### *Level II Courses*

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
ME19201	Engineering Drawing I	2	4	--	6	6	--	--	--	50*	--	50	100
WS19201	Workshop Practice	--	4	--	4	4	--	--	--	--	--	50	50
CE19101	Construction Materials	3	--	--	3	3	60	20	20	--	--	--	100
AM19201	Engineering Mechanics	3	2	--	5	5	60	20	20	25	--	25	150
CE19201	Building Drawing	1	4	--	5	5	--	--	--	50*	--	50	100
CE19202	Surveying I	3	4	--	7	7	60	20	20	50*	--	50	200
CE19203	Libre Office Draw (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
AM19301	Mechanics of Structures	3	2	--	5	5	60	20	20	--	--	25	125
CE19301	Construction Technology	3	2	--	5	5	60	20	20	--	25*	--	125
CE19302	Transportation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
AM19402	Concrete Technology	4	2	--	6	6	60	20	20	--	--	25	125
CE19401	Hydraulics	3	2	--	5	5	60	20	20	--	25	--	125
	<b>Total</b>	<b>28</b>	<b>30</b>	<b>--</b>	<b>58</b>	<b>58</b>	<b>480</b>	<b>160</b>	<b>160</b>	<b>175</b>	<b>50</b>	<b>275</b>	<b>1300</b>

# Government Polytechnic, Mumbai

## Department of Civil Engineering

### Level III Courses

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
AM19302	Soil Mechanics	3	2	--	5	5	60	20	20	--	--	25	125
CE19303	Surveying II	2	4	--	6	6	60	20	20	50*	--	25	175
CE19304	QGIS (16) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
AM19401	Theory of Structures	4	--	01	5	5	60	20	20	--	--	--	100
CE19402	Environmental Engineering	4	2	--	6	6	60	20	20	--	25*	25	150
CE19403	Computer Aided Drafting	1	4	--	5	5	--	--	--	50	--	50	100
CE19408	QCAD (5) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
AM19501	Design of Reinforced Concrete and Steel Structures	4	4	--	8	8	60	20	20	--	25*	25	150
CE19501	Estimation and Costing	4	2	--	6	6	60	20	20	--	--	25	125
CE19502	Contracts, Accounts and Valuation	4	2	--	6	6	60	20	20	--	25*	--	125
CE19503	Irrigation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
CE19506	Project	--	4	--	4	4	--	--	--	--	50*	50	100
	<b>Total</b>	<b>29</b>	<b>32</b>	<b>01</b>	<b>62</b>	<b>62</b>	<b>480</b>	<b>160</b>	<b>160</b>	<b>100</b>	<b>125</b>	<b>225</b>	<b>1250</b>

# Government Polytechnic, Mumbai

## *Department of Civil Engineering*

### *Level IV Courses*

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
	Elective – I (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
CE19404	Repairs & Rehabilitation of Building	--	--	--	--	--	--	--	--	--	--	--	--
CE19405	Building Services & Maintenance	--	--	--	--	--	--	--	--	--	--	--	--
CE19406	Material Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19407	Safety & Quality Control	--	--	--	--	--	--	--	--	--	--	--	--
	Elective – II (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
AM19502	Prestressed & Precast Concrete	--	--	--	--	--	--	--	--	--	--	--	--
AM19503	Advanced Geotechnical Engineering	--	--	--	--	--	--	--	--	--	--	--	--
CE19505	Solid Waste Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19601	Inplant Training	--	40	--	40	20	--	--	--	--	100*	100*	200
	<b>Total</b>	<b>08</b>	<b>40</b>	<b>--</b>	<b>48</b>	<b>28</b>	<b>120</b>	<b>40</b>	<b>40</b>	<b>--</b>	<b>100</b>	<b>100</b>	<b>400</b>

# Government Polytechnic, Mumbai

## Department of Civil Engineering

### Level V Courses

	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
	Elective – II (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
CE19504	Construction Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19507	Entrepreneurship (NPTEL)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>04</b>	<b>04</b>	<b>--</b>	<b>08</b>	<b>08</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>100</b>

# Government Polytechnic, Mumbai

## Semester wise credits and marks distribution

### *Department of Civil Engineering*

Sr.No.	Term / Semester	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
1.	I	14	16	--	30+5	30	240	80	80	100	--	150	650
2.	II	14	16	--	30+5	30	240	80	80	150	--	150	700
3.	III	14	16	--	30+5	30	300	100	100	50	50	100	700
4.	IV	20	14	01	35	35	300	100	100	50	50	100	700
5.	V	19	16	--	35	35	300	100	100	--	100	100	700
6.	VI	--	40	--	40	20	--	--	--	--	100	100	200
	<b>Total</b>	<b>81</b>	<b>118</b>	<b>01</b>	<b>215</b>	<b>180</b>	<b>1380</b>	<b>460</b>	<b>460</b>	<b>350</b>	<b>300</b>	<b>700</b>	<b>3650</b>
	<b>Grand Total</b>	<b>81</b>	<b>119</b>		<b>215</b>	<b>180</b>	<b>2300</b>			<b>1350</b>		<b>3650</b>	
	<b>%</b>	<b>45</b>	<b>66.11</b>				<b>63</b>			<b>37</b>			



**GOVERNMENT POLYTECHNIC MUMBAI**  
(Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**(Term / Semester – I)**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
SC19107	Engineering Chemistry	3	2	--	5	5	60	20	20	25*	--	25	150
SC19109	Basic Mathematics	4	--	--	4	4	60	20	20	--	--		100
HU19101	Communication Skill	2	2	--	4	4	60	20	20	25*	--	25	150
ME19201	Engineering Drawing I	2	4	--	6	6	--	--	--	50*	--	50	100
WS19201	Workshop Practice	--	4	--	4	4	--	--	--	--	--	50	50
CE19101	Construction Materials	3	--	--	3	3	60	20	20	--	--	--	100
CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>14</b>	<b>16</b>	<b>--</b>	<b>30</b>	<b>30</b>	<b>240</b>	<b>80</b>	<b>80</b>	<b>100</b>	<b>--</b>	<b>150</b>	<b>650</b>
Student Centered Activity(SCA)					<b>05</b>								
Total Contact Hours					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal assessment, #indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library -1 hour, Sports- 2hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCS/Spoken Tutorials /NPTEL/SWAYAM/FOSSEE etc.

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

In-Charge  
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Head of Departments  
Department of Civil Engineering

Principal

**GOVERNMENT POLYTECHNIC MUMBAI**  
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**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - II**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
SC19102	Engineering Physics	3	2	--	5	5	60	20	20	25*	--	25	150
SC19110	Engineering Mathematics	4	--	--	4	4	60	20	20	--	--		100
CE19201	Building Drawing	1	4	--	5	5	--	--	--	50*	--	50	100
CE19202	Surveying I	3	4	--	7	7	60	20	20	50*	--	50	200
AM19201	Engineering Mechanics	3	2	--	5	5	60	20	20	25	--	25	150
CE19203	Libre Office Draw (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>14</b>	<b>16</b>	<b>--</b>	<b>30</b>	<b>30</b>	<b>240</b>	<b>80</b>	<b>80</b>	<b>150</b>	<b>--</b>	<b>150</b>	<b>700</b>
Student Centered Activity(SCA)					<b>05</b>								
Total Contact Hours					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCs / Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

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Dept. of Civil Engineering

Head of Department  
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**GOVERNMENT POLYTECHNIC MUMBAI**  
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**Teaching and Examination Scheme (P19)**  
With effect from AY 2019-20

Programme: Diploma in Civil Engineering (Sandwich Pattern)

Term / Semester - III

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
CE19301	Construction Technology	3	2	--	5	5	60	20	20	--	25*	--	125
CE19302	Transportation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
CE19303	Surveying II	2	4	--	6	6	60	20	20	50*	--	25	175
AM19301	Mechanics of Structures	3	2	--	5	5	60	20	20	--	--	25	125
AM19302	Soil Mechanics	3	2	--	5	5	60	20	20	--	--	25	125
HU19102	Environmental Studies	--	2	--	2	2	--	--	--	--	25	25	50
CE19304	QGIS (16) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>14</b>	<b>16</b>	<b>--</b>	<b>30</b>	<b>30</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>700</b>
Student Centered Activity(SCA)					<b>05</b>								
Total Contact Hours					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
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**GOVERNMENT POLYTECHNIC MUMBAI**  
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**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - IV**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
AM19401	Theory of Structures	4	--	01	5	5	60	20	20	--	--	--	100
AM19402	Concrete Technology	4	2	--	6	6	60	20	20	--	--	25	125
CE19401	Hydraulics	3	2	--	5	5	60	20	20	--	25	--	125
CE19402	Environmental Engineering	4	2	--	6	6	60	20	20	--	25*	25	150
CE19403	Computer Aided Drafting	1	4	--	5	5	--	--	--	50	--	50	100
	Elective – I (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
CE19404	Repairs & Rehabilitation of Building	--	--	--	--	--	--	--	--	--	--	--	--
CE19405	Building Services & Maintenance	--	--	--	--	--	--	--	--	--	--	--	--
CE19406	Material Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19407	Safety & Quality Control	--	--	--	--	--	--	--	--	--	--	--	--
CE19408	QCad (5) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>20</b>	<b>14</b>	<b>01</b>	<b>35</b>	<b>35</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>700</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

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**Teaching and Examination Scheme (P19)**  
With effect from AY 2019-20

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - V**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
AM19501	Design of Reinforced Concrete and Steel Structures	4	4	--	8	8	60	20	20	--	25*	25	150
CE19501	Estimation and Costing	4	2	--	6	6	60	20	20	--	--	25	125
CE19502	Contracts, Accounts and Valuation	4	2	--	6	6	60	20	20	--	25*	--	125
CE19503	Irrigation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
	Elective – II (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
AM19502	Prestressed & Precast Concrete	--	--	--	--	--	--	--	--	--	--	--	--
CE19504	Construction Management	--	--	--	--	--	--	--	--	--	--	--	--
AM19503	Advanced Geotechnical Engineering	--	--	--	--	--	--	--	--	--	--	--	--
CE19505	Solid Waste Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19506	Project	--	4	--	4	4	--	--	--	--	50*	50	100
CE19507	Entrepreneurship (NPTEL)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>19</b>	<b>16</b>	<b>--</b>	<b>35</b>	<b>35</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>--</b>	<b>100</b>	<b>100</b>	<b>700</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
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**GOVERNMENT POLYTECHNIC MUMBAI**  
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**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - VI**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
CE19601	Inplant Training	--	40	--	40	20	--	--	--	--	100*	100*	200
	<b>Total</b>	--	<b>40</b>	--	<b>40</b>	<b>20</b>	--	--	--	--	<b>100</b>	<b>100</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
 Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

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# Government Polytechnic, Mumbai

## *Department of Civil Engineering*

### *Award of Diploma*

For the award of diploma in all programmes, all courses of 5th semester and Inplant training will be considered along with weightage from first semester to fourth semester courses as shown in following table.

All courses of 5 <sup>th</sup> Semester	700 to 800 Marks
Inplant training	200 Marks
Consolidated marks of 1 <sup>st</sup> to 4 <sup>th</sup> Semester*	400 Marks
Total marks	1300 to 1400 Marks

\*Consolidated Marks of first to fourth semester – the total marks of first, second, third and fourth semesters are converted to 100 marks each. These marks are then added (1<sup>st</sup> Sem + 2<sup>nd</sup> Sem + 3<sup>rd</sup> Sem + 4<sup>th</sup> sem) as 100+100+100+100 = 400 marks.

# Government Polytechnic, Mumbai

## *Department of Civil Engineering*

### *Direct second Year admitted students Backlogs*

Entry LEVEL Qualification	Course Code and Course Name Exempted from appearing for Examination		Course Code and Course Name <u>NOT</u> Exempted	
I T I (CTS)	HU19101	Communication Skill	SC19109	Basic Mathematics
	SC19107	Engineering Chemistry	CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)
	WS19201	Workshop Practice	CE19203	Libre Office draw (Spoken Tutorials)
	ME19201	Engineering Drawing I	AM19201	Engineering Mechanics
	SC19102	Engineering Physics		
	SC19110	Engineering Mathematics		
	CE19101	Construction Materials		
	CE19202	Surveying I		
CE19201	Building Drawing			
12th Science, Biofocal – D9 (Technical) other than Civil group	HU19101	Communication Skill	CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)
	SC19107	Engineering Chemistry	CE19203	Libre Office draw (Spoken Tutorials)
	WS19201	Workshop Practice	CE19202	Surveying I
	ME19201	Engineering Drawing I	CE19201	Building Drawing
	SC19102	Engineering Physics		
	SC19110	Engineering Mathematics		
	CE19101	Construction Materials		
	SC19109	Basic Mathematics		
AM19201	Engineering Mechanics			
12 Science	HU19101	Communication Skill	CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)
	SC19109	Basic Mathematics	CE19203	Libre Office draw (Spoken



				Tutorials)
	SC19107	Engineering Chemistry	CE19202	Surveying I
	WS19201	Workshop Practice	CE19201	Building Drawing
	ME19201	Engineering Drawing I		
	SC19102	Engineering Physics		
	SC19110	Engineering Mathematics		
	CE19101	Construction Materials		
	AM19201	Engineering Mechanics		
(HSC Vocational / MCVC) (J7/J8/J9) (HA/HB/HC)	HU19101	Communication Skill	CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)
	SC19107	Engineering Chemistry	SC19109	Basic Mathematics
	WS19201	Workshop Practice	CE19203	Libre Office draw (Spoken Tutorials)
	ME19201	Engineering Drawing I	AM19201	Engineering Mechanics
	SC19109	Basic Mathematics		
	HU19101	Communication Skill		
	SC19102	Engineering Physics		
	SC19110	Engineering Mathematics		
	CE19101	Construction Materials		
	CE19202	Surveying I		
	CE19201	Building Drawing		
12th Science, Biofocal - D9 (Technical) with Civil Engg .group	HU19101	Communication Skill	CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)
	SC19109	Basic Mathematics	CE19203	Libre Office draw (Spoken Tutorials)
	SC19107	Engineering Chemistry		
	WS19201	Workshop Practice		
	ME19201	Engineering Drawing I		
	SC19102	Engineering Physics		
	SC19110	Engineering Mathematics		
	AM19201	Engineering Mechanics		
	CE19101	Construction Materials		
	CE19202	Surveying I		
CE19201	Building Drawing			

# Government Polytechnic, Mumbai

## *Department of Civil Engineering*

### Equivalence of P16 to P19 scheme

SEM	Old Course Scheme (2016)		New Course Scheme (2019)		SEM
	Course Code	Course Name	Course Code	Course Name	
I	HU16101	Basics of communication	HU19101	Communication Skills	I
I	HU16103	Generic skills	No equivalence. Should be completed across the table		I
I	HU16104	Environmental studies	HU19102	Environmental Studies	III
I	NC16101	Yoga	---	Student Centered Activity (SCA)	I
I	NC16102	Social service	---	Student Centered Activity (SCA)	II
I	SC16107	Mathematics I	SC19109	Basic Mathematics	I
I	ME16201	Engineering drawing, I	ME19201	Engineering drawing, I	I
I	SC16105	Engineering chemistry	SC19107	Engineering Chemistry	I
I	CO16201	Computer Fundamentals	CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)	I
I	WS16201	Workshop practice	WS19201	Workshop Practice	I
II	HU16102	Communication skill	No equivalence. Should be completed across the table		---
II	SC16104	Engineering physics	SC19102	Engineering Physics	II
II	SC16108	Mathematics II	SC19110	Engineering Mathematics	II
II	AM16201	Engineering mechanics	AM19201	Engineering Mechanics	II
II	CE16201	Building construction	CE19301	Construction Technology	III
II	CE16202	Surveying	CE19202	Surveying I	II
II	CE16203	Building drawing	CE19201	Building Drawing	II
---	---	---	CE19203	Libre office draw	II

III	CE16204	Hydraulics	CE19401	Hydraulics	IV
III	AM16202	Mechanics of structure	AM19301	Mechanics of Structures	III
III	AM16203	Concrete technology	AM19402	Concrete Technology	IV
III	CE16205	Highway engineering	CE19302	Transportation Engineering	III
III	CE16306	Water supply engineering	CE19402	Environmental Engineering	IV
III	CE16303	Computer Aided Drafting	CE19403	Computer Aided Drafting	IV
III	CE16302	Advanced construction practice	No equivalence. Should be completed across the table		
IV	CE16302	Advanced surveying	CE19303	Surveying II	III
IV	CE16205	Railway and bridge engineering	CE19302	Transportation Engineering	III
IV	CE16307	Sanitary engineering	CE19402	Environmental Engineering	IV
IV	AM16304	Soil mechanics	AM19302	Soil Mechanics	III
IV	AM16301	Theory of structure	AM19401	Theory of Structures	IV
IV	CE16501	Construction management	CE19504	Construction Management	V
IV	CE 16401(O)	Repairs and rehabilitation of structures	CE19404(O)	Repairs & Rehabilitation of Building	IV
IV	CE 16402(O)	Plumbing and sanitary services	CE19405(O)	Building Services & Maintenance	IV
IV	CE 16404(O)	Safety and quality control	CE19407(O)	Safety and quality control	IV
IV	CE 16403(O)	Material management	CE19406(O)	Material Management	IV
---	---	---	CE19408	Q Cad (Spoken Tutorials)	IV
V	CE16305	Irrigation engineering	CE19503	Irrigation Engineering	V
V	CE16304	Estimating and costing	CE19501	Estimation and Costing	V

V	CE 16309	Contracts, accounts and valuation	CE19502	Contracts, Accounts and Valuation	V
V	MG16502	Entrepreneurship Development	CE19507	Entrepreneurship (NPTEL)	V
V	AM16302	Design of RCC and Steel structures.	AM19501	Design of Reinforced Concrete and Steel Structures	V
V	CE16308	Project	CE19506	Project	V
V	AM16401(O)	Prestressed and precast concrete	AM19502	Prestressed & Precast Concrete	V
V	AM16402(O)	Advanced geotechnical engineering	AM19503	Advanced Geotechnical Engineering	V
V	CE 16405(O)	Solid waste management	CE19505	Solid Waste Management	V
V	AM16403(O)	Advanced Design of Structures	---	---	---
VI	CE16406	Industrial training	CE19601	In plant Training	VI
---	---	---	CE19101	Construction Materials	I
---	---	---	CE19304	QGIS (Spoken Tutorials)	III

## **Policy for Course Detention P19**

If the theory attendance of the student in any course in a semester is less than 75% and practical attendance is less than 100% (student has not completed all the prescribed practicals and not submitted the Term Work), he/she will be detained in that course at the end of the semester. Such student will not be allowed to appear for end semester examination of that course. Such students need to do course registration of that course again as per detention rules given below. Student has to satisfy the attendance and Term work criterion. After that he/she will be allowed for examination of that course. Rules of detention are as follows

- If a student is detained in any course of first year, he/she will not be eligible for second year admission, till he/she will not clear his/her detention.
- If a student is detained in any course of second year, he/she will not be eligible for third year admission, till he/she will not clear his/her detention.
- However, if a student is detained in any course of Odd semester, he/she can register for detained courses (maximum 2) in even semester, by paying additional fees as per rules.
- If a student is detained in any course of Even semester, he/she can register for detained courses (maximum 2) in vacation semester, for which he/she needs to pay additional fees as per rules of vacation semester.
- Student will not be eligible for registration of Inplant training unless, he/she completes minimum 100 credits.
- MOOC courses are exempted from above rules.
- Detention rule is not applicable for First Year Backlog courses of Direct Second Year admitted students.



**Government Polytechnic, Mumbai**

*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

**Semester-I  
(Course Contents)**

**GOVERNMENT POLYTECHNIC MUMBAI**  
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**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**(Term / Semester – I)**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
SC19107	Engineering Chemistry	3	2	--	5	5	60	20	20	25*	--	25	150
SC19109	Basic Mathematics	4	--	--	4	4	60	20	20	--	--		100
HU19101	Communication Skill	2	2	--	4	4	60	20	20	25*	--	25	150
ME19201	Engineering Drawing I	2	4	--	6	6	--	--	--	50*	--	50	100
WS19201	Workshop Practice	--	4	--	4	4	--	--	--	--	--	50	50
CE19101	Construction Materials	3	--	--	3	3	60	20	20	--	--	--	100
CE19102	Libre Office Calc on BOSS Linux (9) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>14</b>	<b>16</b>	<b>--</b>	<b>30</b>	<b>30</b>	<b>240</b>	<b>80</b>	<b>80</b>	<b>100</b>	<b>--</b>	<b>150</b>	<b>650</b>
Student Centered Activity(SCA)					<b>05</b>								
Total Contact Hours					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal assessment, #indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library -1 hour, Sports- 2hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCS/Spoken Tutorials /NPTEL/SWAYAM/FOSSEE etc.

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

In-Charge  
Curriculum Development Cell

Head of Departments  
Department of Civil Engineering

Principal

Programme : <b>Diploma in CE/ME( Sandwich Pattern)</b>										
Course Code: <b>SC19107</b>				Course Title: <b>Engineering Chemistry</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs.)	TS1 (1 Hr.)	TS2 (1Hr)	PR	OR	TW	Total
<b>3</b>	<b>2</b>	<b>--</b>	<b>5</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>25*</b>	<b>--</b>	<b>25</b>	<b>150</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

**Note:** For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term.

### Rationale:

The subject is included under category of basic sciences. The role is to understand the fundamental concepts and facts about infrastructure of physical matters and their interrelationship. This will provide input for better understanding of other foundation and technology subjects

**Course Outcomes:** Student should be able to

CO1	Apply the principles of chemistry under different engineering situations.
CO2	Apply various applications of electrolysis in engineering field.
CO3	Illustrate various methods of softening of hard water
CO4	Adopt methods of prevention of corrosion for environmental and safety concerns.
CO5	Select suitable Lubricants, material for a particular use effectively.



**Course Content Details:**

<b>Unit No</b>	<b>Topics / Sub-topics</b>
<b>1</b>	<p><b>Atomic Structure</b></p> <p>1.1 Introduction of atom, Molecules, Fundamental Particles, Proton, Neutron, Electron. their mass, charge, location. And symbol Bohr's theory, Postulates, Structure of modern atom.</p> <p>1.2 Atomic number and atomic mass number. Atomic weight Numerical based on atomic number &amp; atomic mass number</p> <p>1.3 Rules governing filling up of atomic orbitals, Quantum no. Pauli's Exclusion Principle, Aufbau's Principle, Hund's rule. Electronic configuration of atoms up to atomic number 30</p> <p>1.4 Valence and chemical bonding. Valence: Definition, &amp; examples. Types of valence :Electrovalence &amp; Co-valence</p> <p>1.5 Electrovalent bond: Definition, Formation. Formation of NaCl</p> <p>1.6 Co-valent bond : Definition &amp; formation Formation of following molecules Single bond:, Chlorine. Double bond : Oxygen,, Triple Bond : Nitrogen,,</p> <p>1.7 Distinction between electrovalent and covalent compound.</p> <p><b>Course Outcome: CO1 Teaching Hours : 8 hrs Marks: 10 (R- 2, U-4, A-4)</b></p>
<b>2</b>	<p><b>Electrochemistry</b></p> <p>2.1 Definition of Electrochemistry, Electrolytes: Definition, Types. Differences between Atom and ion. Definition of ionization &amp; electrolytic dissociation, Arrhenius theory, Degree of ionization with factors affecting it.</p> <p>2.2 Terms related to Electrolysis Mechanism of electrolysis. Examples of: mechanism of Electrolysis of <math>\text{CuSO}_4</math> by using Cu electrodes.</p> <p>2.3 Faradays First law and its mathematical derivation. Faradays second law &amp; its mathematical derivation, Numerical based on laws of Faraday.</p> <p>2.4 Application of Electrolysis: Electroplating.</p> <p><b>Course Outcome: CO2 Teaching Hours : 8 hrs Marks: 10 (R- 4 , U-4 , A-2 )</b></p>
<b>3</b>	<p><b>Water</b></p> <p>3.1 Sources of water, impurities present in water.(suspended, dissolved, colloidal, biological) Types of water: hard &amp; soft Causes of hardness of water Types of Hardness, Unit of hardness, Definition of hardness.</p> <p>3.2 Bad effects of Hard Water for Domestic purposes.&amp; Industrial purposes (Textile ,Dyeing, Sugar industry, Bakery)</p> <p>3.3 Bad effects of hard water in Boiler, Scales and Sludge's, causes of their formation, their disadvantages and their removal.</p> <p>3.4 Treatment of hard water for industrial purposes by Zeolite &amp; Ion Exchange process</p> <p>3.5 Treatment of hard water for drinking purposes.(city water supply)</p> <p><u>Various steps:</u> Screening, Sedimentation, Coagulation, Filtration, Sterilization by boiling.</p> <p>3.6 pH value: Definition, Formula, pH scale, its salient features, Numerical based on pH, Applications of pH related to Engg .field (corrosion of bridges, Electroplating,).</p>

	<p><b>Course Outcome: CO3 Teaching Hours : 8 hrs Marks: 10 (R-2 , U-4 , A-4 )</b></p>
4	<p><b>Corrosion</b></p> <p>4.1 Definition of corrosion. Types of corrosion. Atmospheric &amp; Electrochemical Corrosion.</p> <p>4.2 Mechanism of atmospheric corrosion, types of oxide films formed, (stable, unstable, volatile, with examples)</p> <p>4.3 Electrochemical corrosion/immersed corrosion Definition. Example. Factors Affecting, Atmospheric &amp; Electrochemical Corrosion.</p> <p>4.4 Protection of metals from Corrosion:- By protective coatings a) organic coating ( Paints and Varnishes), b) inorganic coating (Metallic Coating)</p> <p>4.5 Different methods of Protective metallic coatings. A) Hot dipping (Galvanizing &amp; Tinning) b) Sherardizing c) Metal Spraying</p> <p><b>Course Outcome: CO4 Teaching Hours :8 hrs Marks: 10 (R-2, U-4 , A-4 )</b></p>
5	<p><b>Lubricants</b></p> <p>.1 Definition of lubricant, example, functions of lubricant, classification of lubricants (solid, semi-solid and liquid) examples. Conditions under which each lubricant is used.</p> <p>5.2 Lubrication: definition and types conditions under which each lubricant is used. Types of lubrications, Fluid film, Boundary, Extreme pressure lubrication. Definition, diagram &amp; description of each type.</p> <p>5.3 Characteristic of good lubricant A) Physical Characteristics</p> <ul style="list-style-type: none"> <li>• Viscosity</li> <li>• Viscosity index</li> <li>• Oiliness</li> <li>• Volatility</li> <li>• Flash point &amp; Fire Point</li> <li>• Cloud and Pour point</li> </ul> <p>B) Chemical Characteristics</p> <ul style="list-style-type: none"> <li>• Acidity /Neutralization no.</li> <li>• Emulsification</li> </ul> <p>Saponification value</p> <p><b>Course Outcome: CO5 Teaching Hours : 6 Marks: 10 (R-4 , U-4 , A-2 )</b></p>
6	<p><b>Nonmetallic Engineering Material</b></p> <p>6.1 Definition of nonmetallic engineering materials</p> <p><b>6.2 Plastic :</b> definition , example Polymerization : definition ,Types of Polymerization addition and condensation Addition polymerization : definition formation of polyethylene , Condensation-polymerization : definition Formation Of nylon-66 Types of plastic: thermo softening, thermo setting plastics, Differences between them. Compounding of plastic , Materials needed for it (pigments, fillers, Plasticizers</p>

	<p>Accelerators etc.,) Properties and engineering applications of plastic.</p> <p><b>6.3 Rubber:</b>  definition of rubber (elastomer) Natural rubber : Basic unit in natural rubber(isoprene)  Occurrence &amp; Processing of Latex .Drawbacks of natural Rubber, Vulcanization Of rubber: I  Chemical reactions, ,Types of Rubber Synthetic rubber Importance ,difference , Example Bu  rubber, Thiokol, Neoprene  Properties of rubber: Elasticity, Tack, Rebound ,Abrasion resistance Applications of rubber</p> <p><b>6.4 Thermal insulating materials</b>  Definition, Examples Thermocole, Glass wool. <b>Thermocole:</b> Definition, Preparation,  Properties &amp; uses, <b>Glass wool:</b> Definition, Preparation, Properties &amp; uses</p> <p><b>Course Outcome: CO5 Teaching Hours : 7 hrs Marks: 10 (R- 2 , U- 6 , A- 2 )</b></p>
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**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Atomic Structure	02	04	04	10
2	Electrochemistry	04	04	02	10
3	Water	02	04	04	10
4	Corrosion	02	04	04	10
5	Lubricants	04	04	02	10
6	Nonmetallic Engineering Materials	02	06	02	10
<b>Total</b>		<b>16</b>	<b>26</b>	<b>18</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	CO	List of Experiments	Hours
1	1	CO1	Introduction of chemistry laboratory & safety measures.	2
2	2	CO2	Determination of conductivity of different electrolytes by using conductivity meter.	2
3	3	CO3	Estimation of Chloride content from given water sample	2
4	4	CO4	Estimation of percentage purity of iron from the given alloy sample	2
5	5	CO5	To find out acid value of given lubricant	2
6	1	CO1	Basic radicals : $\text{Cu}^{++}$ , $\text{Fe}^{++}$ , $\text{Fe}^{+++}$ , $\text{Cr}^{+++}$ , $\text{Mn}^{++}$ , $\text{Ni}^{++}$ , $\text{Zn}^{++}$ , $\text{Ca}^{++}$ , $\text{Ba}^{++}$ , $\text{Mg}^{++}$ , $\text{NH}_4^+$ Acidic Radicals: $\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ , $\text{CO}_3^-$ , $\text{SO}_4^-$ , $\text{NO}_3^-$	6
7	2	CO2	Determination of electrochemical equivalent of copper by using cu -electrodes	2
8	3	CO3	Find out the total hardness from given sample of water by EDTA method	2
9	4	CO4	To Study Corrosion of Aluminum rod in acidic and basic medium and plot a graph of rate of corrosion.	2
10	5	CO5	Determination of coefficient of viscosity of given oil ( Glycerin) by using Ostwald's Viscometer	2
11	3	CO3	To find out pH of different solutions using Lovibond comparator, pH paper, pH meter.	2
12	4	CO4	Estimation of moisture content in given coal sample	2
13	6	CO5	Preparation of phenol formaldehyde / Bakelite plastic	2
			<b>Total</b>	<b>30</b>

**Note: Experiments No. 1 to 10 are compulsory and should map all units and Cos. Remaining experiments are to be perform on the basis of availability of time.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Engineering Chemistry	M.M. Uppal, Khanna Publisher, Delhi	978-81-7409-262-5
2	Polytechnic Chemistry	V.P. Mehta, Jain Brothers, Delhi	978-81-8360-093-X
3	Applied Chemistry	P.C. Jain, Monica Jain, Dhanpat Rai and Sons , Delhi	13: 9788187433170
4	Chemistry in Engineering and technology Volume 1 and 2	J.C. Kurlacose, J. Jairam Tata Mcgraw hill.	9780074517352

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2. [www.chemistryclassroom.com](http://www.chemistryclassroom.com)
3. [www.youtube/chemistry](http://www.youtube/chemistry)
4. [www.ferrochemistry.com](http://www.ferrochemistry.com)
5. <http://hperchemistry.phastr.gsu.edu/hbase/hph.htm>
6. [www.sciencejoywagon.com/](http://www.sciencejoywagon.com/)
7. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-chemistry>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	1		1	
CO2	3	2	1	2	2	2	1			
CO3	3	2	1	1	2	2	1		1	
CO4	3	2	1	2	2	2	1		1	
CO5	3	2	1	2	2	2	1			1

**CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	2	2	1	1	1	1
CO2	3	2	1	2	2	2	1	1	1
CO3	3	2	1	1	2	2	1	1	2
CO4	3	2	1	2	2	2	1	2	2

CO5	3	2	1	2	2	2	1	2	2
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**Industry Consultation Committee:**

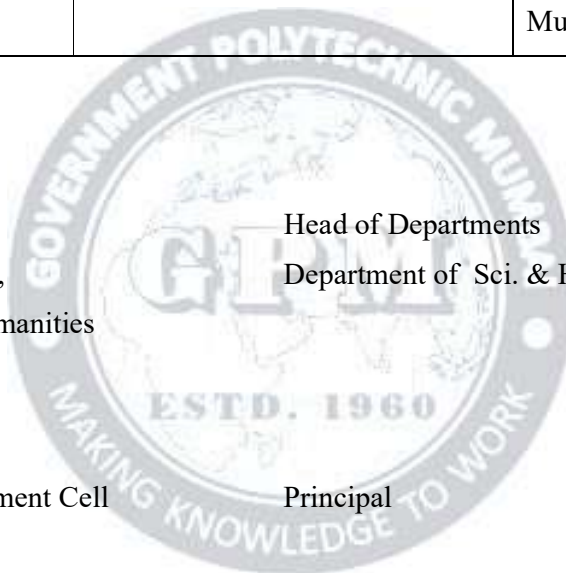
Sr. No	Name	Designation	Institute/Organisation
1	Neelamkumar R. Sawant	State Head Technical Services for (Maharashtra and Goa)	JSW Cement Ltd. Mumbai Head Office
2	Mrs Vaishali Gokhale	Lecturer in Chemistry	Government Polytechnic Pune
3	Dr. Mrs. Smita Petkar Dhopate	Lecturer in Chemistry	Government Polytechnic Nagpur
4	Mrs J. V. Iyengar	Lecturer in Chemistry	Government Polytechnic Mumbai
5	Mrs S.M. Patil	Lecturer in Chemistry	Government Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Sci. & Humanities

Head of Departments  
Department of Sci. & Humanities

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in CE/ME/IT/CO/EC/IS/EE(Sandwich Pattern)</b>										
Course Code: <b>SC19109</b>				Course Title: <b>BASIC MATHEMATICS</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs. 30 Min.)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	-	-	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	-	-	-	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

### Rationale:

This subject is kept under the branch of sciences. This subject intends to teach student basic facts ,concepts, principles, and procedure of mathematics as a tool to analyze engineering problems and as such lays down foundation for understanding the engineering and core technology subject.

**Course Outcomes:** Student should be able to

<b>CO1</b>	Identify the basic principles of mathematics about the field analysis of any engineering problem.
<b>CO2</b>	Apply rules ,concept and properties to solve the basic problems.
<b>CO3</b>	Establish relation between two variables.

## Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>1.Trigonometry:</b></p> <p>1.1 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), Sub multiple angles</p> <p>1.2 Factorization and De-factorization Formulae</p> <p>1.3 Inverse Circular function (definition and simple problems).</p> <p><b>Course Outcome: CO1 Teaching Hours : 10 hrs Marks: 10 (R- 4, U-4, A-2)</b></p>
2	<p><b>2.Vectors:</b></p> <p>2.1 Definition of vector , position vector</p> <p>2.2 Algebra of vectors(Equality, addition ,subtraction and scalar multiplication)</p> <p>2.3 Dot (Scalar) product &amp; Vector (Cross) product with properties.</p> <p><b>Course Outcome: CO3 Teaching Hours : 10 hrs Marks: 10 (R- 2 , U-4 , A-4 )</b></p>
3	<p><b>3.Logarithms:</b></p> <p>3.1 Definition of logarithm</p> <p>3.2 Laws of logarithm</p> <p>3.3 simple examples based on laws.</p> <p><b>Course Outcome: CO2 Teaching Hours : 10hrs Marks:10 (R-4 , U- 4 , A-2 )</b></p>
4	<p><b>4.Probability :</b></p> <p>4.1 Definition of random experiment , sample space, event, occurrence of event and types of event ( Impossible , mutually exclusive , exhaustive ,equally likely )</p> <p>4.2 Definition of Probability</p> <p>4.3 Addition &amp; Multiplication Theorems of probability without proof , simple examples</p> <p><b>Course Outcome: CO1 Teaching Hours :10hrs Marks:10 (R-4, U- 4 , A-2 )</b></p>
5	<p><b>5.Determinants:-</b></p> <p>5.1 Definition of Determinant</p> <p>5.2 Expansion of Determinant of order 2X3</p> <p>5.3 Crammer's rule to solve simultaneous equations in 3 unknowns</p> <p><b>Course Outcome: CO2 Teaching Hours :10 hrs Marks:10 (R- 2 , U-4 , A-4 )</b></p>
6	<p><b>6.Matrices:</b></p> <p>6.1 Definition of a matrix of order m x n</p> <p>6.2 Types of matrices</p> <p>6.3 Algebra of matrices - equality, addition,subtraction ,multiplication &amp; scalar multiplication.</p> <p>6.4 Transpose of matrix.</p> <p>6.5 Minor , co-factor of an element.</p> <p>6.6 Adjoint &amp; inverse of a matrix by adjoint method.</p> <p>6.7 Solution of a simultaneous equations by matrix inversion method.</p> <p><b>Course Outcome: CO3 Teaching Hours : 10 hrs Marks: 10 (R- 2 , U- 4 , A- 4 )</b></p>



**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	<b>Trigonometry</b>	04	04	02	10
2	<b>Vectors</b>	02	04	04	10
3	<b>Logarithms</b>	04	04	02	10
4	<b>Probability</b>	04	04	02	10
5	<b>Determinants</b>	02	04	04	10
6	<b>Matrices</b>	02	04	04	10
<b>Total</b>		<b>18</b>	<b>24</b>	<b>18</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Mathematics for Polytechnic Students	S.P.Deshpande, Pune Vidyavardhini Graha Prakashan	-
2	Mathematics for Polytechnic Students ( Volume I )	H.K.Dass, S.Chand Prakashan	9788121935241
3	Companions to Basic Maths	G.V.Kumbhojkar, Phadke Prakashan	10-B07951HJDQ 13-B07951HJDQ
4	Applied Mathematics	N.Raghvendra Bhatt late, Tata McGraw Hill Publication Shri R Mohan Singh	9789339219567, 9339219562

**E-References:**

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3. [www.mathworks.com/Products/Matlab/-MATLAB](http://www.mathworks.com/Products/Matlab/-MATLAB)
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7. [www.allmathcad.com/-Math CAD](http://www.allmathcad.com/-Math CAD)
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9. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-maths>
10. MYCBSEGUIDE

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		1
CO2	3	2					1	1		1
CO3	3			2			1	1		1

**CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			2			1	1	
CO2	3	2					1	1	
CO3	3			2			1	1	

**CO Vs PO and CO Vs PSO Mapping (COMPUTER ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		
CO2	3	2					1	1		
CO3	3			2			1	1		

**CO Vs PO and CO Vs PSO Mapping (INFORMATION TECHNOLOGY)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		1
CO2	3	2					1	1		1
CO3	3			2			1	1		1

**CO Vs PO and CO Vs PSO Mapping (ELECTRONICS ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1		1	1
CO2	3	2					1		1	1
CO3	3			2			1		1	1

**CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1		1	
CO2	3	2					1		1	
CO3	3			2			1		1	

**CO Vs PO and CO Vs PSO Mapping ( INSTRUMENTATION ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			2			1	1	1
CO2	3	2					1	1	1
CO3	3			2			1	1	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Neelamkumar R. Sawant	State Head Technical Services for (Maharashtra and Goa)	JSW Cement ltd. Mumbai Head Office
2	Mrs. Deepawali S. kaware	Lecturer in Mathematics	Government polytechnic Vikaramgad
3	Mr. A.S.Patil	Lecturer in Mathematics	Government polytechnic Mumbai
4	Mr. V.S.Patil	Lecturer in Mathematics	Government polytechnic Mumbai

Head of Department

Coordinator,  
Curriculum Development,  
Department of Science And Humanities

Department of Science And Humanities

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in CE/ME/IT/CO/IS/EE/EC/LG/LT (Sandwich Pattern)</b>										
Course Code: <b>HU19101</b>				Course Title: <b>Communication Skills</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs. 30 Min.)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>02</b>	<b>02</b>	<b>-</b>	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>25*</b>	<b>-</b>	<b>25</b>	<b>150</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

**Note:** For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term.

**Rationale:** Communication skills play a vital and decisive role in career development. In this age of globalization, competition is tough. Hence effective communication skills are important. The subject Communication Skills introduces basic concepts of communication. It also describes the verbal, non-verbal modes and techniques of oral & written communication.

In this context, it will help the engineering diploma students to select and apply the appropriate methods of communication in various situations and business communication. Students are also required basics of communication and use of different skills.

This course will guide and direct to develop a good personality and improve communication skills. It will enable the students to utilize the skills necessary to be a competent communicator.

**Course Outcomes:** Student should be able to

<b>CO1</b>	Apply proper communication technique to cope up with the challenges of the modern world.
<b>CO2</b>	Interpret feedback at various situations by using appropriate body language and avoid the barriers in effective communication.
<b>CO3</b>	Able to participate in Group Discussion and Acquire the practical knowledge of an interview.
<b>CO4</b>	Able to develop PowerPoint Presentation and Business correspondence.
<b>CO5</b>	Write letters, circulars, memos, notices, reports and communicate effectively in written communication.

**Course Content Details:**

<b>Unit No</b>	<b>Topics / Sub-topics</b>
<b>1</b>	<p><b>Introduction to Communication</b></p> <p>1.1 Elements of Communication</p> <p>1.2 Communication Cycle</p> <p>1.3 Types of communication</p> <p>1.4 Definition and Types of Barriers-</p> <p>a) Mechanical</p> <p>b) Physical</p> <p>c) Language</p> <p>d) Psychological</p> <p>1.5 How to overcome Barriers</p> <p><b>Course Outcome: CO1      Teaching Hours :6 hrs      Marks: 14 (R- 2, U-4, A-8)</b></p>
<b>2</b>	<p><b>Non- verbal Communication</b></p> <p>2.1 Meaning and Importance of Non-verbal Communication</p> <p>2.2 Body Language</p> <p>2.3 Aspects of Body Language</p> <p>2.4 Graphic language</p> <p><b>Course Outcome: CO2      Teaching Hours :6 hrs      Marks: 12 (R- 4, U-4, A-4)</b></p>
<b>3</b>	<p><b>Group Discussion And Interview Skills</b></p> <p>3.1 Need and Importance of Group Discussion</p> <p>3.2 Use of Knowledge and Logical sequence.</p> <p>3.3 Types of Interview</p> <p>3.4 Preparing for an Interview</p> <p><b>Course Outcome: CO3      Teaching Hours :6 hrs      Marks: 10 (R-2, U-4, A-4)</b></p>
<b>4</b>	<p><b>Presentation Skills</b></p> <p>4.1 Presentation Skills - Tips for effective presentation</p> <p>4.2 Guidelines for developing PowerPoint presentation</p> <p><b>Course Outcome: CO4      Teaching Hours :4 hrs      Marks: 08 (R- 2, U-2, A-4)</b></p>
<b>5</b>	<p><b>Business Correspondence</b></p> <p>5.1 Office Drafting – a) Notice b) Circular c) Memo d) Email-writing.</p> <p>5.2 Job Application with resume.</p> <p>5.3 Business Letters – a) Enquiry b) Order c) Complaint</p> <p>5.4 Report Writing – a) Fall in Production b) Accident Report</p> <p><b>Course Outcome: CO5      Teaching Hours: 8 hrs      Marks: 16 (R- 4, U-4, A-8)</b></p>

**List of experiments: Any 10 experiments out of 15**

Sr. No.	Unit No	COs	List of Experiments	Hours
1	1	CO1,CO4	Conversation between students on various situations.	02
2	3	CO2,CO4	Non- Verbal Communication.	02
3	3	CO3,CO4	Group Discussion	02
4	4	CO3,CO4	Mock Interview	02
5	5	CO4,CO5	Business Communication a) Advertisement, Tender, Diary writing. b) Job Application With Resume.	02
6	1	CO1	Communication Barriers	02
7	5	CO5	Business Letters – a) Enquiry b)Order c)Complaint	02
8	4	CO1,CO4	Speeches- a)Welcome Speech b)Farewell Speech c) Vote of Thanks	02
9	5	CO5	Report Writing – a) Fall in Production b) Accident Report	02
10	All	CO4	Showing Videos on different types of Communication.	02
11		CO1	*Articles	02
12		CO1	*Preposition and Conjunction	02
13		CO1	*Direct Indirect Speech	02
14		CO1	*Change the voice	02
15		CO1	*Vocabulary Building	02
			<b>Total</b>	<b>30</b>

**Note:** Experiments No.1 to 10 are compulsory. Remaining experiments are to be performed on availability of time.\* These experiments will be performed during practical hours only.

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Communication Skills	Joyeeta Bhattacharya - Reliable Series	9780000176981, 0000176982
2	Communication Skills	Sanjay Kumar, PushpaLata- Oxford University Press	13: 978-0199488803
3	Successful presentation Skills	Andrew Brad bury- The Sunday Times	13: 9780749456627

**E-References:**

- 1) Website: [www.mindtools.com/page8.html-99k](http://www.mindtools.com/page8.html-99k)
- 2) Website: [www.inc.com/guides/growth/23032.html-4](http://www.inc.com/guides/growth/23032.html-4)
- 3) Website: [www.khake.com/page66htm/-72k](http://www.khake.com/page66htm/-72k)
- 4) Website: [www.BMConsultant India Consultant India.Com](http://www.BMConsultantIndia.com)
- 5) <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-English>
- 6) MYCBSEGUIDE
- 7) Website: [www.letstak.co.in](http://www.letstak.co.in)
- 8) <https://learnenglishteens.britishcouncil.org/>

**CO Vs PO and CO Vs PSO Mapping (Civil Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1	2	1
CO2	3	3	2	3	2	3	2	1	2	1
CO3	3	2	2	1	2	3	2	1	2	1
CO4	3	3	2	1	2	3	2	1	2	
CO5	3	3	2	1	2	3	2	1	2	

**CO Vs PO and CO Vs PSO Mapping (Mechanical Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	2	3	2	3	2	2	1
CO2	3	3	2	3	2	3	2	2	1
CO3	3	2	2	1	2	3	2	2	1
CO4	3	3	2	1	2	3	2	2	1
CO5	3	3	2	1	2	3	2	2	1

**CO Vs PO and CO Vs PSO Mapping (Electronics Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	2	
CO2	3	3	2	3	2	3	2	1	2	1
CO3	3	2	2	1	2	3	2	1	1	1
CO4	3	3	2	1	2	3	2	1		
CO5	3	3	2	1	2	3	2	1		

**CO Vs PO and CO Vs PSO Mapping (Electrical Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1	2	3
CO2	3	3	2	3	2	3	2	2		3
CO3	3	2	2	1	2	3	2	2		3
CO4	3	3	2	1	2	3	2	1		2
CO5	3	3	2	1	2	3	2			

**CO Vs PO and CO Vs PSO Mapping (Instrumentation Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	2	3	2	3	2	1	2
CO2	3	3	2	3	2	3	2	1	2
CO3	3	2	2	1	2	3	2	1	2
CO4	3	3	2	1	2	3	2		2
CO5	3	3	2	1	2	3	2		

**CO Vs PO and CO Vs PSO Mapping (Computer Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1	2	1
CO2	3	3	2	3	2	3	2	1	2	1
CO3	3	2	2	1	2	3	2	1	2	1
CO4	3	3	2	1	2	3	2		2	
CO5	3	3	2	1	2	3	2		2	



**COVs PO and CO Vs PSO Mapping (Information Technology)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	1	1
CO2	3	3	2	3	2	3	2	2	1	1
CO3	3	2	2	1	2	3	2	1		2
CO4	3	3	2	1	2	3	2	1		
CO5	3	3	2	1	2	3	2	1		

**CO Vs PO and CO Vs PSO Mapping (LG/LT Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1		2
CO2	3	3	2	3	2	3	2	1		2
CO3	3	2	2	1	2	3	2	1	1	2
CO4	3	3	2	1	2	3	2	1		2
CO5	3	3	2	1	2	3	2	1		2

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Neelamkumar R. Sawant	State Head Technical Services for (Maharashtra and Goa)	JSW Cement Ltd. Mumbai Head Office
2	Ms Shilpa D. Khune	Corporate Consultant Trainer	Mahindra Pride Classroom
3	Mrs.S.S. Kulkarni	Lecturer in English	Government Polytechnic Pune
4	Mrs. K.S.Pawar	Lecturer in English	Government polytechnic Mumbai
5	Ms.N.N.Dhake	Lecturer in English	Government polytechnic Mumbai

Coordinator,

Head of Department

Curriculum Development,  
Department of Science And Humanities

Department of Science And Humanities

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Mechanical Engineering &amp; Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>ME19201</b>				Course Title: <b>Engineering Drawing-I</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>2</b>	<b>4</b>	<b>--</b>	<b>6</b>	<b>--</b>	<b>--</b>	<b>-</b>	<b>50*</b>	<b>--</b>	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Engineering drawing is the common graphical language of engineers, technicians and workers to express engineering ideas and concepts. Correct interpretation of engineering drawings is one of the basic duties of First Line Supervisors. Study of Engineering Drawing induces the concepts of accuracy and exactness of information necessary for the production of engineering component. It also develops judgements about distances and angles.

This basic course aims at building a foundation for the further courses in drawing and other allied subjects. This course is useful in developing imagination, drafting and sketching skills of the students.

**Course Outcomes:** Student should be able to

CO1	Draw geometric figures and engineering curves using appropriate drawing instruments
CO2	Draw views of line and plane, by applying principles of first angle method of projections
CO3	Draw orthographic views of given object by applying principles of orthographic projections
CO4	Draw isometric view from given orthographic views, by applying principles of isometric projections
CO5	Draw the free hand sketches of given engineering objects/elements

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Principles of Drawing</b></p> <p>1.1 Drawing instruments and their uses, Standard sizes of drawing sheets (ISO-A series), letters and numbers (single stroke vertical), Conventions of lines and their applications, Drawing Scales (reduced, enlarge and full size), Methods of Dimensioning: Chain, parallel and coordinate dimensioning (Refer SP-46 Code latest Edition)</p> <p>1.2 Simple Geometrical Constructions, Redrawing figures using above geometrical constructions</p>
<p><b>Course Outcome- CO1      Teaching Hours – 04      Marks –06</b></p>	

2	<p><b>Engineering Curves and Loci of Points</b></p> <p>2.1 Method to draw Ellipse by Arcs of Circle Method and Concentric Circle Method.</p> <p>2.2 Method to draw Parabola and Hyperbola by Directrix and Focus Method.</p> <p>2.3 Methods to draw Involute of circle and pentagon,</p> <p>2.4 Methods to draw Cycloid,</p> <p>2.5 Loci of Points of Single Slider Crank Mechanism with given specifications.</p> <p><b>Course Outcome- CO1 Teaching Hours – 06 Marks –06</b></p>
3	<p><b>Projection of lines and planes</b></p> <p>3.1 Concepts of Reference Planes and Projections, Views – Top, Front, Side Views</p> <p>3.2 Projections of Line inclined to one reference plane (H.P/V.P) and limited to both ends in one quadrant only.</p> <p>3.3 Projections of simple planes of circular, square rectangular, rhombus, pentagonal and hexagonal shape, inclined to one reference plane and perpendicular to other</p> <p><b>Course Outcome- CO2 Teaching Hours – 06 Marks –10</b></p>
4	<p><b>Orthographic projections</b></p> <p>4.1 Introduction to orthographic projections, Symbol of First Angle Projection, Conversion of pictorial view into orthographic views –Top, Front and End View of objects containing plain surfaces, slant surfaces, slots, ribs, cylindrical surfaces. (First Angle Projection Method Only)</p> <p>4.2. Sectional Orthographic Views and conversion of pictorial view into sectional orthographic views</p> <p>(Objects involving plain surfaces, slant surfaces, slots, ribs, cylindrical surfaces, threads etc.)</p> <p><b>Course Outcome- CO3 Teaching Hours – 06 Marks –12</b></p>
5	<p><b>Isometric projections</b></p> <p>5.1 Isometric scale, Comparison of Natural Scale with Isometric Scale</p> <p>5.2 Conversion of Orthographic Views into Isometric View/Projection</p> <p>(Objects involving plain surfaces, slant surfaces, slots, ribs, cylindrical surfaces, holes etc)</p> <p><b>Course Outcome- CO4 Teaching Hours – 06 Marks –12</b></p>
6	<p><b>Freehand sketches</b></p> <p>6.1 Drawing of proportional freehand sketches of – Different types of thread forms, nuts, bolts, screws, washers and foundation bolts (Rag and Lewis type)</p> <p>(Teacher shall also explain use/ function of all the above elements)</p> <p><b>Course Outcome- CO5 Teaching Hours – 02 Marks –04</b></p>

**List of Sheets: All sheets compulsory**

Sr. No.	Unit No	List of Experiments	CO	Hours
1	1	<b>Basics of Engineering Graphics</b> Drawing sheet containing types of lines, Lettering, Redrawing given figure, dimensioning and geometrical constructions	CO1	08
2	2	<b>Engineering curves and loci points</b> (minimum 4 problems)	CO1	08
3	3	<b>Projections of Lines and Planes</b> Three cases on lines and three cases on planes	CO2	08
4	4	<b>Orthographic projections</b> Using first angle method of projections (minimum 2 problems)	CO3	08
5	4	<b>Sectional Orthographic projections</b> Using first angle method of projection (minimum 2 problems)	CO3	08
6	5	<b>Isometric Projection-I</b> Using isometric scale (minimum 2 objects)	CO4	08
7	5	<b>Isometric Projection-II</b> To draw isometric views of objects including slots, holes and sloping faces (minimum 2 objects)	CO4	08
8	6	<b>Free hand sketches</b> To draw free hand sketches of different types of threads forms, nuts, bolts and screws, foundation bolts.	CO5	04
<b>Total</b>				<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Engineering drawing	N.D.Bhatt, Charotar Publishing House, 53 <sup>rd</sup> Edition, 2016	978-93-80358-178
2	Engineering Graphics	P.J. Shah, S. Chand, revised edition, 2014	978-81-21929-679
3	Engineering Drawing	Amar Pathak, Wiley Publication, 1 <sup>st</sup> Ed. 2010	978-93-50040-164
4	Engineering drawing	D.Jolhe, Tata McGraw Hill Education, 2017	978-00-70648-371
5	Textbook on engineering drawing	K.L.Narayan, P.Kannaiah, Scitech publications, 24 <sup>th</sup> reprint, 2010,	978-81-83714-228
6	Engineering drawing practice For school and colleges	IS Code SP-46	-

**E-References:**

1. <https://ocw.mit.edu/courses/drawing>
2. <https://nptel.in/courses/drawing>
3. <https://home.iiik.edp.ac.in>

**CO VsPO and CO Vs PSOMapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	1	1	1	1	2	1	1
CO2	2	2	2	1	1	1	2	1	1
CO3	3	2	2	2	1	2	2	1	1
CO4	3	2	2	2	2	2	2	1	1
CO5	2	1	1	1	1	1	2	1	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. U.A.Agnihotri	Sel. Grade Lecturer in Mechanical Engineering	Govt. Polytechnic, Mumbai
2	Mr. Ruhil Alwi	Sr. Executive	Coffee Day Beverages, Mumbai
3	Mr. A.S. Sangwkar	Sel. Grade Lecturer in Mechanical Engineering	Govt. Polytechnic, Thane
4	Mr. E.C. Dhembre	Lecturer in Mechanical Engineering	Govt. Polytechnic, Mumbai

Coordinator,  
Curriculum Development,  
Department of Mechanical Engineering

Head of Departments  
Department of Mechanical Engineering

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in ME/CE/IS/LG/LT/RT (Sandwich Pattern)</b>										
Course Code: <b>WS19201</b>				Course Title: <b>Workshop Practice</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 minutes)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	<b>4</b>	--	<b>4</b>	--	--	--	--	--	<b>50</b>	<b>50</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. The knowledge of basic shops like Wood working, Fitting, Welding, Plumbing and Sheet Metal shop is essential for technicians to perform their duties in industries. Irrespective of engineering stream, the use of workshop practices in day to day industrial as well domestic life helps to solve various minor but critical problems. Working in workshop develops the attitude of working in a group and the basis for safety awareness is created. This foundation course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on attitude of enquiry to know why and how for the various instructions and practices imparted to them in each hop. Furthermore the demonstration of CNC Machine will give feel of advancement in industry.

**Course Outcomes:** Student should be able to

CO1	Lay-outing of shop & Sketching of jobs, tools & equipment.
CO2	Select appropriate tools, machinery, equipment and consumables for given application.
CO3	Use & Operate hand tools, equipment and machinery in different shops.
CO4	Prepare the simple jobs as per specification & drawing.
CO5	Maintain workshop related tools, equipment and machineries.

### Course Content Details:

Unit No	Topics / Sub-topics
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1	<p><b>1.1 Introduction to workshop:-</b></p> <p><b>1.2</b> Workshop layout, Importance of various sections/shop of workshop, Types of jobs done in each shop.</p> <p><b>1.3</b> Causes of accidents, general safety rules and work procedure in workshop, Safety signs and symbols, First Aid.</p> <p><b>1.4</b> Fire, Causes of Fire, Basic ways of extinguishing the fire. Classification of fire, Firefighting equipment, fire Extinguishers and their types.</p> <p><b>1.5</b> Issue and return system of tools, equipment and consumables.</p> <p><b>Course Outcome: CO1,CO2 Teaching Hours : 06Marks: 05 (R-NA, U- NA , A-NA)</b></p>
2	<p><b>Smithy and Forging:-</b></p> <p><b>2.1</b> Sketching, understanding the specifications, materials, various applications and methods used in Smithy and Forging shop along with use of tools like anvil, hammers, Swage block, tongs, chisels, flatters etc;</p> <p><b>2.2</b> Demonstration of Smithy and Forging operations like bending, setting down, bulging, Upsetting etc;</p> <p><b>2.3</b> Preparation of smithy &amp; forging, job.</p> <p><b>2.4</b> Safety precautions &amp; Personal Protective Equipments.</p> <p><b>Course Outcome: CO2,CO3,CO4Teaching Hours :10 Marks: 08(R-NA, U- NA ,A-NA)</b></p>
3	<p><b>Carpentry Section :-</b></p> <p><b>3.1</b> Types of wood and their applications.</p> <p><b>3.2</b> Types of carpentry hardware's and their uses.</p> <p><b>3.3</b> Sketching, understanding the specifications, materials, various applications and Methods used in Carpentry shop along with use of tools like saws, planner, chisels, Hammers, mallet, marking gauge, Vice, try square, rule, etc;</p> <p><b>3.4</b> Demonstration of carpentry operations such as marking, sawing, planning, chiseling, Grooving, boring, joining, etc;</p> <p><b>3.5</b> Preparation of wooden joints.</p> <p><b>3.6</b> Safety precautions &amp; Personal Protective Equipments.</p> <p><b>Course Outcome:CO2,CO3,CO4 Teaching Hours : 10 Marks: 08(R-NA ,U- NA, A-NA )</b></p>
4	<p><b>Welding Section :-</b></p> <p><b>4.1</b> Types, sketching, understanding the specifications, materials and applications of arc &amp; Gas welding Accessories and consumables.</p> <p><b>4.2</b> Demonstration of metal joining operations like arc welding, soldering and brazing. Show effect of Current and speed. Also demonstrate various welding positions.</p> <p><b>4.3</b> Demonstrate gas cutting operation.</p> <p><b>4.4</b> Preparation of metal joints.</p> <p><b>4.5</b> Safety precautions &amp; Personal Protective Equipments.</p> <p><b>Course Outcome:CO2,CO3,CO4 Teaching Hours : 10Marks: 08(R-NA, U- NA, A-NA )</b></p>



	<p><b>Fitting Section:-</b></p> <p><b>5.1</b> Sketching, understanding the specifications, materials, various applications and methods used in fitting, Marking, measuring, work holding, cutting &amp; finishing tools.</p> <p><b>5.2</b> Demonstration of various fitting operations such as chipping, filing, scraping, grinding, Sawing, marking, Drilling ,tapping, etc;</p> <p><b>5.3</b> Preparation of male, female joint.</p> <p><b>5.4</b> Safety precautions &amp; Personal Protective Equipments</p> <p><b>Course Outcome:CO2,CO3,CO4Teaching Hours :12 Marks:10(R-N , U- NA, A-NA )</b></p>
6	<p>Types, specification, material and applications of pipes.</p> <p><b>6.2</b> Types, specification, material, applications and demonstration of pipe fitting tools.</p> <p><b>6.3</b> Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, Dismantling etc;</p> <p><b>6.4</b> Types and application of various spanners such as flat, fix, ring, bo, adjustable,etc.</p> <p><b>6.5</b> Preparation of pipe fitting jobs.</p> <p><b>6.6</b> Concept and conversions of SWG and other gauges in use. Use of wire gauge.</p> <p><b>6.7</b> Safety precautions &amp; Personal Protective Equipments</p> <p><b>Course Outcome:CO2,CO3,CO4Teaching Hours : 06 Marks: 06(R-NA,U- NA,A-NA )</b></p>
7	<p><b>Lathe and CNC Operations :-</b></p> <p><b>7.1</b> Working principle of lathe along with sketch and procedure for its general mainte.</p> <p><b>7.2</b> Demonstration of Lathe machine operation like plain turning, taper turning, threading, Chamfering, etc.</p> <p><b>7.3</b> Simple job demonstration for a group on CNC Machine.</p> <p><b>Course Outcome:CO5Teaching Hours : 06 Marks: 05 (R-NA , U- NA , A-NA )</b></p>

**List of experiments:**

Sr. No.	Unit No	List of Experiments	CO	Hours
1	1	Causes of accidents, general safety rules and work procedure in workshop, Safety signs and symbols, First Aid. Perform mock drill session in group of minimum 10 students for Extinguishing fire.	CO1	06
2	2	Prepare job involving operations like bending, setting down, bulging, upsetting etc; e.g. Pegs ( Square/round), Hook, Hammer tongue, Agro equipment etc. ( Individually )	CO2	10
3	3	Prepare two wooden joints as per given drawings. ( Individually)	CO2,CO3, CO4	10
4	4	Prepare lap joint/butt joint using either arc / gas welding as per given drawing.( Individually )	CO2,CO3, CO4	10
5	5	Prepare one Male- Female type fitting job as per given drawing. ( Individually )	CO2,CO3, CO4	12
6	6	Prepare two pipe joints as per given drawings. ( Individually )	CO2,CO3, CO4	06

7	7	Demonstration of Lathe machine & CNC machine operations.	CO5	06
<b>Total</b>				<b>60</b>

**SUGGESTED STUDENT ACTIVITIES :-**List of proposed student activities like.

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Function as a team member.
- d. Maintain tools and equipment.
- e. Follow ethics & maintain discipline.
- f. Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be Performed, required raw materials, tools, equipment, date of performance with signature of the teacher.
- g. Prepare journals consisting of free hand sketches of tools and equipment in each shop, detail specifications and Precautions to be observed while using tools and equipment.
- h. Prepare / Download specifications of following; i) various tools and equipment in various shop. ii) Precision Equipment in workshop iii) Various machineries in workshop.
- I. Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
- J. Visit any fabrication / wood working / sheet metal / forging workshop and prepare a report.

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Workshop Technology - 1	Hazra and Chaudhary Media promoters & Publisher private limited.	ISBN: 9788185099149
2	Workshop Technology - 1	W.A.J.Chapmam Taylor & francis.	SBN: 9780713132724
3	Workshop Practice Manual for Engineering Diploma & ITI Students	Hegde.R .K Sapna Book House, 2012,	ISBN: 13 : 9798128005830
4	Workshop familiarization.	E. Wilkinson Pitman engineering craft series.	ISBN: 0273316729
5	Mechanical workshop practice.	K.C.John PHI.	ISBN 10: 8120337212
6	Workshop practice manual	K. Venkata Reddy B. S. Publications.	ISBN-10: 8178001497
7	A Course in Workshop Technology	Raghuwanshi, B.S DhanpatRai sons, New Delhi	ISBN: 10 - 0000017108

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## CO VsPO and CO Vs PSOMapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	1	2	1	2	2	1	2	2
CO2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	3	3	3	2	2
CO5	2	2	2	2	2	2	2	2	2

## Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	S. V. Joshi	Lecturer	G. P. Mumbai
2	N. M. Ambadekar	Workshop Superintendent,	G. P. Thane
3	D. B. Jadhav	Senior Manager	Auto. Division, Mahindra and Mahindra Ltd., Kandivali

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Departments  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19101</b>				Course Title: <b>Construction Materials</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	--	--	<b>03</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Construction material is the key element in the construction project. A diploma engineer has to constantly deal with selection of materials for various engineering projects of constructions such as residential or commercial buildings, roads, metro, railways, bridges, dams, tunnels and fly-over. Modern techniques are developed to handle and use materials for economic and safer designs of engineering structures. At diploma level, students are expected to study about these aspects so as to develop their understanding, performance oriented abilities in order to apply their knowledge in construction industry.

**Course Outcomes:** Student should be able to

CO1	Identify relevant construction materials.
CO2	Identify relevant natural and artificial construction materials.
CO3	Select relevant special type construction materials.
CO4	Select relevant finishing materials for construction.
CO5	Identify relevant processed construction materials.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Introduction :</b></p> <p>1.1 Scope of construction materials in Construction Technology, Transportation Engineering, Environmental Engineering, Irrigation Engineering. (Applications only)</p> <p>1.2 Selection of materials for different civil engineering structures on the basis of strength, durability, ecofriendly and economy.</p> <p>1.3 Broad classification of materials – Sources, Natural, Artificial – special, finishing and recycled.</p> <p><b>Course Outcome: CO1 Teaching Hours : 4 hrs Marks: 08 (R-4, U-4, A-0)</b></p>

2	<p><b>Natural Construction Materials:</b></p> <p>2.1 Stone : Requirements of good building stone, characteristics, tools for stone</p> <p>2.2 Timber : Structure, properties, seasoning, preservation, defects</p> <p>2.3 Asphalt, bitumen and tar : properties, uses</p> <p>2.4 Lime : types, uses</p> <p>2.5 Soil : types, suitability in construction</p> <p>2.6 Sand : properties, uses</p> <p>2.7 Course aggregate : classification according to size , uses</p> <p><b>Course Outcome: CO2 Teaching Hours : 12 hrs Marks: 14 (R-6, U-6, A-2)</b></p>
3	<p><b>Construction of Road Paveme Artificial Construction Materials :</b></p> <p>3.1Brick: Conventional/Traditional bricks, modular and standard bricks, characteristics, classification, field tests on bricks.</p> <p>3.2 Flooring tiles : types, uses</p> <p>3.3 Cement : types, uses</p> <p>3.4 Pavement blocks, pre-cast concrete block</p> <p>3.5 Glass : soda lime glass, lead glass and borosilicate glass and their uses</p> <p>3.6 Plywood, particle board, veneers, laminated board and their uses</p> <p>3.7 Ferrous and non-ferrous metals and their uses</p> <p><b>Course Outcome:CO2 Teaching Hours : 14 hrs Marks:14 (R-6, U-6, A-2)</b></p>
4	<p><b>Special Construction Materials:</b></p> <p>4.1 Waterproofing materials, Termite proofing materials, Thermal &amp; Sound insulating materials : types, suitability in construction</p> <p>4.2 Fibers : types – jute, glass, plastic asbestos fibers – uses</p> <p>4.3 Geopolymer cement : properties, applications</p> <p><b>Course Outcome:CO3 Teaching Hours : 6 hrs Marks:08 (R-4, U-4, A-0)</b></p>
5	<p><b>Finishing Materials :</b></p> <p>5.1 Plastering materials : lime mortar, cement mortar – uses</p> <p>5.2 Plaster of Paris (POP) : constituents, uses</p> <p>5.3 Paints : oil paints, distempers, varnishes- uses</p> <p><b>Course Outcome:CO4 Teaching Hours : 6 hrs Marks:08 (R-4, U-4, A-0)</b></p>
6	<p><b>Processed Construction Materials :</b></p> <p>6.1 Industrial waste materials : fly ash, blast furnace slag, granite, marble polishing waste – uses</p> <p>6.2 Agro waste materials : Rice husk, bagasse, coir fibres – uses</p> <p>6.3 Special processes construction materials : Geosynthetic, ferrocrete, artificial timber, artificial sand – uses</p> <p><b>Course Outcome:CO5 Teaching Hours : 6 hrs Marks: 08 (R-2, U-2, A-4)</b></p>

### Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction	4	4	--	08
2	Natural Construction Materials	6	6	2	14

3	Artificial Construction Materials	6	6	2	14
4	Special Construction Materials	4	4	--	08
5	Finishing Materials for Construction	4	4	--	08
6	Processed Construction Materials	2	2	4	08
<b>Total</b>		<b>26</b>	<b>26</b>	<b>08</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Construction Materials	Ghose D.N., Tata MacGraw Hill, New Delhi	ISBN : 0074516477
2	Building Materials	Varghese P.C., PHI Learning, New Delhi	ISBN-10: 9788120350915
3	Engineering Materials	Rangwala S.C., Charator Publisher, Ahemadabad	ISBN : 978-93-85039-17-1
4	Civil Engineering Materials	Somayaji, Shah, Pearson education, New Delhi	ISBN 10: 0131776436

**E-References:**

- 1) <https://www.engineeringcivil.com>
- 2) [www.youtube.com/](http://www.youtube.com/)
- 3) <http://civildigital.com>
- 4) <http://www.quora.com>
- 5) <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	--	1	3	--	2	--	3	--
CO2	3	3	--	1	3	--	2	--	3	--
CO3	3	2	--	1	3	--	2	--	3	--
CO4	3	2	--	1	3	--	2	--	3	--
CO5	3	3	--	1	3	--	2	--	3	--

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm

3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engg.

Head of Department  
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal



## **CE 19102 Libre Office Calc**

### **1. Introduction to Libre Office Calc (Foss: LibreOffice Calc on BOSS Linux – English)**

**Outline:** Introduction to LibreOffice Calc What is Calc, Who should use Calc, What can be done using Calc. About spreadsheets, sheets and cells. Basic features – parts of main Ca.

### **2. Working with Cells**

**Outline:** Working with Cells How to enter numbers, text, numbers as text, date and time in Calc. How to Navigate between cells and in between sheets. How to select items in row.

### **3. Working with Sheets**

**Outline:** Working with Sheets Inserting and Deleting rows and columns Calc. Inserting and Deleting Sheets in Calc. Renaming Sheets

### **4. Formatting Data**

**Outline:** Formatting Data Borders, Color, Formatting Text, Increasing Cell Size Formatting multiple lines of text, numbers, fonts, cell borders, cell background Automatic Wrappi.

### **5. Basic Data Manipulation**

**Outline:** Basic Data Manipulation Paste and paste special (values, transpose), pasting a spread sheet into writer as a table Introduction to Formulas – Sum, Average, basic formula.

### **6. Working with Data**

**Outline:** Working with data Speed up using Fill tools and Selection lists. Sharing content between sheets Remove data, Replace data, Change part of a data.

### **7. Using Charts & Graphs**

**Outline:** Using Charts and graphs in Calc Creating, Editing and Formatting Charts Types of charts Resizing and moving of charts

### **8. Formulas & Functions**

**Outline:** Formulas and Functions Creating formulas, operator types and referencing Basic arithmetic and statistic functions - relative and fixed (\$) referencing in a function .

### **9. Linking Calc Data**

**Outline:** Linking Calc Data Referencing other sheets and documents Working with Hyperlinks





**Government Polytechnic, Mumbai**

*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

**Semester-II  
(Course Contents)**

**GOVERNMENT POLYTECHNIC MUMBAI**  
(Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - II**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
SC19102	Engineering Physics	3	2	--	5	5	60	20	20	25*	--	25	150
SC19110	Engineering Mathematics	4	--	--	4	4	60	20	20	--	--		100
CE19201	Building Drawing	1	4	--	5	5	--	--	--	50*	--	50	100
CE19202	Surveying I	3	4	--	7	7	60	20	20	50*	--	50	200
AM19201	Engineering Mechanics	3	2	--	5	5	60	20	20	25	--	25	150
CE19203	Libre Office Draw (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>14</b>	<b>16</b>	<b>--</b>	<b>30</b>	<b>30</b>	<b>240</b>	<b>80</b>	<b>80</b>	<b>150</b>	<b>--</b>	<b>150</b>	<b>700</b>
Student Centered Activity(SCA)					<b>05</b>								
Total Contact Hours					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCs / Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,  
Curriculum Development,  
Dept. of Civil Engineering

Head of Department  
Dept. of Civil Engineering

In-Charge  
Curriculum Development Cell

Principal

Programme : <b>Diploma in CE/ ME (Sandwich pattern)</b>										
Course Code: SC19102				Course Title: <b>Engineering Physics</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs.30 minutes)	TS1 (1 Hr.)	TS2 (1Hr.)	PR	OR	TW	Total
<b>3</b>	<b>2</b>	<b>--</b>	<b>5</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>25*</b>	<b>--</b>	<b>25</b>	<b>150</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

### Rationale:

The subject is included under the category of science. The special feature of the subject is to develop the laboratory skill using principles of scientific phenomenon. This course will serve to satisfy the need of the technical students for their development in technical field. The course is designed by selecting the topics which will develop intellectual skills of the students and will guide students to solve broad based engineering problems. Ultimately the focus of the course is to develop psychomotor skills in the Students.

**Course Outcomes:** Student should be able to

CO1	State the different physical quantities identify the proper unit of it and to estimate in the measurement of physical quantities.
CO2	Apply laws of motion in various engineering applications
CO3	Identify the properties of solid , liquid such as elasticity, liquid friction ,viscosity and surface tension
CO4	Analyze types of waves and acoustics of good building.
CO5	Create awareness about the properties and application of light, LASER in engineering field.

**Course Content Details:**

<b>Unit No</b>	<b>Topics / Sub-topics</b>
<b>1</b>	<p><b>Units and Measurements</b></p> <p>1.1 Fundamental Physical quantities, examples.            1.2 Derived physical quantities, examples.            1.3 Definition and requirements of unit            1.4 System of units, C. G. S., M. K. S. and S. I. units.            1.5 Rules to write the unit and conventions of units and Significant figures, rules to write significant figures.            1.6 Error – Definition, types of errors and estimation of errors            1.7 Numerical</p> <p><b>Course Outcome: CO1 Teaching Hours : 8 hrs. Marks: 6 (R- 2, U-2, A-2)</b></p>
<b>2</b>	<p><b>Motions</b></p> <p><b>2.1 Linear motion</b> –Definition – distance, displacement, velocity, equation of motions, acceleration due to gravity and under gravity, numerical  <b>2.2</b> Periodic motions : a)Oscillatory motion, b)Vibratory motion, c) S.H.M            d) Circular motion. (only definition and examples),  <b>2.3 Angular motion:</b> a) Definition: Time period, frequency, amplitude, wavelength, and phase. Uniform circular motion, Radius vector, linear velocity, Angular velocity , Angular acceleration,Numerical.            b) Relation between linear velocity and angular Velocity (derivation), Radial or centripetal acceleration, Three equations of motion (no derivations) Centripetal and Centrifugal force, examples and applications.  <b>2.4 Kinetics</b>            2.4.1 Definition Kinetics , momentum, impulse, impulsive force            2.4.2 Newton’s laws of motion with equation            2.4.3 Application of Newton’s laws of motion            2.4.4 Definition and unit - work power energy            2.4.5 Work energy principle            2.4.6 Numerical.</p> <p><b>Course Outcome: CO2 Teaching Hours :10 hrs. Marks: 10 (R- 2 , U-4 , A-4 )</b></p>
<b>3</b>	<p><b>General Properties of Matter</b></p> <p><b>3.1 Elasticity:</b>            3.1.1 Deforming force, restoring force, Elastic, plastic and rigid substances, and their examples.            3.1.2 Definition of elasticity, stress, strain and its types.            3.1.3 Hooke’s Law and elastic limit.            3.1.4 Stress - Strain curve, yield point, breaking point.            3.1.5 Young’s Modulus, Bulk modulus and Modulus of rigidity</p>

	<p>Definition and relation among them.</p> <p>3.1.6 Factor of safety.</p> <p>3.1.7 Applications of elasticity</p> <p>3.1.8 Numerical.</p> <p><b>3.2 Liquid Friction</b></p> <p>3.2.1 Friction liquid, pressure</p> <p>3.2.2 pressure height relation</p> <p>3.3.3 Pascal's law, Archimedes' Principle and application of it.</p> <p><b>3.3 Viscosity</b></p> <p>3.3.1 Concept and Definition of viscosity, velocity gradient.</p> <p>3.3.2 Newton's law of viscosity, Co-efficient of viscosity, unit of viscosity</p> <p>3.3.3 Stokes' law, terminal velocity, derivation of Stokes' formula.</p> <p>3.3.4 Streamline flow, turbulent flow, critical velocity, examples.</p> <p>3.3.5 Reynolds' number and its significance.</p> <p>3.3.6 Applications of viscosity.</p> <p>3.3.7 Numerical.</p> <p><b>3.4 Surface Tension :</b></p> <p>3.4.1 Concept of surface tension.</p> <p>3.4.2 Adhesive and cohesive forces, examples.</p> <p>3.4.3 Laplace's Molecular theory of surface tension</p> <p>3.4.4 Angle of contact, its significance.</p> <p>3.4.5 Expression for surface tension by capillary rise method.</p> <p>3.4.6 Effect of impurity and temperature.</p> <p>3.4.7 Applications of surface tension.</p> <p>3.4.8 Numerical.</p> <p><b>Course Outcome: CO3 Teaching Hours: 12 hrs. Marks: 18 (R- 4 , U- 6 , A- 8 )</b></p>
4	<p><b>Sound and Acoustic</b></p> <p><b>4.1 Sound Waves :</b></p> <p>4.1.1 Wave motion, types of waves – progressive, longitudinal and transverse waves.</p> <p>4.1.2 Characteristics of longitudinal and transverse waves and comparison.</p> <p>4.1.3 Free or natural vibrations and forced vibrations, resonance – definition and examples.</p> <p>4.1.4 Determination of velocity of sound by resonance method.</p> <p><b>4.1.5 Numerical.</b></p> <p><b>4.2 Acoustics :</b></p> <p>4.2.1 Definition of echo, reverberation , reverberation time and acoustic</p> <p>4.2.2 Sabine's formula for reverberation time (no derivation)</p> <p>4.2.3 Factors affecting acoustics of sound.</p> <p>4.2.4 Acoustical planning of building.</p> <p>4.2.5 Numerical.</p> <p><b>Course Outcome: CO4 Teaching Hours: 8 hrs. Marks: 10 (R- 2 , U- 4 , A- 4 )</b></p>

<b>5</b>	<p><b>Optics and Optical Fiber</b></p> <p><b>5.1 Optics :</b></p> <p>5.1.1 Revision of reflection and refraction of light.</p> <p>5.1.2 Laws of refraction, Snell's law.</p> <p>5.1.3 Determination of refractive index.</p> <p>5.1.4 Dispersion, dispersive power, Prism formula ( derivation)</p> <p>5.1.5 Critical angle, Total internal reflection. Examples and applications.</p> <p>5.1.6 Numerical.</p> <p><b>5.2 Optical Fiber :</b></p> <p>5.2.1 Principle of propagation of light through optical fiber.</p> <p>5.2.2 Structure of optical fiber.</p> <p>5.2.3 Applications.</p> <p>5.2.4 Difference between optical fiber cable and electric cable wire</p> <p><b>Course Outcome: CO5 Teaching Hours : 4 hrs. Marks: 10 (R- 2 , U- 4 , A- 4 )</b></p>
<b>6</b>	<p><b>LASER</b></p> <p>6.1 LASER introduction,</p> <p>6.2 Properties of laser,</p> <p>6.3 Spontaneous and stimulated emission,</p> <p>6.4 Population inversion, Optical pumping,</p> <p>6.5 Applications of LASER.</p> <p><b>Course Outcome: CO5 Teaching Hours : 3 hrs. Marks: 6 (R- 2 , U- 2 , A-2 )</b></p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	<b>Units and Measurements</b>	2	2	2	6
2	<b>Motion</b>	2	4	4	10
3	<b>General properties of matter</b>	4	6	8	18
4	<b>Sound and Acoustic</b>	2	4	4	10
5	<b>Optics and Optical fiber</b>	2	4	4	10
6	<b>LASER</b>	2	2	2	6
<b>Total</b>		<b>14</b>	<b>22</b>	<b>24</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	CO	List of Experiments	Hours
1	1	CO 1	To know your Physics laboratory and use of scientific calculator.	2
2	1	CO 1	To measure the dimensions of given objects and to determine their Volume using Vernier caliper.	2
3	2	CO 2	To determine Acceleration due to gravity by simple pendulum	2
4	3	CO 3	To determine coefficient of viscosity of liquid by Stokes' method	2
3	3	CO 3	To determine the surface tension of liquid using capillary rise method.	2
6	4	CO 4	To determine velocity of sound by resonance method.	2
7	5	CO 5	To determine refractive index by using pin method	2
8	1	CO 1	To measure the dimensions of given objects and to determine their Volume using micrometer screw gauge.	2
9	2	CO 2	To determine stiffness constant by using helical spring	2
10	3	CO 3	To determine the Young's modulus of elasticity of wire using Young's apparatus	2
11	3	CO 3	To verify the relation between radius of capillary tube and height of liquid in a capillary tube.	2
12	4	CO 4	To determine velocity of sound by using sonometer.	2
13	6	CO 5	Experiment on LASER	2
14	5	CO 5	To demonstrate spectrometer	2
15	ALL	CO 1	Showing Video on different applications related to units,	2
<b>Total</b>				<b>30</b>

**Note: Experiments No. 1 to 10 are compulsory and should map all units and Cos. Remaining 5 experiments are to be performing on the importance of topic.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Applied Physics	Manikpure & Deshpande ,S.Chand & Company	10:8121919541 13:9788121919548
2	Applied Physics	B.G.Bhandarkar, Vrinda Publication	0071779795
3	Optics & Optical Fibers	Brijlal Subhramanyan	978-3-662-52764-1
4	Engineering Physics	Gaur and S.L.Gupta S.Chand & Company	0-07-058502
5	Physics	Resnick and Halliday Tata McGraw Hills	978-0-07-1755487- 3
6	Physics part I & II	H.C .Varma	9788177091878
7	Properties of Matter	D.S .Mathur	13: 978- 8121908153

**E-References:**

1. [www.physics.org](http://www.physics.org)
2. [www.physicsclassroom.com](http://www.physicsclassroom.com)
3. [www.youtube.com/physics](http://www.youtube.com/physics)
4. [www.ferrophysics.com](http://www.ferrophysics.com)
5. <http://hperphysics.phastr.gsu.edu/hbase/hph.htm>
6. [www.sciencejoywagon.com/physicszone](http://www.sciencejoywagon.com/physicszone)
7. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-physics>
8. MYCBSEGUIDE
9. <https://ndl.iitkgp.ac.in/>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	1	1	2	1	
CO2	3	--	1	---	1	1	1	2	1	1
CO3	3	1	1	---	1	1	1	1	1	
CO4	3	1	1	2	1	1	1	2	1	1



**CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	1	2	---
CO2	3	1	1	---	1	1	1	1	1
CO3	3	1	1	---	1	1	1	2	1
CO4	3	---	1	2	1	1	1	2	---

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/organization
1	Mr. Rajesh Masane	Sr. Engineer	L and T Mumbai
2	Mrs B.J. Choudhary	Lecturer in Physics	Govt. Polytechnic Thane
3	Mrs S.A. Thorat	Lecturer in Physics	Govt. Polytechnic Mumbai
4	Dr. D.S. Nikam	Lecturer in Physics	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Sci. & Humanities

Head of Departments  
Department of Sci. & Humanities

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in CE/ME/CO/IF/EC/EE/IS(Sandwich Pattern)</b>										
Course Code: <b>SC19110</b>				Course Title: <b>ENGINEERING MATHEMATICS</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Min.)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>4</b>	--	--	<b>4</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

#### Rationale:

This subject is kept under the branch of sciences. This subject intends to teach student basic facts ,concepts, principles, and procedure of mathematics as a tool to analyze engineering problems and as such lays down foundation for understanding the engineering and core technology subject.

**Course Outcomes:** Student should be able to

CO1	Define the basic principles of function, limits, derivatives, complex number and relations between two variables.
CO2	Apply rules, concept and properties to solve the problems
CO3	Solve the given problems of integration using suitable method.

**Course Content Details:**

Unit No	Topics / Sub-topics
1	<p><b>1. Function</b></p> <p>1.1 Definition of variable, constant, intervals such as open, closed, semi-open etc</p> <p>1.2 Definition of function, value of function and types of functions and simple examples</p> <p><b>Course Outcome: CO1 Teaching Hours : 10 hrs Marks: 10 (R- 4, U-4, A-2)</b></p>
2	<p><b>2. Limits</b></p> <p>2.1 Definition of neighbourhood, concept and definition of limit</p> <p>2.2 Limits of Algebraic function</p> <p>2.3 Limits of Trigonometric Functions with simple examples</p> <p><b>Course Outcome: CO1 Teaching Hours : 10 hrs Marks: 10 (R- 2, U-4, A-4)</b></p>
3	<p><b>3. Derivatives &amp; Application of derivative</b></p> <p>3.1 Definition of the derivative.</p> <p>3.2 Derivatives of standard function. (No proof by first principle)</p> <p>3.3 Differentiation of sum, difference, product and quotient of two or more functions</p> <p>3.4 Differentiation of composite function with simple example.</p> <p>3.5 Second order derivative.</p> <p>3.6 Geometrical Meaning of Derivative</p> <p>3.7 Tangents &amp; Normals to the curve,</p> <p>3.8 Maxima &amp; minima of the function</p> <p>3.9 Radius of curvature</p> <p><b>Course Outcome: CO2 Teaching Hours : 10 hrs Marks: 10 (R-4, U-4, A-2)</b></p>
4	<p><b>4. Integration &amp; Application of integration</b></p> <p>4.1 Definition of integration as antiderivative, Integration of standard function</p> <p>4.2 Rules of integration (Integration of sum, difference, scalar multiplication) without proof</p> <p>4.3 Integration by substitution</p> <p>4.4 Integration of composite function</p> <p>4.5 Definition of definite integral</p> <p>4.6 Properties of definite integral with simple problems</p> <p>4.7 Area under the curve</p> <p>4.8 Area bounded by two curves</p> <p><b>Course Outcome: CO3 Teaching Hours : 10 hrs Marks: 10 (R-4, U-4, A-2)</b></p>
5	<p><b>5. Complex Number:-</b></p> <p>5.1 Definition of complex number Cartesian, Polar, Exponential form of complex number</p> <p>5.2 Algebra of complex number :- Equality, addition, Subtraction, Multiplication &amp; Division with simple examples</p> <p><b>Course Outcome: CO2 Teaching Hours : 10 hrs Marks: 10 (R- 2, U-4, A-4)</b></p>
6	<p><b>6. Numerical Analysis</b></p> <p>6.1 Solution of Algebraic equations using –</p> <p>i) Bisectional method ii) Regular – Falsi method, iii) Newton- Raphson method</p> <p>6.2 Solution of simultaneous equation</p> <p>(i) Gauss elimination method</p> <p>(ii) Jacobi's method (iii) Gauss-Seidal method</p> <p><b>Course Outcome: CO2 Teaching Hours : 10 hrs Marks: 10 (R- 2, U-4, A-4)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	<b>Function</b>	04	04	02	10
2	<b>Limits</b>	02	04	04	10
3	<b>Derivatives &amp; Application of Derivatives</b>	04	04	02	10
4	<b>Integration &amp; Application of Integration</b>	04	04	02	10
5	<b>Complex Number</b>	02	04	04	10
6	<b>Numerical Analysis</b>	02	04	04	10
<b>Total</b>		<b>18</b>	<b>24</b>	<b>18</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Mathematics for Polytechnic Students	S.P.Deshpande, Pune Vidyavardhini Graha Prakashan	-
2	Mathematics for Polytechnic Students ( Volume I )	H.K.Dass, S.Chand Prakashan	9788121935241
3	Companions to Basic Maths	G.V.Kumbhojkar, Phadke Prakashan	10-B07951HJDQ 13-B07951HJDQ
4	Applied Mathematics	N.Raghvendra Bhatt late, Tata McGraw Hill Publication Shri R Mohan Singh	9789339219567, 9339219562

**E-References:**

1. [www.math-magic.com](http://www.math-magic.com)
2. [www.Scilab.org/-SCI](http://www.Scilab.org/-SCI) Lab
3. [www.mathworks.com/Products/Matlab/-MATLAB](http://www.mathworks.com/Products/Matlab/-MATLAB)
4. [www.wolfram.com/mathematica/-Mathematica](http://www.wolfram.com/mathematica/-Mathematica)
5. <https://www.khanaacademy.org/math?gclid=CNqHuabCys4CFdoJaAoddHoPig>
6. [www.dplot.com/-Dplot](http://www.dplot.com/-Dplot)
7. [www.allmathcad.com/-Math CAD](http://www.allmathcad.com/-Math CAD)
8. [www.easycalculation.com](http://www.easycalculation.com)
9. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-maths>
10. MYCBSEGUIDE

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	1		1
CO2	3			1			1	1		1
CO3	3			1			1	1		1

**CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			1			1	1	
CO2	3			1			1	1	
CO3	3			1			1	1	

**CO Vs PO and CO Vs PSO Mapping (COMPUTER ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	1	1	
CO2	3			1			1	1	1	
CO3	3			1			1	1	1	

**CO Vs PO and CO Vs PSO Mapping (INFORMATION TECHNOLOGY)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	1		1
CO2	3			1			1	1		1
CO3	3			1			1	1		1

**CO Vs PO and CO Vs PSO Mapping (ELCTRONICS ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1		1	1
CO2	3			1			1		1	1
CO3	3			1			1		1	1

**CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1		1	
CO2	3			1			1		1	
CO3	3			1			1		1	

**CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			1			1	1	1
CO2	3			1			1	1	1
CO3	3			1			1	1	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Neelamkumar R. Sawant	State Head Technical Services for (Maharashtra and Goa)	JSW Cement Ltd. Mumbai Head Office
2	Mrs. Deepawali S. kaware	Lecturer in Mathematics	Government polytechnic Vikaramgad
3	Mr. A.S.Patil	Lecturer in Mathematics	Government polytechnic Mumbai
4	Mr. V.S.Patil	Lecturer in Mathematics	Government polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Sci. & Humanities

Head of Departments  
Department of Science & Humanities

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19201</b>				Course Title: <b>BUILDING DRAWING</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>1</b>	<b>4</b>	<b>--</b>	<b>5</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>50*</b>	<b>--</b>	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Drawing is a universal language of Engineers. It is the language through which Engineers can communicate with skilled, semiskilled and unskilled labours. The students have to use this subject to develop ability to read, understand and prepare drawings, to use it for different subjects during diploma course. Student will be taught to draw building structures and its various parts using conventions and symbols as per IS 962. Civil Engineer has to convert design parameters, process details into pictorial views. Therefore it is required to understand and prepare the drawings and interpret the drawings, so that, the work can be executed. Civil engineer should be competent to convert his ideas into the drawing. Drawings are essential for drafting specifications and tender documents. The knowledge of this course is useful for construction technology, estimating and costing, design of structure, surveying, and projects.

### Course Outcomes: Student will

CO1	Interpret and Draw the conventions, signs and symbols.
CO2	Know and apply basic rules & bylaws governing the planning of building and calculate different areas such as plinth area, floor area, built-up area, carpet area.
CO3	Know the different agencies involved in building construction works.
CO4	Draw line plan, developed plan, elevation, section, site plan, location plan and foundation plan and measured drawing of residential building.
CO5	Draw line plans of public building.
CO6	Draw perspective drawing of object.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<b>Introduction :</b> 1.1 Purpose of drawing, primary requirements of good drawing. Conventions as per IS 962:1989.

	<p>1.2 Symbols for different materials such as earthwork, brickwork, stonework, concrete, woodwork etc. used in civil engineering construction, graphical symbols for door and window, Abbreviations, symbols for sanitary and electrical installations.</p> <p>1.3 Types of lines- visible lines, centre line, hidden line, section line, dimension line, extension line, pointers, arrow head or dots, Appropriate lettering and numbering.</p> <p>1.4 Types of scale- Monumental, Intimate, criteria for Proper Selection of scale for various types of drawing</p> <p><b>Course Outcome: CO1      Teaching Hours : 2 hrs      Marks: 04 (R- 4, U-0, A-0)</b></p>
2	<p><b>Principles of Planning :</b></p> <p>2.1 Principles of Planning of building : aspect, prospect, orientation, privacy, circulation, grouping, roominess, furniture requirements, sanitation, elegance, economy.</p> <p>2.2 Space requirement and norms for minimum dimension of different units in the residential and public buildings.</p> <p>2.3 Rules and building bylaws of plan sanctioning authority for residential and public building regarding plot area, built up area, super built up area, plinth area, carpet area, floor area, FAR (Floor Area Ratio) / FSI, RERA Carpet Area, Volume plot ratio.</p> <p><b>Course Outcome: CO2      Teaching Hours : 3 hrs      Marks:08 (R- 4 , U-4 , A-0)</b></p>
3	<p><b>Agencies in Building Construction work :</b></p> <p>3.1 Functions of different agencies involved in construction work such as owner, Project Manager, Geotechnical Engineer, Architects, Structural Engineer, Contractor, Promoter, Quantity surveyor, Supervisor, HVAC services, Arbitrator, Safety Engineer, QA/QC team, Third party Audit.</p> <p><b>Course Outcome: CO3      Teaching Hours : 1 hrs      Marks: 04 (R- 4, U-0, A-0)</b></p>
4	<p><b>Residential building :</b></p> <p>4.1 Line plans for residential building of minimum three rooms including w/c, bath and staircase as per principles of planning.</p> <p>4.2 Development of line plan, drawing of plan, elevation, sections, site plan, location plan, Block Plan, foundation plan, preparing schedule of openings, construction notes, Area statement. Global Co-ordinates, Bench mark</p> <p>4.3 Measured drawing, Submission drawing and working drawing and its significance.</p> <p><b>Course Outcome: CO4      Teaching Hours : 4 hrs      Marks:14 (R- 0 , U- 10 , A-14)</b></p>
5	<p><b>Public Building :</b></p> <p>5.1 Data required for planning public building such as Library, community centre, post office, high school, primary health centre, market, hospital, bank, hostel, Bus Depot.</p> <p>5.2 Line plans for public building: school building, primary health centre, hospital building, bank, post office, hostel, canteen, Restaurant, Industrial building with monitor roof, Ware house.</p> <p><b>Course Outcome: CO5      Teaching Hours : 3 hrs      Marks:10 (R- 0 , U- 2 , A-8 )</b></p>



<b>6</b>	<p><b>Perspective Drawing :</b>          6.1 Definition, Types of perspective, terms used in perspective drawing, principles used in perspective drawing.          6.2 One Point and Two Point Perspective of small objects such as steps, monuments, pedestals, Concept of Bird's Eyeview.  <b>Course Outcome: CO6      Teaching Hours : 2 hrs      Marks:10 (R- 0 , U- 4 , A-6)</b></p>
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**Suggested Specifications Table (Practical):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	<b>Introduction</b>	04	--	--	04
2	<b>Principles of Planning</b>	04	04	--	08
3	<b>Agencies in Building Construction work</b>	04	--	--	04
4	<b>Residential building</b>	--	04	10	14
5	<b>Public Building</b>	--	02	08	10
6	<b>Perspective Drawing</b>	--	04	06	10
<b>Total</b>		<b>12</b>	<b>14</b>	<b>24</b>	<b>50</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Draw various types of lines, Legends-graphical symbols for materials, doors, windows, sanitary and water supply installations, electrical installations, abbreviations as per IS 962:1989 (on A3 paper)	08
2	2	CO2	Assignment on Principles of planning	04
3	3	CO3	Visit to Construction sites and write assignment on Agencies involved in Building Construction work	04
4	4	CO4	Submission drawing, to the scale 1:100, of (G+1) Residential Building Framed Structure (2 BHK with attached toilet to 1 bedroom showing the position of European type WC pan) showing developed plan, elevation, section passing through staircase, site plan (1:200), foundation plan (1:50), area statement, schedule of openings, Construction Notes, Reference Note, Revision History and Cloud marks.(on A1 paper)	12
5	4	CO4	Measured Drawing of small residential building or flat with minimum two rooms, kitchen, sanitary block consisting of plan, elevation, section, opening schedule, site plan, construction notes. .(on A1 paper)	12
6	5	CO5	To draw line plans of at least five public buildings, Industrial	10

			buildings on A3 paper. (Visit to Public building to be arranged.)	
7	5	CO5	Visit to Pre-Engineered Building.	04
8	6	CO6	One point and Two Point Perspective Drawing of small objects - steps, monuments, pedestals (any one) scale 1:50. (on A1 paper)	06
<b>Total</b>				<b>60</b>

**Note: All Experiments are compulsory.**

#### References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Building Drawing	Shah, Kale, Patki, Tata McGraw Hill, New Delhi	0-07-460378-7
2	Planning and Design of building	Y.S.Sane, Allies bookstall Poona – 4 & Engineering Book publishers, Company Pune - 16.	ASIN B0007JVH92
3	Civil Engineering Drawing	Malik & Mayo, New Asian Publishers, Nai Sadak, New Delhi - 6	978-8173180026
4	IS code 962:1989		

#### E-References:

1. <https://ndl.iitkgp.ac.in/>
2. [www.google.com](http://www.google.com)
3. [www.youtube/](http://www.youtube/)
4. <http://www.nationallibrary.gov.in>

#### CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	--	--	3	3	3	3	3	1
CO2	3	3	3	--	3	3	3	1	3	1
CO3	2	1	2	--	3	3	3	1	2	--
CO4	3	1	1	--	3	3	3	3	3	1
CO5	3	1	1	--	2	3	3	3	2	1
CO6	3	1	--	--	2	1	3	3	1	--

#### Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Shivkumar Aade	Deputy Chief Engineer	MHADA
2	Mr. Sharad Sonawane	Director	Om Ajay Constructions
3	Mr. K.V. Kelgandre	Sr. Lecturer	K.J. Somaiya Polytechnic
4	Ms. S.M. Male	Lecturer	G.P. Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19202</b>				Course Title: <b>Surveying-I</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	<b>04</b>	<b>--</b>	<b>07</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>50*</b>	<b>-</b>	<b>50</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Development and planning process for any civil engineering project needs survey of that area to be carried out and various types of survey maps are to be prepared. These maps and drawing are used for taking various decisions regarding the planning, designing, estimation, execution and construction process. The diploma pass outs/technicians should therefore know the various methods and instruments required for surveying. They should also have the skill and information to handle and operate the needed survey instruments. This course is therefore one of the core courses required for Civil Engineers.

**Course Outcomes:** Student should be able to

CO1	Select the type of survey required for given situation.
CO2	Compute area of open field using chain, tape and cross staff.
CO3	Conduct traversing in the field using chain and compass.
CO4	Use plane Table to prepare plans.
CO5	Use leveling instruments to determine reduced level of ground points.
CO6	Draw/interpret contour maps of an area collecting field data.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Introduction.</b></p> <p>1.1 Definition of Surveying, Object of Surveying, Purpose and Uses of Surveying</p> <p>1.2 Classification of surveying- Primary and Secondary classification</p> <p>1.3 Principles of Survey</p> <p><b>Course Outcome: CO1 Teaching Hours :3 hrs Marks: 04 (R- 2, U-2, A- 0)</b></p>
2	<p><b>Chain And Cross Staff Survey</b></p> <p>2.1 Principle of Chain Surveying, Well Conditioned and Ill-Conditioned Triangles</p> <p>2.2 Instruments used in chain survey - Metric Chain, Tapes, Arrow, Ranging rod, Line ranger, Offset rod, Open cross staff, optical square Principle of optical square</p> <p>2.3 Selection of survey station, Subsidiary station, Tie station, Base line, Check line, Tie</p>

	<p>line, Offset- Perpendicular and Oblique</p> <p>2.4 Location Sketch of survey station and running measurements of building</p> <p>2.5 Conventional symbols, recording of measurements in a field book.</p> <p>2.6 Ranging: Direct Ranging and Indirect Ranging</p> <p><b>Course Outcome: CO2    Teaching Hours :8 hrs    Marks:10    (R-2 , U- 4 , A- 4 )</b></p>
3	<p><b>Chain and Compass traverse Survey</b></p> <p>3.1 Principle of compass survey, Traversing- closed traverse, open traverse</p> <p>3.2 Technical Terms: True, Magnetic and Arbitrary Meridians and Bearings, Fore Bearing and Back Bearing, Whole Circle Bearing System and Reduced Bearing System, Examples on conversion of WCB in to RB and vice versa, Calculation of internal and external angles from bearings at a station. Dip of Magnetic needle, Magnetic Declination.</p> <p>3.3 Components of Prismatic Compass and their Functions, Method of using Prismatic Compass- temporary adjustments and observing bearings</p> <p>3.4 Local attraction, Methods of correction of observed bearings-Correction at station and correction to included angles,</p> <p>3.5 Methods of plotting a traverse and closing error, Graphical adjustment of closing error.</p> <p><b>Course Outcome:CO3    Teaching Hours :12 hrs    Marks:14    (R- 2, U- 6 , A- 6 )</b></p>
4	<p><b>Plane Table Survey</b></p> <p>4.1 Principle of plane table survey.</p> <p>4.2 Accessories of plane table and their use, Telescopic alidade.</p> <p>4.3 Setting of plane table; Orientation of plane table - Back sighting and Magnetic meridian method.</p> <p>4.4 Methods of plane table surveys- Radiation, Intersection and Traversing. Merits and demerits of plane table survey.</p> <p><b>Course Outcome:CO4    Teaching Hours :5 hrs    Marks:08    (R-4 , U-4, A- --)</b></p>
5	<p><b>Levelling</b></p> <p>5.1 Definitions: Levelling, Level surface, Level line, Horizontal plane, Horizontal line, Vertical line and vertical plane, Datum surface, Reduced Level, Line of collimation, Axis of telescope, Axis of bubble tube, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Back sight, Fore sight, intermediate sight, Change point, Height of instruments .</p> <p>5.2 Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its fundamental axes. Temporary adjustments of Dumpy and Auto Level.</p> <p>5.3 Types of Levelling: Simple, Differential, Fly, Profile and Reciprocal Levelling</p> <p>5.4 Types of Levelling Staffs: Self-reading staff and Target staff.</p> <p>5.5 Reduction of level by Line of collimation method and Rise/ Fall Method</p> <p>5.6 Numerical examples to find the R. L. by H.I.Method and Rise and Fall Method with necessary checks</p> <p>5.7 Errors in Levelling</p> <p><b>Course Outcome:CO5    Teaching Hours :12 hrs    Marks:16    (R- 4 , U- 4 , A-8 )</b></p>
6	<p><b>Contouring</b></p> <p>6.1 Definitions: Contour, contour interval, horizontal equivalent.</p> <p>6.2 Uses of contour maps, Characteristics of contours, methods of Contouring: Direct and</p>

indirect 6.3 Interpolation of contours by Approximate method and Arithmetic method. <b>Course Outcome:CO6 Teaching Hours :5 hrs Marks:08 (R- 2 , U- 4 , A- 2 )</b>
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**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction	2	2	--	04
2	Chain And Cross Staff Survey	2	4	4	10
3	Chain and Compass traverse Survey	2	6	6	14
4	Plane Table Survey	4	4	--	08
5	Levelling	4	4	8	16
6	Contouring	2	4	2	08
<b>Total</b>		<b>16</b>	<b>24</b>	<b>20</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Select the type of survey to measure distance between two points in the field.	2
2	2	CO2	Determine area of open field using chain & cross staff survey	2
3	3	CO3	Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.	2
4	4	CO4	Use Plane Table Survey to prepare plans of a 5 sided closed traverse by Radiation Method.	2
5	5	CO5	Undertake simple leveling using dumpy level/ Auto level and leveling staff and find reduced levels of ground points and bottom of chajja/slab.	2
6	6	CO6	Conduct block contouring for the area of 40m x 40m and grid 10m x 10m to draw its contour plan.	4
7	3	CO3	Measure Fore Bearing and back bearing of a closed traverse of 5or 6 sides and correct the bearings and included angles for the local attraction	4
8	4	CO4	Use plane table survey to prepare plans locate details by Traversing Method	2
9	5	CO5	Undertake differential leveling and determine Reduced Levels by Height of Instrument method and Rise and Fall method using dumpy /auto level and leveling staff.	4
10	3	CO3	Undertake <b>Survey Project</b> with chain and compass for closed traverse for minimum 5 sides ( <b>Compulsory</b> )	1 Full Day (8 hrs)

11	3	CO3	Plot the traverse on A1 size imperial drawing sheet for data collected in <b>Survey Project</b> mentioned at practical no.10	4
12	5	CO5	Undertake <b>Survey Project</b> with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval. <b>(Compulsory)</b> .	1 Full Day (8 hrs)
13	5	CO5	Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in <b>Survey Project</b> mentioned at practical no.12	4
14	6	CO6	Undertake <b>Survey Project</b> for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m. <b>(Compulsory)</b>	1 Full Day (8 hrs)
15	6	CO6	Plot the contours on A1 size imperial drawing sheet for data collected in <b>Survey Project</b> mentioned at practical no.14	4
<b>Total</b>				<b>60</b>

**Note: All experiments are compulsory.**

#### References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Surveying and Levelling	N. N. Basak Tata McGraw Hill Education Private Ltd. New Delhi , 33 <sup>rd</sup> reprint2010	ISBN 93-3290-153-8
2	Surveying and Levelling volume I	Kanetkar, T. P.; Kulkarni, S. V. Pune Vidyarthi Gruh Prakashan	ISBN 978-81-858-2511-3
3	Survey I	Duggal, S. K. McGraw Hill Education Private Ltd. New Delhi,	ISBN 978-00-701-5137-6
4	Surveying I	Punmia B.C., Jain Ashok Kumar; Jain Arun Kumar Laxmi Publications., New Delhi.	ISBN: 8-17-008853-4

#### E-References:

- <http://www.asnu.com.au>
- [www.oupinheonline.com](http://www.oupinheonline.com)
- <http://www.mtu.edu/technology/undergrad>
- <http://www.wb.psu.edu/Academics/Degrees>
- <http://www.tjc.edu/info/2004134/profess>
- <http://www.pstcc.edu/catalog/12-13/cerp>
- [https://youtu.be/e\\_yabRh5GY](https://youtu.be/e_yabRh5GY)
- <https://youtu.be/Z4yYHHX8N0>
- <https://youtu.be/2hL4wWUUSFc>
- <https://youtu.be/j8poe2vvD2Q>
- [https://youtu.be/chhuq\\_t40rY](https://youtu.be/chhuq_t40rY)
- <https://youtu.be/L54T4uvpMTg>
- <https://youtu.be/NdNEy-HBsoA>
- <https://youtu.be/7dN3Iku0Bns>
- <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	3	2	2	2	3
CO2	3	3	3	3	2	2	2	2	2	3
CO3	3	3	2	3	2	3	2	2	2	3
CO4	3	3	3	3	2	3	2	2	2	3
CO5	3	3	3	3	2	3	2	2	2	3
CO6	3	2	3	3	2	3	2	2	2	2

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Mr. D. K. Fad	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engg.

Head of Department  
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering &amp; Mechanical Engineering (Sandwich Pattern)</b>										
Course Code:AM19201				Course Title: <b>Engineering Mechanics</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30min)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	<b>02</b>	<b>--</b>	<b>05</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>25</b>	<b>--</b>	<b>25</b>	<b>150</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

In day to day life we come across different structures, at the time of design of structures, analysis plays an important role. Perfect analysis is possible only when one knows the types and effect of forces acting on the structure. This course provides knowledge about the different types of forces/loads, their effects while acting in different conditions/systems. The course also provides the knowledge about basic concepts of laws of engineering, their application to different engineering problem. The principles of mechanics are fundamental to Mechanical and Civil Engineering and related programs such as Mechatronic Engineering, Naval Architecture, Aerospace, Manufacturing as well as Biomedical engineering. This course is needed as a prerequisite for the courses at higher level such as Mechanics of Structures, Strength of Materials, Design of Structures, Theory of Machines, etc.

**Course Outcomes:** Student should be able to

CO1	Apply principles of simple machines.
CO2	Determine unknown forces of various force system.
CO3	Apply the principles of equilibrium to engineering problems.
CO4	Apply the principle of friction in various conditions.
CO5	Calculate centroid and center of gravity for various geometrical figures.
CO6	Apply the principles of dynamics.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<b>Simple Machines:</b> 1.1 Definitions 1.2 Simple machine, compound machine , load , effort , mechanical advantage , velocity ratio , input of a machine ,output of a machine efficiency of a machine , ideal machine,

	<p>ideal effort and ideal load, load lost in friction, effort lost in friction</p> <p>1.3 Analysis: Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self-locking machine, simple numerical problems.</p> <p>1.4 Velocity Ratio for simple machines :</p> <p>Simple axle and wheel, differential axle and wheel, Weston's differential pulley block, single purchase crab, double purchase crab, worm and worm wheel, geared pulley block, screw jack, calculation of mechanical advantage, efficiency, identification of type such as Reversible or not etc.</p> <p><b>Course Outcome: CO1      Teaching Hours : 6 hrs      Marks: 12 (R- 2, U-4, A-6)</b></p>
2	<p><b>Force systems:</b></p> <p>2.1 Fundamentals and Force systems: Definitions engineering mechanics, statics, Dynamics. Classification of force system according to plane coplanar and non-coplanar, sub classification of coplanar force system-collinear, concurrent, non-concurrent, parallel, Definition of a force, representation of a force by vector and by Bow's notation method. Characteristics of a force, effects of a force, principle of transmissibility.</p> <p>2.2 Resolution of a force and Moment of a force: Definition, Method of resolution, along mutually perpendicular direction and along two given direction. Definition of moment, classification of moments, sign convention, law of moments, Varignon's theorem of moment and its use, definition of couple, properties of couple</p> <p>2.3 Composition &amp; resolution of forces : Definition of Resultant force, methods of composition of forces, Law of parallelogram of forces, Algebraic method for determination of resultant for various force system.</p> <p>2.4 Graphical method: Space diagram, vector diagram, polar diagram, and funicular polygon. Resultant of concurrent and parallel force system only.</p> <p><b>Course Outcome: CO2      Teaching Hours: 10 hrs      Marks: 12 (R -4, U- 4, A- 4)</b></p>
3	<p><b>Equilibrium:</b></p> <p>3.1 Equilibrant and Lami's Theorem: Definition of equilibrant, relation between resultant and equilibrant, equilibrant of concurrent and non-concurrent force system. Analytical, free body and free body diagram. Statement and explanation of Lami's theorem and Application.</p> <p>3.2 Beams: Definition, Types of beams (cantilever, simply supported, overhanging, fixed, continuous), Types of end supports (simple support, hinged, roller), classification of loads, point load, inclined point load, uniformly distributed load. Analytical method to determine reactions of simply supported, cantilever and over hanging beam subjected to point loads and UDL and graphical method to determine reactions for beams subjected to vertical point loads &amp; UDL only</p> <p><b>Course Outcome: CO3      Teaching Hours:8 hrs      Marks: 10 (R- 2, U- 4, A- 4)</b></p>

<b>4</b>	<p><b>Friction:</b> 4.1 Definition: Friction, Types of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction, angle of repose and coefficient of friction. Cone of friction, advantages and disadvantages of friction.</p> <p>4.2 Equilibrium of body on Horizontal and inclined plane: Equilibrium of body on horizontal plane subjected to horizontal and inclined force. Equilibrium of body on inclined plane subjected to forces applied parallel to the plane only. Concept of ladder friction.</p> <p>4.3 Introduction (only) - Dynamic friction</p> <p><b>Course Outcome: CO4      Teaching Hours: 8 hrs      Marks: 10 (R- 2 ,U- 4, A- 4)</b></p>
<b>5</b>	<p><b>Centroid and Centre Of Gravity:</b> 5.1 Centroid: Definition of centroid. Moment of an area about an axis. Centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite figure with not more than three geometrical figures.</p> <p>5.2 Center of gravity: Definition, center of gravity of simple solids such as cylinder, sphere, hemisphere, cone, cube, and rectangular block. Centre of gravity of composite solids with not more than Two simple solids. (Hollow solids are expected.)</p> <p><b>Course Outcome: CO5      Teaching Hours: 8 hrs      Marks: 10 (R- 2, U- 2, A- 6)</b></p>
<b>6</b>	<p><b>Dynamics :</b> 6.1 Kinetics : Definition of kinetics, Newton's laws of motion and its applications. 6.2 Kinematics : Definition of kinematics, Basic concepts of motion, rectilinear motion, displacement, velocity, speed, acceleration. 6.3 Angular motion : Introduction, definition of angular velocity, angular acceleration, angular displacement, (Simple Numericals) 6.4 Motion under gravity. (No numerical on this subtopic)</p> <p><b>Course Outcome: CO6      Teaching Hours: 5 hrs      Marks: 6 (R-2, U- 0, A- 4)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Simple Machines	2	4	6	12
2	Force Systems	4	4	4	12
3	Equilibrium	2	4	4	10
4	Friction	2	4	4	10
5	Centroid and Centre Of Gravity	2	2	6	10
6	Dynamics	2	--	4	6
<b>Total</b>		<b>14</b>	<b>18</b>	<b>28</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	01	CO1	To determine MA, VR, Efficiency, Ideal Effort, Effort lost in friction for Differential axle & wheel and for Simple screw jack.	02
2	01	CO1	To determine MA, VR, Efficiency, Ideal Effort, Effort lost in friction for single purchase crab and for double purchase crab.	02
3	02	CO2	Verify law of polygon of forces	02
4	02	CO2	Graphically determine resultant of concurrent and non-concurrent force system.	04
5	02	CO2	Graphically determine resultant of parallel force system.	02
6	02	CO2	To verify law of moments.	02
7	03	CO3	To verify of Lami's theorem	02
8	03	CO3	To verify the Equilibrium of parallel forces – simply supported beam reactions	02
9	04	CO4	To determine coefficient of friction for motion on horizontal plane.	04
10	05	CO5	Determination of Centroid of basic geometrical figures such as square, rectangle, triangle, circle & Centre of gravity of simple solids such as cylinder, sphere, cone, cube.	04
11	06	CO6	Numericals on Angular motion	04
		<b>Total</b>		<b>30</b>

**Note: All experiments are compulsory**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Engineering Mechanics	R.S.Khurmi, S. Chand & Company Ltd.	10-9352833961
2	Engineering Mechanics	Shames and Rao, Pearson Education.	13-978-0133569087
3	Engineering Mechanics	R.C.Hibbeler, Pearson Education.	13-978-0133073577
4	Applied Mechanics	S. Ramamrutham, Dhanpat Rai & Sones, Delhi.	10-935216427X

**E-References:**

1. [support@swayam.gov.in](mailto:support@swayam.gov.in)
2. [arunasis@iitg.ernet.in](mailto:arunasis@iitg.ernet.in)
3. [www.google.com](http://www.google.com)
4. [www.youtube.com](http://www.youtube.com)
5. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	3	2	--
CO2	3	3	3	2	1	1	2	3	--	--
CO3	3	3	3	2	1	1	2	3	--	--
CO4	3	3	3	2	1	1	2	3	--	--
CO5	3	3	3	2	1	1	2	3	--	--
CO6	3	3	3	2	1	1	2	3	--	--

**CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	2	1	2	2	3	2
CO2	3	3	3	2	1	1	2	3	3
CO3	3	3	3	2	1	1	2	3	3
CO4	3	3	3	2	1	1	2	3	3
CO5	3	3	3	2	1	1	2	3	3
CO6	3	3	3	2	1	1	2	3	3

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Shri Shivkumar Aade	Deputy Chief Engineer	Mhada
2	Shri Sharad Sonawane	Director	Om Ajay Constructions
3	Smt Yaxika Soni	Sr.Lecturer in Civil Engineering	S.B.M.Polytechnic
4	Smt Sanjana Male	Lecturer in Civil Engineering	G.P.Mumbai
5	Smt Ashwini Hagawane	Lecturer in Mechanical Engineering	G.P.Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

## CE 19203 Libre Office Draw

### 1. Promo of LibreOffice Suite (Foss: *LibreOffice Suite Draw – English*)

**Outline:** LibreOffice promo - Features of LibreOffice - Uses of LibreOffice - LibreOffice formats - LibreOffice tutorials in Spoken Tutorial - Applications of LibreOffice - LibreOffi.

### 2. Introduction

**Outline:** Introduction to LibreOffice Draw LibreOffice Draw Create and save an Impress Draw file LibreOffice Draw Workspace Graphics - Bitmap or raster image - Vector graphics.

### 3. Create simple drawings

**Outline:** Create simple drawings Basic shapes (lines, arrows, rectangles and squares, circles) (How to improve upon a water cycle diagram by adding shapes and so on.) Geometric shapes (basic..

### 4. Basics of working with objects

**Outline:** Basics of working with objects Cut, copy, paste objects Resize objects dynamically using handles Object Arrangement Adding a new page to a file Group and ungroup objects Edit.

### 5. Fill objects with color

**Outline:** Fill objects with color, gradients, hatching and bitmaps Making outlines invisible Adding a shadow to the objects Creating new colors How to import a bitmap into Draw. Set...

### 6. Insert text in drawings

**Outline:** Insert text in drawings Insert text directly inside an object Changing the text color Working with text boxes and formatting text in objects Making the line wider. Set prefere..

### 7. Common editing and print functions

**Outline:** Common editing and print functions Set the draw page for page size and margins Paper size, page count, page numbers, date, and time Undo and redo actions Rename a page Print a..

### 8. Polygons and Curves

**Outline:** Curves and Polygons Various types of Polygons Draw directions using arrows Flow charts Insert tables and graphs Page Margins and Orientation Font Type and Size modification ..

### 9. Edit Curves and Polygons

**Outline:** Use the Edit Points toolbar Insert new points Move existing points Using control lines to change the shape of the objects Group the objects together

## **10. Flow Charts Connectors Glue Points**

**Outline:** Draw Flowcharts To Draw Beizer curve Insert text in flow charts Various text insertion options -Resizing shape to fit text width -Word wrap text in shape What is Flowcha..

## **11. Working with Objects**

**Outline:** What are Grids? What are Guides? What are Snap Lines? Position objects with grids, guides and snap lines Resize objects exactly and duplicate objects Distribute objects ..

## **12. Import and Export Images**

**Outline:** Import images into a Draw page \*as a link \* as an embedded image Edit Links Remove links Automatic embedding of images Delete the picture Export the whole Draw file or one ..

## **13. Basics of Layers Password Encryption PDF**

**Outline:** Basics-of-Layers-Password-Encryption-PDF Layers -Layout -Controls -Dimensions How to protect a Draw file Using password encryption Export it as..

## **14. Working with 3D objects**

**Outline:** Enable the grids and the guide lines How to create 3D objects Extrusion(Creating 3D objects, using 2D objects) 3D Toolbar 3D Rotation Object Typing text in 3D objects using Te..

## **15. Set Draw preferences**

**Outline:** Learn how to set the following preferences: \*\*Properties \*\*Create versions \*\*View in color/grayscale/black-and-white Setting Title, Subject, Keywords and Comments of a file..



**Government Polytechnic, Mumbai**

*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

**Semester-III  
(Course Contents)**



**GOVERNMENT POLYTECHNIC MUMBAI**  
(Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme (P19)**  
With effect from AY 2019-20

Programme: Diploma in Civil Engineering (Sandwich Pattern)

Term / Semester - III

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
CE19301	Construction Technology	3	2	--	5	5	60	20	20	--	25*	--	125
CE19302	Transportation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
CE19303	Surveying II	2	4	--	6	6	60	20	20	50*	--	25	175
AM19301	Mechanics of Structures	3	2	--	5	5	60	20	20	--	--	25	125
AM19302	Soil Mechanics	3	2	--	5	5	60	20	20	--	--	25	125
HU19102	Environmental Studies	--	2	--	2	2	--	--	--	--	25	25	50
CE19304	QGIS (16) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>14</b>	<b>16</b>	<b>--</b>	<b>30</b>	<b>30</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>700</b>
Student Centered Activity(SCA)					<b>05</b>								
Total Contact Hours					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,  
Curriculum Development,  
Dept. of Civil Engineering

Head of Department  
Dept. of Civil Engineering

In-Charge  
Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code:CE19301				Course Title: <b>Construction Technology</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	<b>02</b>	<b>--</b>	<b>05</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>25*</b>	<b>--</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

Building construction is a core course in civil engineering. This course is intended for gaining useful knowledge with respect to facts, concepts, principles and procedures related to building construction system so that student can effectively plan, execute quality building construction work.

The course helps to learn building materials required for construction. It provides necessary knowledge about properties, uses of building materials.

**Course Outcomes:** Student should be able to

CO1	Identify components of building structures.
CO2	Propose suitable type of foundation for building structures.
CO3	Select suitable type of masonry for building structures.
CO4	Propose relevant means of communications for different types of buildings.
CO5	Select relevant material for finishing works.
CO6	Select appropriate formwork.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Introduction :</b></p> <p>1.1 Classification of Buildings as per National Building Code Group A to I, As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure.</p> <p>1.2 Building Components - Functions of Building Components, Substructure – Foundation, Plinth.</p> <p>1.3 Superstructure – Walls, Partition wall, Cavity wall, Sill, Lintel, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 4 hrs Marks: 04 (R- 2, U-2, A- 0)</b></p>
2	<p><b>Construction of Substructure :</b></p> <p>2.1 Job Layout: Site Clearance, Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method, Precautions.</p> <p>2.2 Earthwork: Excavation for Foundation, Timbering and Strutting, Earthwork for embankment, Material for plinth Filling, Tools and plants used for earthwork.</p> <p>2.3 Foundation: Functions of foundation, Types of foundation – Shallow Foundation,</p>

	<p>Stepped Footing, Wall Footing, Column Footing, Isolated and Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation - Pile Foundation, Well foundation and Caissons, Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams (Introduction only)</p> <p><b>Course Outcome: CO2      Teaching Hours : 8 hrs      Marks:12 (R-4 , U- 4 , A- 4 )</b></p>
3	<p><b>Construction of Superstructure :</b></p> <p>3.1 Stone Masonry: Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice. Types of stone masonry: Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose. Selection of Stone Masonry, Precautions to be taken in Stone Masonry Construction</p> <p>3.2 Brick masonry: Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Junctions in brick masonry and their purpose and procedure.</p> <p>3.3 Precautions to be observed in Brick Masonry Construction.</p> <p>3.4 Comparison between stone and Brick Masonry. Tools and plants required for construction of stone and brick masonry. Hollow concrete block masonry and composite masonry.</p> <p><b>Course Outcome:CO3      Teaching Hours :12 hrs      Marks:14 (R- 4 , U- 6 , A- 4 )</b></p>
4	<p><b>Building Communication and Ventilation :</b></p> <p>4.1 Horizontal Communication: Doors –Components of Doors, Full Panelled Doors, Partly Panelled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS.</p> <p>4.2 Windows: Component of windows, Types of Windows - Full Panelled, Partly Panelled and Glazed, wooden, Steel, Aluminium windows, Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight. Sizes of Windows recommended by BIS. Ventilators.</p> <p>4.3 Fixtures and fastenings for doors and windows- Material used and functions of Window Sill and Lintels, Shed / Chajja.</p> <p>4.4 Vertical Communication: Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators. Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder. Types of staircase (On the basis of shape): Straight, dog-legged, open well, Spiral, quarter turn, bifurcated, Three quarter turn and Half turn, (On the basis of Material): Stone, Brick, R.C.C., wooden and Metal.</p> <p><b>Course Outcome:CO4      Teaching Hours :12 hrs      Marks:12 (R- 4 , U- 4, A-4)</b></p>
5	<p><b>Building Finishes and Wall Finishes :</b></p> <p>5.1 Floors : Types of Floor Finishes and its suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado. Process of Laying and Construction, Finishing and Polishing of Floors.</p> <p>5.2 Roofs : Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss, terms used in roofs.</p> <p>5.3.Plastering : Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, Rough finish, Neeru Finishing and Plaster of Paris (POP). Special 5.4 Plasters- Stucco plaster, sponge finish, pebble finish. Plaster Board and Wall Claddings. Precautions to be taken in plastering, defects in plastering.</p>

	5.4 Pointing: Necessity, Types of pointing and procedure of Pointing. Painting –Necessity, Surface Preparation for painting, Methods of Application. <b>Course Outcome:CO5 Teaching Hours : 6 hrs Marks: 12 (R- 4, U- 4, A- 4 )</b>
6	<b>Scaffolding and Shoring:</b> 6.1 Scaffolding: Purpose, Types of Scaffolding, Process of Erection and Dismantling. 6.2 Shoring: Purpose and Types of Shoring, Underpinning. 6.3 Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal of formwork. Scaffolding and Shoring <b>Course Outcome: CO6 Teaching Hours : 3 hrs Marks: 06 (R- 2 , U- 2, A- 2 )</b>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction	2	2	--	04
2	Construction of Substructure	4	4	4	12
3	Construction of Superstructure	4	6	4	14
4	Building Communication and Ventilation	4	4	4	12
5	Building Finishes Floors and Roofs	4	4	4	12
6	Scaffolding and Shoring	2	4	--	06
<b>Total</b>		<b>22</b>	<b>24</b>	<b>18</b>	<b>60</b>

**List of experiments:**

/Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	2	CO1	To visit the institute building to study different components of building, types of Structures, etc.	2
2	2	CO2	Observing the models, specimen of different types of foundations.	2
3	2	CO2	To set out Foundation Plan on ground for load bearing structure.	4
4	3	CO2	To set out foundation plan on ground for framed structure.	4
5	3	CO2	To visit building construction site to understand construction of substructure.	6
6	3	CO3, CO5	To visit building construction site to understand construction of super structure, plastering and painting work.	6
7	2&3	CO2, CO3, CO4	To draw different components of building observed in site visit (as built drawing)	2
8	3	CO2, CO3, CO4,	<b>Sketches to be drawn on drawing sketch book(any TWO )</b> A. Brick masonry - Plans & elevation of English bond and Flemish bond for one, one & half, two brick thick wall.	2

		CO5	B. Doors - Plan, elevation & section of fully panelled, glazed, flush, collapsible, revolving doors, rolling shutters C. Window - elevation and section of a louvered window-centrally hung ventilator, glazed window and window with aluminum frame and sliding glass shutter D. Stairs (Plans only) : straight, quarter turn, half turn, open well, doglegged, spiral, bifurcated, circular.	
		CO6	Group activity of model making like scaffolding, formwork, centering. (Any one)	2
<b>Total</b>				<b>30</b>

**Note : All experiments are compulsory.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Building Construction	S. P. Arora and Bindra., N. N. Basak, Dhanpat Rai Publication, Delhi Edition 2013	ISBN: 9788189928803
2	Building Construction	Sushil Kumar. Standard Publication.edition 2006	ISBN: 8186308024
3	Building Construction	Rangawala, S. C., Charotar Publication, Anand.	ISBN-13: 978-8185594859
4	Building Construction	Punmia B. C., and Jain A. K., ,Firewall Media., 2005	ISBN 9788170080534

**E-Reference :**

1. <http://www.learningconstruction.com/>
2. <http://www.understandconstruction.com/>
3. <http://www.constructionknowledge.net/>

**CO Vs PO and CO Vs PSO Mapping :**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	2	3	1
CO2	2	3	3	3	2	3	2	1	3	1
CO3	2	3	3	3	2	3	2	1	3	1
CO4	2	3	3	3	2	3	2	1	3	1
CO5	2	3	3	3	2	3	2	1	3	1
CO6	2	3	3	3	2	3	2	1	3	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Smt.Meera Anserwadekar	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19302</b>				Course Title: <b>Transportation Engineering</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	--	--	<b>03</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

This is a core technology subject which is intended to teach students facts, concepts, principles, procedures, of transportation engineering. system. (Roads, Railways) so that students can use this knowledge to identify types of roads as per IRC recommendations, geometric design features of highways, different tests on road materials, components of railway tracks.

**Course Outcomes:** Student should be able to

CO1	Identify the types of roads as per IRC recommendations.
CO2	Understand geometrical design features of different highways.
CO3	Know different tests on road materials.
CO4	Understand the components of railway tracks.
CO5	Know the defects in railway tracks.
CO6	Understand importance of waterways & airways.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Overview of Highway Engineering</b></p> <p>1.1 Role of transportation in the development of nation, Scope and Importance of roads in India and its' Characteristics.</p> <p>1.2 Different modes of transportation – land way, waterway, airway. Merits and demerits.</p> <p>1.3 General classification of roads.</p> <p>1.4 Selection and factors affecting road alignment.</p> <p>1.5 Metro : types, necessity, advantages &amp; disadvantages, layout of metro station, high speed metro.</p> <p><b>Course Outcome: CO1 Teaching Hours : 4 hrs Marks: 06 (R-4, U-2, A-0)</b></p>
2	<p><b>Geometric Design of Highway</b></p> <p>2.1 Camber: Definition, purpose, types as per IRC – recommendations.</p> <p>2.2 Kerbs: Road margin, road formation, right of way.</p> <p>2.3 Design speed and various factors affecting design speed as per IRC – recommendations.</p> <p>2.4 Gradient: Definition, types as per IRC – Recommendations.</p>

	<p>2.5 Sight distance (SSD): Definition, types as per IRC – recommendations.</p> <p>2.6 Curves: Necessity, types: Horizontal, vertical curves.</p> <p>2.7 Necessity of Extra widening of roads.</p> <p>2.8 Super elevation: Definition, formula for calculating minimum and maximum Super elevation and method of providing super-elevation</p> <p>2.9 Standards cross-sections of national highway in embankment and cutting.</p> <p><b>Course Outcome: CO2 Teaching Hours : 10 hrs Marks: 14 (R-4, U-6, A-4)</b></p>
3	<p><b>Construction of Road Pavements</b></p> <p>3.1 Types of road materials and their Tests – Test on aggregates-Flakiness and Elongation Index tests, Angularity Number test, test on Bitumen- penetration, Ductility, Flash and Fire point test and Softening point test.</p> <p>3.2 Pavement – Definition, Types, Structural Components of pavement and their functions.</p> <p>3.3 Construction of WBM road. Merits and demerits of WBM &amp; WMM road.</p> <p>3.4 Construction of Flexible pavement / Bituminous Road, Types of Bitumen and its properties, Emulsion, Cutback, Tar, Terms used in BR-prime coat, tack coat, seal coat, Merits and Demerits of BR.</p> <p>3.5 Cement concrete road -methods of construction, Alternate and Continuous Bay Method, joints, filler and sealers, merits and demerits of concrete roads. Types of joints.</p> <p><b>Course Outcome:CO3 Teaching Hours : 10 hrs Marks:10 (R-2, U-4, A-4)</b></p>
4	<p><b>Basics of Railway Engineering</b></p> <p>4.1 Classification of Indian Railways, zones of Indian Railways.</p> <p>4.2 Permanent way: Ideal requirement, Components; Rail Gauge, types, factors affecting selection of a gauge.</p> <p>4.3 Rail, Rail Joints - requirements, types.</p> <p>4.4 Creep of rail: causes and prevention.</p> <p>4.5 Sleepers - functions and Requirement, types - concrete sleepers and their density.</p> <p>4.6 Ballast - function and types, suitability.</p> <p>4.7 Rail fixtures and fastenings – fish plate, spikes, bolts, keys, bearing plates, chairs-types of anchors and anti-creepers.</p> <p><b>Course Outcome:CO4 Teaching Hours : 8 hrs Marks:12 (R-5, U-5, A-2)</b></p>
5	<p><b>Track geometrics, Construction and Maintenance</b></p> <p>5.1 Alignment- Factors governing rail alignment.</p> <p>5.2 Track Cross sections – standard cross section of single and double line in cutting and embankment. Important terms-permanent land, formation width, side drains.</p> <p>5.3 Railway Track Geometrics: Gradient, curves- types and factors affecting, grade compensation, super elevation, limits of Super elevation on curves, cant deficiency, negative cant, coning of wheel, tilting of rail.</p> <p>5.4 Branching of Tracks, Points and crossings, Turn out- types, components, functions and inspection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle.</p> <p>5.5 Station -Purpose, requirement of railway station, important technical terms, types of railway station, factors affecting site selection for railway station.</p> <p>5.6 Station yard: Classification- Passenger, goods, locomotive and marshalling yards. Function &amp; drawbacks of marshalling yards.</p> <p>5.7 Track Maintenance- Necessity, Classification, Tools required for track maintenance with their functions, Organisation of track maintenance, Duties of permanent way</p>



	inspector, gang mate <b>Course Outcome:CO5 Teaching Hours : 10 hrs Marks:12 (R-4, U-4, A-4)</b>
6	<b>Waterway &amp; Airways :</b> 6.1 Scope of waterways & airways 6.2 Importance of waterways & airways 6.3 Uses of waterways & airways 6.4 Route alignment, Signaling system. <b>Course Outcome:CO6 Teaching Hours : 3 hrs Marks: 06 (R-2, U-4, A-0)</b>

❖ **Note : Students should visit roads, railway station and road material testing laboratory and prepare a report based on site visit.**

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Overview of Highway Engineering	4	2	0	06
2	Geometric Design of Highway	4	6	4	14
3	Construction of Road Pavements	2	4	4	10
4	Basics of Railway Engineering	5	5	2	12
5	Track geometrics, Construction and Maintenance	4	4	4	12
6	Waterways & Airways	2	4	0	06
<b>Total</b>		<b>21</b>	<b>25</b>	<b>14</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Transportation Engineering	L.R. Kadiyali Khanna Publishing House, New Delhi	ISBN: 978-9382609-858 Edition 2018
2	Highway Engineering	Khanna S.K., Justo, C E G and Veeraragavan Nem Chand and Brothers, Roorkee.	ISBN : 8185240779, 9788185240770
3	Transportation Engineering	Arora, N. L. Khanna Publishers, Delhi.	ISBN-13 978-93-87394-29-2
4	A Textbook of Railway Engineering	Saxena S. C. and Arora S. P. Dhanpat Rai Publication.	ISBN-13: 978-8189928834
5	Road, Railways, Bridge and Tunnel Engg	Birdi, Ahuja Standard Book House, New Delhi.	ISBN-13: 978-8189401337

**E-References:**

- 1) <https://www.engineeringcivil.com>
- 2) [www.youtube.com/watch?v=2g6s4euVoWo&list](http://www.youtube.com/watch?v=2g6s4euVoWo&list)
- 3) <http://civildigital.com>
- 4) <http://www.quora.com>
- 5) [www.railway-technical.com](http://www.railway-technical.com)
- 6) <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	--	--	1	3	2	2	3	1	--
CO2	3	2	3	--	3	2	3	3	2	2
CO3	3	3	1	3	--	1	3	3	2	3
CO4	3	3	2	2	3	3	3	3	2	2
CO5	3	3	3	1	3	3	3	3	3	3

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engg.

Head of Department  
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code:CE19303				Course Title: <b>Surveying II</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>02</b>	<b>04</b>	<b>--</b>	<b>06</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>50*</b>	<b>--</b>	<b>25</b>	<b>175</b>

Abbreviations: TH- Theory; PR-Practical; TU-Tutorial; TS1 and TS2- Term Tests; OR-Oral Exam; TW: Term Work (progressive assessment), \* Indicates assessment by External Examiner else internal assessment  
Note: For Minimum passing marks under various heads, refer, examination rule AR26.

### Rationale:

Development and planning process for any civil engineering project needs survey of that area to be carried out and various types of survey maps are to be prepared. In the era of globalization today, the technology has brought the significant advancements in surveying instruments and techniques. This results in the availability of the precise digital surveying instruments like Electronic Distance Meter (EDM), Micro Optic Theodolite, Total Station Instrument, and Global positioning System (GPS) which are being used currently due to its accuracy, speed and easy operation of the same. Since, Remote sensing and Geographic Information System (GIS) is a vital discipline and being widely used for plotting and storing spatial information, it is expected the students should know the basics of the same to apply it in field. Therefore, the content of this course are designed to deal with the concepts and the principles related to the various advanced digital surveying instruments and the techniques to operate the same to get the desired out put in a short period with highest accuracy. Through this course students will develop the desired skills and competencies which are expected from them for survey related works. This course is therefore one of the core courses required for Civil Engineers.

**Course Outcomes:** Student should be able to

CO1	Use Theodolite to perform survey.
CO2	Prepare plan of the areas using Theodolite
CO3	Find distance and elevations using Tacheometer
CO4	Set out simple circular curves
CO5	Prepare plan of the areas using Total Station instrument
CO6	Locate coordinates of stations using GPS

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<b>Theodolite Surveying :</b> 1.1 Types and uses of Theodolite; Component parts of transit Theodolite and their functions, Reading the Vernier of transit Theodolite 1.2 Technical terms- Swinging, Transiting, Face left, Face right 1.3 Fundamental axes of transit Theodolite and their relationship 1.4 Temporary adjustment of transit Theodolite 1.5 Measurement of horizontal angle- Direct and Repetition method, Measurement of

	<p>vertical Angle. 1.6 Measurement of magnetic bearing of a line, deflection angle.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 5 hrs Marks: 10 (R-4, U-6, A- --)</b></p>
2	<p><b>Theodolite Traversing And Computations</b> 2.1 Traverse Parameters- Open Traverse, Closed Traverse. 2.2 Theodolite traversing by included angle method and deflection angle method. Check in open and closed traverse, Calculations of bearing from angles. 2.3 Traverse computation-Latitude, Departure, Consecutive coordinates, Independent coordinates, Balancing the traverse by Bowditch's rule and Transit rule. 2.4 Gale's Traverse table computation. 2.5 Calculation of area from total Latitudes and Departures.</p> <p><b>Course Outcome: CO2 Teaching Hours :8 hrs Marks:14 (R-2 , U- 4 , A- 8 )</b></p>
3	<p><b>Tacheometric surveying :</b> 3.1 Definition , Principle of tacheometry, tacheometer and its component parts, Characteristics of tacheometer. 3.2 Tacheometric formula for horizontal distance with telescope horizontal and staff vertical. 3.3 Field method for determining constants of tacheometer, 3.4 Determining horizontal and vertical distances with tacheometer by fixed hair method when line of sight is inclined and staff held vertical.( Simple Numerical Problems ) 3.5 Limitations of tacheometry.</p> <p><b>Course Outcome:CO3 Teaching Hours : 4 hrs Marks:10 (R- 2, U- 2 , A- 6 )</b></p>
4	<p><b>Curve setting :</b> 4.1 Introduction, Types of curves used in roads and railway alignments. Relation between degree and radius of curve. 4.2 Elements of simple circular curve. Designation of curve by radius and degree of curve. 4.3 Setting of simple circular curve by offsets from long chord and Rankine's method of deflection angle. 4.4 Simple numerical problems on above.</p> <p><b>Course Outcome:CO4 Teaching Hours : 4 hrs Marks:10 ( R-2 , U-2, A-6)</b></p>
5	<p><b>Advanced surveying equipment :</b> 5.1 Principle of Electronic Distance Meter (E.D.M), use of E.D.M., Construction and use of One Second Micro Optic Theodolite, Electronic Digital Theodolite. 5.2 Construction and Use of Total Station. Temporary adjustments of Total Station. 5.3 Use of function keys. Measurements of Horizontal angles, vertical angles, distances and Coordinates using Total Station. 5.4 Traversing, Profile Survey and Contouring with Total Station. 5.5 LiDAR survey (introduction) 5.6 Study and use of Digital Planimeter.</p> <p><b>Course Outcome:CO5 Teaching Hours :6 hrs Marks:10 (R- 2 , U- 4 , A- 4 )</b></p>
6	<p><b>Remote sensing and GIS :</b> 6.1 Introduction to Remote sensing, Remote sensing system- Active and Passive system, Applications of remote sensing. 6.2 Construction and Use of Global Positioning System (G.P.S.) 6.3 Geographic Information System (GIS): Definition, Components and Applications in</p>

surveying.
<b>Course Outcome:CO6      Teaching Hours :3 hrs   Marks:06   (R- 2 , U- 4 , A- -- )</b>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Theodolite Surveying	4	6	-	10
2	Theodolite Traversing And Computations	2	4	8	14
3	Tacheometric surveying	2	2	6	10
4	Curve setting	2	2	6	10
5	Advanced surveying equipment	2	4	4	10
6	Remote sensing and GIS	2	4	-	06
<b>Total</b>		<b>14</b>	<b>22</b>	<b>24</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Demonstrate the functional utility of Transit Theodolite and Perform temporary adjustments of Transit Theodolite	2
2	2	CO2	Use transit theodolite to carry out <b>Survey Project</b> for closed traverse having minimum 5 sides.	8
3	3	CO3	Use theodolite as a tachometer to compute reduced levels and horizontal distances correctly	2
4	4	CO4	Set out a circular curve by offsets from long chord method.	2
5	5	CO5	Demonstrate the functional utility of the components of Total Station and the function of keys and perform its temporary adjustments.	2
6	6	CO6	Use GPS to locate the coordinates of a station correctly	2
7	1	CO1	Use transit theodolite to measure Horizontal and Vertical angle correctly by direct method	2
8	1	CO1	Use transit theodolite to measure Horizontal angle correctly by method of Repetition	6
9	2	CO2	Prepare Gale's traverse table and Plot the traverse on A1 size imperial drawing sheet for the output of Survey Project mentioned at practical no.2	6
10	4	CO4	Set out a circular curve by Rankine's method of Deflection angles	2
11	5	CO5	Use Total station instrument to measure horizontal distance, horizontal angle and vertical angle.	6
12	5	CO5	Use Total station instrument to carry out <b>Survey Project</b> for closed traverse having minimum 5 sides.	8
13	5	CO5	Plot the traverse on A1 size imperial drawing sheet for the output	6

			of Survey Project mentioned at practical no.12	
14	5	CO5	Use One Second Micro Optic Theodolite / Digital Theodolite to Measure Horizontal angle by direct method	4
15	5	CO5	Use Digital Planimeter to measure area of any irregular figure.	2
<b>Total</b>				<b>60</b>

**Note : All experiments are compulsory.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Surveying and Levelling	N. N. Basak Tata McGraw Hill Education Private Ltd. New Delhi , 33 <sup>rd</sup> reprint2010	ISBN 93-3290-153-8
2	Surveying and Levelling volume I & II	Kanetkar, T. P.; Kulkarni, S. V. Pune Vidyarthi Gruh Prakashan	ISBN 978-81-858-2511-3 & ISBN 13: 9788185825007
3	Surveying and Levelling	Subramanian, R. Oxford University Press.	ISBN 13:978-0-19-808542-3
4	Survey I and Surveying II	Duggal, S. K. McGraw Hill Education Private Ltd. New Delhi,	ISBN 978-00-701-5137-6 and ISBN-13: 978-1259029837
5	Surveying Vol.I and Vol. II	Punmia B.C., Jain Ashok Kumar; Jain Arun Kumar Laxmi Publications., New Delhi.	ISBN: 8-17-008853-4 ISBN 13: 9788170088837

**E-References:**

- [https://www.youtube.com/watch?v=n\\_EMrTbDZak](https://www.youtube.com/watch?v=n_EMrTbDZak)
- <https://www.youtube.com/watch?v=H2AQq2jshgg>
- <https://www.youtube.com/watch?v=C8UKJtZIAWE>
- [https://www.youtube.com/watch?v=J6j\\_sJyyudI](https://www.youtube.com/watch?v=J6j_sJyyudI)
- <http://www.asnu.com.au>
- [www.oupinheonline.com](http://www.oupinheonline.com)
- <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	2	2	3
CO2	3	3	3	2	2	1	2	2	2	3
CO3	3	3	2	2	2	1	2	2	2	3
CO4	3	3	3	2	2	2	2	2	2	3

<b>CO5</b>	3	3	3	3	2	1	2	2	2	3
<b>CO6</b>	3	2	3	3	2	1	2	2	2	2

**Industry Consultation Committee:**

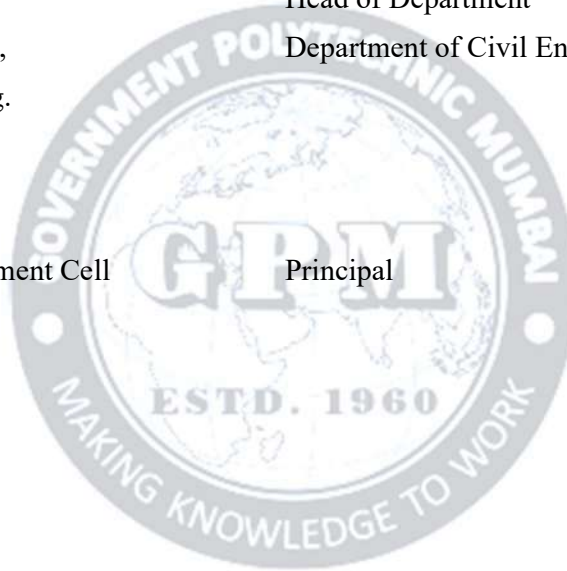
<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
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I/C, Curriculum Development Cell

Principal



Programme: <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>AM19301</b>				Course Title: <b>Mechanics of Structures</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hrs)	TS2 (1Hrs)	PR	OR	TW	Total
<b>03</b>	<b>02</b>	<b>--</b>	<b>05</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>--</b>	<b>25</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Understanding the concept and approach of strength of Material is to induce the knowledge of loading applied and corresponding deformation by the students. In addition to analysis and design of structure, it is needs to understand the material properties and their behaviour. The students enable to analyse the structures/bodies under the action of direct and transverse loading and stress condition. The approach of teaching this course is to think critically and apply their skills while solving the problems. The experiments are expected to perform in the laboratory by acquiring knowledge with required skill of material features.

**Course Outcomes:** Student should be able to

CO1	Compute the Moment of Inertia of symmetrical and asymmetrical structural sections.
CO2	Know the material properties, deformation and stress induced under different loadings
CO3	Determine the elastic constants and volumetric strain subjected to different loadings
CO4	Compute shear force and bending moment along with their distribution diagrams.
CO5	Estimate the shear and bending stresses along with their distribution diagrams.
CO6	Calculate the combined stresses subjected to direct load and bending moment.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Moment of Inertia</b></p> <p>1.1 Concept of moment of inertia for plane bodies, radius of gyration, section modulus, expression for moment of inertia about centroidal axes for regular plane figures such as rectangular, triangular, circular, semicircular and quarter circular sections.</p> <p>1.2 Theorems of Moment of Inertia, Parallel axis theorem, perpendicular axis theorem, polar moment of inertia, Numerical problems on Moment of inertia of composite sections for sections as mentioned in sub-topics 1.1 only.</p> <p><b>Course Outcome: CO1, Teaching Hours: 06 hrs, Marks:10 (R-2, U-4, A- 4)</b></p>
2	<p><b>Simple Stresses and Strains</b></p> <p>2.1. Definition of elastic, plastic and rigid bodies, concept of deformation, stresses and strains, different properties of Engineering materials.</p> <p>2.2. Axial tensile and compressive load, Hooke's Law, Young's modulus, axial stress, axial</p>



	<p>strain, lateral strain, modulus of elasticity, Poisson's ratio, problems on bars of uniform and stepped cross section.</p> <p>2.3. Behavior of mild steel under tensile loading, stress-strain curve along with important points such as limit of proportionality, yield stress, ultimate stress, breaking stress. Factor of safety, safe stress, working stress.</p> <p>2.4. Concept of composite section, conditions for composite sections, advantages and limitations of composite section (Simple numerical problems asked in the examination).</p> <p>2.5. Concept of temperature stresses and strains, nature of stresses, simple problems on temperature stresses on homogenous sections only.</p> <p><b>Course Outcome: CO2, Teaching Hours: 10 hrs, Marks:10 (R-2, U-4, A-4)</b></p>
3	<p><b>Elastic Constants and Strain Energy</b></p> <p>3.1. Concept of shear load, shear stress &amp; strain, modulus of rigidity, simple shear, complementary shear, punching shear.</p> <p>3.2. Volumetric strain, bulk modulus, Concept of "uni-axial stress, equation of total strain in Uni-axial direction, elastic constants, relation between elastic moduli (No derivations of these relations). Simple numerical problems.</p> <p>3.4. Concept of strain energy, resilience, proof resilience, modulus of resilience, strain energy stored due to gradual, sudden and impact loadings, simple numerical problems.</p> <p><b>Course Outcome:CO3, Teaching Hours :06 hrs, Marks:10 (R-2, U-4, A-4)</b></p>
4	<p><b>Shear Force and Bending Moment</b></p> <p>4.1 Concept and definition of shear force and bending moment, sign convention, relation between bending moment, shear force and rate of loading.</p> <p>4.2 Shear force and bending moment diagram for simply supported, cantilever and overhanging beams subjected to concentrated load, uniformly distributed load and couple, point of zero shear, point of contra flexure, simple numerical problems.</p> <p><b>Course Outcome:CO4, Teaching Hours: 08 hrs, Marks:12 (R-2, U-4, A-6)</b></p>
5	<p><b>Shear and Bending Stresses</b></p> <p>5.1 Concept of pure bending, assumptions in pure bending theory, stress distribution diagram, bending or flexure equation (derivation not required), section modulus, moment of resistance.</p> <p>5.2 Numericals on moment of resistance for symmetrical beam sections. Simple numerical problems on standard sections (No problems built up section)</p> <p>5.3 Shear stress equation with meaning of each terms (Derivation not required)</p> <p>5.4 Shear stress distribution for solid and hollow rectangular section, solid and hollow circular section, I section, T section, Numerical problems on circular and rectangular section only.</p> <p><b>Course Outcome:CO5, Teaching Hours: 08 hrs, Marks:10 (R-0, U-2, A-8)</b></p>
6	<p><b>Direct and Bending Stresses</b></p> <p>6.1 Concept of direct and eccentric load, eccentricity about one principal axis, different nature of stresses, stress distribution diagram.</p> <p>6.2 Condition for no tension, limit of eccentricity, maximum and minimum stresses core section for rectangular and circular sections, stress distribution diagram at base.</p> <p>6.3 Numerical problems on rectangular and circular column sections subjected to eccentric load on any one principal axis.</p> <p><b>Course Outcome:CO6, Teaching Hours :07 hrs, Marks:08 (R-0, U-2, A-6)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Moment of Inertia	2	4	4	10
2	Simple Stresses and Strains	2	4	4	10
3	Elastic Constants	2	4	4	10
4	Shear Force and Bending Moment	2	4	6	12
5	Shear and Bending Stresses	--	2	8	10
6	Direct and Bending Stresses	--	2	6	08
<b>Total</b>		<b>08</b>	<b>20</b>	<b>32</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	2	CO2	List the various parts and their functions of Universal Testing Machine along with brief introduction of other test to be conducted on UTM.	2
2	2	CO2	Tension test on mild steel or TMT specimen as per IS 432 (part I) or HYSD or Fe500 steel specimen as per IS 1608 & 1139. Also, draw the stress strain curve by showing important points on it.	2
3	2	CO2	Hardness test on on mild steel, Aluminium, copper, brass, cast iron (any two metals).	2
4	2	CO2	Compression test on timber along the grain and cross the grain as per IS 2408.	2
5	5	CO1 & CO5	Flexure test on timber beam of rectangular section as per IS 1708 and IS 2408.	2
6	3	CO3	Izod impact load test & Charpy impact test on aluminium, copper, mild steel, brass, cast iron as per IS 1598 (any two metals).	2
7	5	CO2 & CO5	Water absorption and flexural test on flooring or roofing tiles as per IS 1237, IS 13630, IS 654, IS 2690.	3
8	2	CO2	Water absorption and compression test on wet bricks as per IS 3495 (part II), IS 1077.	3
9	2	CO2	Abrasion test on flooring tiles as per IS 13630 (part 7).	2
10	3	CO3	Shear test on mild steel, Aluminium, copper, brass, cast iron as per IS 5242 (any two metals).	2
11	2	CO2	Neoprin test on rubber to check deformation of rubber.	2

12	4	CO4 & CO6	<p>a) Plot shear force and bending moment diagram for cantilever, simply supported and overhanging beams loaded by concentrated and uniformly distributed loads (two problem on each beam types on A4 graph paper).</p> <p>b) Draw the labeled core section diagram for rectangular and circular sections (use A4 graph paper)</p> <p>c) Draw the three probable labeled stress distribution diagrams at base of a rectangular section subjected to eccentric load about one principal axis (use A4 graph paper).</p>	6
<b>Total</b>				<b>30</b>

**Note : All experiments are compulsory.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Mechanics of Material	Beer and Jonson Tata McGraw hill	ISBN 9781259097171
2	Strength of material	Singer and Pytel Harper &Raw	ISBN-10 0060453133
3	Mechanics of structures, Volume-I	Junnarkar, S. B. , Charotar Publishing House, Anand.	ISBN :9789385039270988 ISBN 978-93-85039-02-7
4	Strength of Material	S. Ramamurtham Dhanpat Rai and sons	ISBN-10: 818743354X
5	Strength of Material	R. K. Bansal S Chand	ISBN 9789385401961
6	Strength of Material	B. K. Sarkar Tata McGraw hill	ISBN 0070494843
7	Mechanics of structure	Y. N Walavalker Everest pub-House, Pune 30	ISBN NO: EPH-0-89- 890925-17
8	Strength of Material	S.S Bhavikatti Vikas Publishing House Pvt.Ltd	ISBN 8125912193

**CO-PO and CO-PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	--	3	2	2	3
CO2	3	2	2	2	2	1	2	3	2	3
CO3	2	3	3	3	2	1	2	2	2	2
CO4	3	2	3	2	--	--	3	3	2	2
CO5	3	3	3	3	--	--	2	2	2	3
CO6	3	3	3	3	--	--	3	2	3	2

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr. S.M. Dumne	Sr. lecturer in APM	Govt. Polytechnic Avasari

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering.

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>AM19302</b>				Course Title: <b>Soil Mechanics</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	<b>02</b>	<b>--</b>	<b>05</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>--</b>	<b>25</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

Soil Mechanics engineering is important for every structure, since all structures rest on soil. The stability of these structures depends upon behavior of soil and bearing capacity of soil to carry loads under different loading conditions.

The design of foundation of buildings, dams, Tower, embankments, roads, railways retaining walls, bridges is mainly governed by the knowledge of soil characteristics, stress distribution under loading on soil. Bearing capacity of soil etc. The content of this subject are useful to every engineer in the design, execution and stability analysis of structures.

### Course Outcomes: Student should be able to

CO1	Know the Origin & Field applications of Soil.
CO2	Know the physical properties and behavior of Soils.
CO3	Classify the soil as per IS classification and to know grading & consistency of Soil.
CO4	State the necessity of compaction and consolidation of soil with it techniques.
CO5	Know & understand factors affecting permeability of soil, and Shear Strength of Soil.
CO6	Know importance of bearing capacity and Know the techniques of stabilization of soil.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<p><b>Introduction to Soil Mechanics :</b></p> <p>1.1 IS definition of soil, Origin of soil, Formation of soil, Soil-formation in Geological cycle</p> <p>1.2 General characteristics of different types of soils, Overview of different types of soils in India.</p> <p>1.3 Importance of soil in Civil Engineering as construction material in Civil Engineering Structures, such as foundation bed for structures.</p> <p>1.4 Field application of Soil Mechanics for foundation design pavement design, design of earth retaining structures, applications in design of earthen dams in Maharashtra and India.</p> <p><b>Course Outcome: CO1      Teaching Hours : 3 hrs      Marks: 4 (R- 2, U-2, A-0)</b></p>

2	<p><b>Physical Properties of Soil :</b></p> <p>2.1 Soil as Three Phase System. Water content, determination of Water Content by oven drying method as per IS 2720 (part II).</p> <p>2.2 Physical properties: Void ratio, porosity &amp; degree of saturation, density index, unit wt. of Soil mass - Sp. Gravity, bulk density, dry density, Water content</p> <p>2.3 Relation between: Void ratio and porosity. Void ratio, sp. gravity &amp; degree of saturation. (No derivations) .Concept of various index properties of soil for the Purpose of their classification &amp; Use.</p> <p>2.4 Determination of specific gravity by Pycnometer.</p> <p>2.5 Determination of bulk unit weight and dry unit weight by Core Cutter method (Simple Numerical problems on physical properties only)</p> <p><b>Course Outcome: CO2      Teaching Hours: 8 hrs      Marks: 12 (R -4, U- 4, A- 4)</b></p>
3	<p><b>Grading &amp; Consistency of soil :</b></p> <p>3.1 Particle size distribution, mechanical sieve analysis as per IS code, partial distribution curve, Uniformity coefficient and coefficient of curvature graded and uniformly graded soils, IS. Classification of soil. IS : 460</p> <p>3.2 Consistency of soil: stages of consistency, Atterberg's limits of consistency viz. Liquid limit, plastic limit and shrinkage limit, Plasticity index, Consistency index.</p> <p>3.3 Determination of Liquid limit, Plastic limit and Shrinkage limit as per IS code.</p> <p><b>Course Outcome: CO3      Teaching Hours: 9 hrs      Marks: 12 (R- 2, U- 6, A- 4)</b></p>
4	<p><b>Compaction &amp; Consolidation :</b></p> <p>4.1 Concept of compaction &amp; consolidation, difference between consolidation and compaction.</p> <p>4.2 Compaction: Light and Heavy compaction, zero air void line, O.M.C, Std. Proctor test. Modified Proctor test. Factors affecting compaction.</p> <p>4.3 Field methods of Compaction – rolling, ramming and vibration and Suitability of various compaction equipment’s-smooth wheel roller, sheep foot roller, pneumatic typed roller, Rammer and Vibrator.</p> <p><b>Course Outcome: CO4      Teaching Hours: 10 hrs      Marks: 12 (R-4 ,U- 4, A- 4)</b></p>
5	<p><b>Permeability &amp; Shear strength of soil :</b></p> <p>5.1 Definition &amp; concept of permeability. Darcy’s law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head Permeability tests.</p> <p>5.2 Types of Filters. Use of Geofabric as Filters.</p> <p>5.3 Concept and definition of shear strength of soil. Constituents of shear resistance of soil, definition of Cohesion, internal friction. Angle of shearing resistance.</p> <p>5.4Coulomb's equation &amp; failure envelope, significance of "C" and “<math>\phi</math>” soils. Types of soil C-soil, <math>\phi</math>-soil, C-<math>\phi</math> soil.</p> <p>5.5 Introduction to determination of shearing strength of soil in laboratory by direct Shear test (drained &amp; un drained).</p> <p><b>Course Outcome: CO5      Teaching Hours: 10 hrs      Marks: 12 (R- 2, U- 6, A- 4)</b></p>
6	<p><b>Bearing Capacity and Stabilization of Soil :</b></p> <p>6.1 Concept &amp; definition of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing Capacity, effect of water table on bearing capacity.(No Numerical)</p> <p>6.2 Factors effecting bearing capacity and methods to improve Bearing capacity of soil.</p> <p>6.3 Explain the concept &amp; occurrence mechanism&amp; effect of ‘Liquefaction’ of soil.</p> <p>6.3 Dynamic Plate load test - procedure, and limitations of test only.</p>

6.4 Soil stabilization: Scope & purpose. 6.5 Methods of soil stabilization – Mechanical soil stabilization – GGBS, fly ash, glass slag, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization. California bearing ratio. 6.6 Uses of Geosynthetic. <b>Course Outcome: CO6      Teaching Hours: 5 hrs      Marks: 8 (R- 4, U- 2, A- 2)</b>
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**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Soil Mechanics	2	2	--	04
2	Physical Properties of Soil	4	4	4	12
3	Grading & Consistency of soil	2	6	4	12
4	Compaction & Consolidation	4	4	4	12
5	Permeability & Shear strength of soil	2	6	4	12
6	Bearing Capacity and Stabilization of Soil	4	2	2	08
<b>Total</b>		<b>18</b>	<b>24</b>	<b>18</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	02	CO2	Determine water content of given soil sample by oven drying method as per I.S. 2720 part- II	04
2	01	CO1	Introduction to Soil Mechanics and study various field application.	02
3	02	CO1	Determine specific gravity of soil by pycnometer method as per I.S. 2720 part- III	02
4	03	CO2	Determine grain size distribution of given soil sample by Mechanical sieve analysis as per I.S.. 2720 part- IV	02
5	04	CO4	Determine MDD and OMC by Standard proctor test (OR Study of Modified proctor test).	04
6	05	CO5	To determine Coefficient of permeability by Constant head method (OR Falling head test as per I.S.	04
7	06	CO6	Determine shear strength of soil by direct shear test (OR Vane Shea: Test)	04
8	02	CO2	Determine bulk dry unit weight at soil by core cutter method as per I.S. 2720 part-XXIX.	02
9	03	CO3	Determine Liquid Limit of given soil sample as per I.S. 2720 part- V.	02
10	03	CO3	Determine Plastic Limit of given soil sample as per I.S.. 2720 part- V.	02
11	04	CO4	Study of Shrinkage Limit.	02
<b>Total</b>				<b>30</b>

**Note : All experiments are compulsory.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Soil Mechanics & Foundations Engg.	K.R Arora , Standard Publisher Distributors	ISBN-10: 8180141128; ISBN-13: 978-8180141126
2	Introduction to Soil Mechanics	B.J.Kasmalkar Pune Vidyarthi Grila Prekashan	ISBN 9781407029252
3	Soil Mechanics & Foundations Engg	Gopal Rajan & A.S.R.Rao. New Age international Publisher	ISBN. 978-81-224-1223-9
4	Soil Mechanics	B.C. Punmia Standard Book House,New Delhi	ISBN-10: 8180141128; ISBN-13: 978-8180141126
5	Soil Mechanics	V.N.S Murthy Sai Kripa 'Tectnical Consultants	ISBN-10: 8180141128; ISBN-13: 978-8180141126
6	Geotechnical Engineering (Soil Mechanics)	T.N.Ramanurthy & T.G.Sitharam S Chand and Company Ltd.	ISBN 10: 812192457X
7	Is 2809-1972-Glossary of Terms and Symbols Relating To Soil Engineering.	BIS, New Delhi	
8	Is 1892-1979-Cocce oOf Practice For Sub Surface Investigation of Foundation	BIS, New Delhi	
9	Is 2720-Test For Soil Part 1-1983	BIS, New Delhi	

**E-References:**

1. [https://en.wikipedia.org/wiki/Soil\\_mechanics](https://en.wikipedia.org/wiki/Soil_mechanics)
2. <https://www.nap.edu/read/11558/chapter/9>
3. <https://ascelibrary.org/doi/pdf/10.1061/9780784412886.bm02>
4. <https://www.springer.com/journal/11204>
5. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	1	1	--	2	1
CO2	2	3	3	3	2	2	2	--	2	1
CO3	2	3	3	3	2	2	2	--	2	1
CO4	1	3	2	2	2	1	1	--	2	1
CO5	2	3	3	2	2	1	1	--	2	1



<b>CO6</b>	2	2	2	2	2	1	1	--	2	1
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**Industry Consultation Committee:**

<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. S. Ekbote	Lecturer in Applied Mechanics	Govt. Polytechnic Solapur

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in CE/EE/EC/CO/IT/IS/LG/LT (Sandwich pattern)</b>										
Course Code: <b>HU19102</b>				Course Title: <b>Environmental Studies</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	<b>02</b>	--	<b>02</b>	--	--	--	--	<b>25</b>	<b>25</b>	<b>50</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Technicians working in industries or elsewhere essentially require the knowledge of environmental Studies so as to enable them to work and produce most efficient, economical and eco-friendly finished products. Solve various engineering problems applying ecosystem to produce eco – friendly products. Use relevant air and noise control method to solve domestic and industrial problems. Use relevant water and soil control method to solve domestic and industrial problems. To recognize relevant energy sources required for domestic and industrial problems. Solve local solid and e-waste problems.

**Course Outcomes:** Student should be able to

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Understand the suitable air, extent of noise pollution, and control measures and acts.
CO3	Understand the water and soil pollution, and control measures and acts.
CO4	Understand different renewable energy resources and efficient process of harvesting.
CO5	Understand Solid Waste Management & E Waste Management, ISO 14000, 45001 & Environmental Management.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<b>Ecosystem</b> 1.1 Structure of ecosystem, biotic & Abiotic components 1.2 Food chain and food web 1.3 Aquatic (Lentic and Lotic) and terrestrial ecosystem 1.4 Carbon, Nitrogen, Sulphur, Phosphorus cycle 1.5 Global warming -Causes, effects, process, Green House Effect, Ozone depletion <b>Course Outcome: CO1 Teaching Hours : 6 hrs Marks: 03 (R- NA, U-NA, A- NA)</b>
	<b>Air and Noise Pollution</b> 2.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler) 2.2 Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone

	<p>separator, Electrostatic Precipitator)</p> <p>2.3 Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler</p> <p>2.4 Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution</p> <p><b>Course Outcome: CO2 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)</b></p>
3	<p><b>Water and Soil Pollution</b></p> <p>3.1 Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition</p> <p>3.2 Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis)</p> <p>3.3 Causes, Effects and Preventive measures of Soil Pollution : Causes – Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-waste</p> <p>3.4 Mangroves : Importance, benefits.</p> <p><b>Course Outcome:CO3 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)</b></p>
4	<p><b>Renewable sources of Energy</b></p> <p>4.1 Solar Energy: Basics of Solar energy. Flat plate collector (Liquid &amp; Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.</p> <p>4.2 Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas</p> <p>4.3 Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy</p> <p>4.4 New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy</p> <p><b>Course Outcome:CO4 Teaching Hours : 6 hrs Marks:05 (R- NA, U-NA, A- NA)</b></p>
5	<p><b>Solid Waste Management OR E- Waste Management, ISO 14000 &amp; Environmental Management For Civil Engineering :</b></p> <p>5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste.</p> <p>5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste</p> <p>5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board.</p> <p>5.4 Concept of Carbon Credit, Carbon Footprint.</p> <p>5.5 Environmental management in fabrication industry.</p> <p>5.6 ISO14000: Implementation in industries, Benefits, ISO 45001:2018</p> <p>5.7 Role of MPCB in factory permit.</p> <p>5.8 Green pro IGBC certification, its benefits</p> <p style="text-align: center;"><b>OR</b></p> <p><b>For Computer Engineering &amp; Information Technology :</b></p> <p>5.1 E-Waste Electronic products which have become unwanted, non-working, obsolete</p> <p>5.2 E-Waste Management Services</p> <p>5.3 Separation of E-Waste from other waste</p>

	<p>5.4 Categorization of E-Waste into old working equipments, old computers, non-working components</p> <p>5.5 Authorized Recycling Facilities</p> <p>5.6 Refurbishing</p> <p style="text-align: center;"><b>OR</b></p> <p><b>For Electrical Engineering :</b></p> <p>5.1 Various e-waste sources, their constituents, and health impacts</p> <p>5.2 e-Waste Problem in India</p> <p>5.3 Initiatives on building awareness in e-waste management.</p> <p>5.4 Current Status of e-Waste Management &amp; Environmental (Protection) Act 1986</p> <p>5.5 Development of waste recycling technologies.</p> <p>5.6 Opportunities of e-Waste Management in India</p> <p>5.7 e-Waste Management techniques</p> <p style="text-align: center;"><b>OR</b></p> <p><b>For Electronics Engineering &amp; Instrumentation Engineering :</b></p> <p>5.1 Solid waste generation- Sources and characteristics of : E- waste, biomedical waste.</p> <p>5.2 Toxicity due to hazardous substances in E waste and their impact</p> <p>5.3 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste</p> <p>5.4 Domestic E waste disposal and E waste management</p> <p>5.5 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board.</p> <p>5.6 Concept of Carbon Credit, Carbon Footprint.</p> <p style="text-align: center;"><b>OR</b></p> <p><b>For Leather Technology/ Leather Goods &amp; Footware Technology :</b></p> <p>5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste.</p> <p>5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste</p> <p>5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board.</p> <p>5.4 Concept of Carbon Credit, Carbon Footprint.</p> <p>5.5 Environmental management in fabrication industry.</p> <p>5.6 ISO14000: Implementation in industries, Benefits.</p> <p>5.7 Solid waste management in leather and footwear industries</p> <p><b>Course Outcome:CO5 Teaching Hours : 6 hrs      Marks:07(R- NA, U-NA, A- NA)</b></p>
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**Note : Chapter 5 should be teach as per department mentioned.**

**List of tutorials:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1,2,3, 4,5	CO1,CO2, CO3,CO4, CO5	Prepare a write up on each unit (altogether 5 in number) that summarizes the whole unit and presents important points on it.	14
2	2,3	CO2,CO3	Visit to a local polluted site : Urban/Rural/Industrial/Agricultural and prepare a report	4

			based on visit.	
3	4	CO4	Visit to biomass plant and prepare a report based on visit.	6
4	5	CO5	Visit to municipal solid waste management organization <b>or</b> an authorized e-waste recycling plant and prepare a report based on visit.	6
<b>Total</b>				<b>30</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Environmental Studies	S.C. Sharma & M.P. Poonia Khanna Publishing House, New Delhi	ISBN: 978-93-86173-09-6
2	Understanding Chemistry	C.N.Rao Universities Press(India) Pvt. Ltd. 2011	ISBN:13-9788173712500
3	Waste water treatment for pollution control and reuse	Arceivala, Soli Asolekar, Shyam Mc-Graw Hill Education India Pvt. Ltd. New york, 2007	ISBN:978-07-062099
4	Elements of Environmental Pollution control	O.P.Gupta Khanna Publishing House, New Delhi	ISBN:13-9789382609667

**E-References:**

- 1) [www.eco-prayer.org](http://www.eco-prayer.org)
- 2) [www.teriin.org](http://www.teriin.org)
- 3) [www.cpcp.nic.in](http://www.cpcp.nic.in)
- 4) [www.cpcp.gov.in](http://www.cpcp.gov.in)
- 5) [www.indiaenvironmentportal.org.in](http://www.indiaenvironmentportal.org.in)
- 6) [www.whatis.techtarget.com](http://www.whatis.techtarget.com)
- 7) [www.sustainabledevelopment.un.org](http://www.sustainabledevelopment.un.org)
- 8) [www.conserve-energy-future.com](http://www.conserve-energy-future.com)
- 9) <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (Civil Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	1	1
CO3	3	3	2	2	3	3	3	--	1	1
CO4	3	3	2	2	3	3	3	--	1	1
CO5	3	3	2	2	3	3	3	--	1	1

**CO Vs PO and CO Vs PSO Mapping (Electrical Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	3
CO2	3	3	2	2	3	3	3	--	--	2
CO3	3	3	2	2	3	3	3	--	--	2
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	2

**CO Vs PO and CO Vs PSO Mapping (Electronics Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	2
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	1

**CO Vs PO and CO Vs PSO Mapping (Instrumentation Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	1	3	3	3	--	--
CO2	3	3	2	2	3	3	3	--	--
CO3	3	3	2	2	3	3	3	--	--
CO4	3	3	2	2	3	3	3	--	--
CO5	3	3	2	2	3	3	3	--	--

**CO Vs PO and CO Vs PSO Mapping (Computer Engineering)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	--
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

**CO Vs PO and CO Vs PSO Mapping (Information Technology)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	3	--
CO2	3	3	2	2	3	3	3	--	2	--
CO3	3	3	2	2	3	3	3	--	2	--
CO4	3	3	2	2	3	3	3	--	2	--
CO5	3	3	2	2	3	3	3	--	3	--

**CO Vs PO and CO Vs PSO Mapping (Leather Technology)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

**CO Vs PO and CO Vs PSO Mapping (Leather Goods & Footwear Technology)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engg.

Head of Department  
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal





## CE 19304 QGIS

### 1. Installation of QGIS (Foss: QGIS – English)

**Outline:** System requirements to install QGIS Add QGIS repositories on Ubuntu Linux OS Installation of QGIS on Ubuntu Linux OS Visit the Official QGIS Website Download QGIS installer for..

### 2. Downloading GIS Datasets

**Outline:** Basic introduction to GIS Download open source vector datasets from Natural Earth Data website About geospatial data About vector data View vector data in QGIS Save the map i..

### 3. Coordinate Reference Systems

**Outline:** Add layers to the projections in QGIS Change the color of the layer Resize the panels on the canvas View metadata information for layers in QGIS Save selected features from a l..

### 4. Digitizing Map Data

**Outline:** Create Point and Polygon shape files Digitize Point and Polygon shape files About Toggle editing and Add Feature tools Open attribute table for Point feature Open attribute tab..

### 5. Importing Spreadsheets

**Outline:** Import spreadsheets in CSV format to create a Point layer Convert Point layer to a Polyline layer About QGIS Geoalgorithm About WMS layers Select a WMS map from Bhuvan website ..

### 6. Vector Data Styling

**Outline:** Load vector data in QGIS Open attribute table for the layer Learn to style vector layers using, Single symbol styling Categorized styling Grada..

### 7. Geometric Properties of Vectors

**Outline:** Show attribute table for a shapefile layer Show selected features from attribute table on the map Change the CRS of the layer Add columns to the attribute table Calculate stati..

### 8. Raster Data Styling

**Outline:** Information about download and save example files from the Code files link Change Coordinate Reference System for the given layer Use Identify Features tool to view the pixel va..

## **9. Creating a Map**

**Outline:** Information on how to download the example files given in Code files link Add vector layer on canvas Show labels for the cities on the map About Print Composer tool Show how t..

## **10. Creating Dataset Using Google Earth Pro**

**Outline:** About Google Earth Pro program. Download and install Google Earth Pro on Ubuntu Linux 16.04. Navigate Google Earth Pro. Create a point dataset for a few locations in Maharash..

## **11. Plugins**

**Outline:** Information about the Plugins Enable Core Plugins Install an External Plugin Locate a Plugin on QGIS interface Install QuickMapServices Plugin Download OpenStreetMap data Us..

## **12. Table Joins and Spatial Joins**

**Outline:** Load vector layer on QGIS canvas Open attribute table for the layer About different types of combining attribute data Add Delimited Text Layer on QGIS canvas Join the attribu..

## **13. Nearest Neighbour Analysis**

**Outline:** Open shape files showing locations of volcanoes and cities on QGIS canvas Open attribute table for the layers About Nearest Neighbour Analysis Statistical analysis using Distanc..

## **14. DEM Analysis**

**Outline:** About Digital Elevation Model (DEM) analysis Open Shuttle Radar Topography Mission (SRTM) data website Download DEM data from SRTM data website Save DEM data from SRTM data webs..

## **15. Create Contour Lines**

**Outline:** Add DEM on QGIS map canvas Clip area in DEM using Clipper tool About contour lines Show contour lines for the DEM Change the color of the contour lines Open attribute table fo..

## **16. Interpolation**

**Outline:** About Interpolation Methods of interpolation Load the vector layer on QGIS canvas Label the Point features on the map Enable Interpolation Plugin About Inverse Distance Weight..



**Government Polytechnic, Mumbai**

*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

**Semester-IV  
(Course Contents)**

**GOVERNMENT POLYTECHNIC MUMBAI**  
(Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - IV**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
AM19401	Theory of Structures	4	--	01	5	5	60	20	20	--	--	--	100
AM19402	Concrete Technology	4	2	--	6	6	60	20	20	--	--	25	125
CE19401	Hydraulics	3	2	--	5	5	60	20	20	--	25	--	125
CE19402	Environmental Engineering	4	2	--	6	6	60	20	20	--	25*	25	150
CE19403	Computer Aided Drafting	1	4	--	5	5	--	--	--	50	--	50	100
	Elective – I (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
CE19404	Repairs & Rehabilitation of Building	--	--	--	--	--	--	--	--	--	--	--	--
CE19405	Building Services & Maintenance	--	--	--	--	--	--	--	--	--	--	--	--
CE19406	Material Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19407	Safety & Quality Control	--	--	--	--	--	--	--	--	--	--	--	--
CE19408	QCad (5) (Spoken Tutorials)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>20</b>	<b>14</b>	<b>01</b>	<b>35</b>	<b>35</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>700</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,  
Curriculum Development,  
Dept. of Civil Engineering

Head of Department  
Dept. of Civil Engineering

In-Charge  
Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>AM19401</b>				Course Title: <b>Theory of Structures</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	<b>01</b>	<b>05</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

This course deals with analysis of forces and stresses in structures. This forms base for developing the concepts required in the design of various structures. The application of theoretical principles and laws are applied to field situation to solve field problems which enables the students in understanding concepts.

**Course Outcomes:** Student should be able to

CO1	Analyze stresses induced in vertical member subjected to direct and bending loads.
CO2	Analyze slope and Deflection in fixed and continuous beams.
CO3	Analyze continuous beam under different loading conditions using the principles of Three Moments.
CO4	Analyze continuous beam using Moment Distribution Method under different loading conditions.
CO5	Evaluate axial forces in the members of simple truss.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Direct and Bending Stresses in vertical members :</b></p> <p>1.1 Introduction to axial and eccentric loads, eccentricity about one principal axis only, nature of stresses, Maximum and minimum stresses, resultant stresses and distribution diagram.</p> <p>1.2 Condition for no tension or zero stress at extreme fiber, Limit of eccentricity, core of section for rectangular and circular cross sections, Middle third rule.</p> <p>1.3 Chimneys of circular cross section subjected to wind pressure, Maximum and minimum stresses, resultant stresses and distribution diagram at base.</p> <p>1.4 Analysis of dams subjected to horizontal water pressure, conditions of stability, Maximum and minimum stresses, resultant stresses and distribution diagram at base.</p> <p><b>Course Outcome: CO1      Teaching Hours : 12 hrs      Marks: 12 (R- 4, U-4, A-4)</b></p>

<b>2</b>	<p><b>Fixed and Continuous Beam :</b>            3.1 Concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam.            3.2 Principle of superposition, Fixed end moments from first principle for beam subjected to point load, UDL over entire span.            3.3 Application of standard formulae in finding end moments, end reactions and drawing S.F. and B.M. diagrams for a fixed beam.            3.4 Definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical examples.            3.5 Clapeyron's theorem of three moment (no derivation), Application of Clapeyron's theorem maximum up to three spans and two unknown support moment only, Support at same level spans having same and uniform moment of inertia subjected to concentrated loads and uniformly distributed loads over entire span.            3.6 Drawing SF diagrams showing point of contraflexure, shear and BM diagrams showing net BM and point of contraflexure for continuous beams.  <b>Course Outcome: CO3      Teaching Hours:16 hrs      Marks: 14 (R- 4, U- 4, A- 6)</b></p>
<b>3</b>	<p><b>Moment distribution method :</b>            4.1 Introduction to moment distribution method, sign convention, Carry over factor, stiffness factor, distribution factor.            4.2 Application of moment distribution method to various types of continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same or different moment of inertia, supports at same level, up to three spans and two unknown support moments only.            4.3 Introduction to portal frames – Symmetrical and unsymmetrical portal frames with the concept of Bays and stories.  <b>Course Outcome: CO4      Teaching Hours: 12 hrs      Marks: 12 (R- 2 ,U- 4, A- 6)</b></p>
<b>4</b>	<p><b>Slope and Deflection:</b>            2.1 Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation).            2.2 Double integration method to find slope and deflection of cantilever and simply supported beams subjected to concentrated load and uniformly distributed load on entire span.            2.3 Macaulay's method for slope and deflection, application to cantilever and simply supported beam subjected to concentrated and uniformly distributed load on entire span.  <b>Course Outcome: CO2      Teaching Hours: 12 hrs      Marks: 12 (R -2, U- 4, A- 6)</b></p>
<b>5</b>	<p><b>Simple trusses:</b>            5.1 Types of trusses (Simple, Fink, compound fink, French truss, pratt truss, Howe truss, North light truss, King post and Queen post truss)            5.2 Calculate support reactions for trusses subjected to point loads at joints            5.3 Calculate forces in members of truss using Method of joints and Method of sections.  <b>Course Outcome: CO5      Teaching Hours: 8 hrs      Marks: 10 (R- 2, U- 2, A- 6)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Direct and Bending Stresses in vertical members	4	4	4	12
2	Fixed and Continuous Beam	4	4	6	14

3	Moment distribution method	2	4	6	12
4	Slope and Deflection	2	4	6	12
5	Simple trusses	2	2	6	10
<b>Total</b>		<b>14</b>	<b>20</b>	<b>26</b>	<b>60</b>

**List of Tutorials:**

Sr. No.	Unit No	COs	Title of the Tutorials	Hours
1	01	CO1	Assignment 1 : Solving of four problems on Bending Stresses in vertical members.	02
2	02	CO2	Assignment 2 : Solving of four problems on Slope and Deflection.	02
3	03	CO3	Assignment 3 : Solving of three problems on Fixed Beam.	02
4	03	CO3	Assignment 3 : Solving of three problems on Continuous Beam.	03
5	04	CO4	Assignment 4 : Solving of four problems on Moment distribution method.	02
6	05	CO5	Assignment 5 : Solving of four problems Simple trusses.	04
<b>Total</b>				<b>15</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Theory of structures	Ramamrutham.S, Dhanpatrai & Sons.	ISBN-10: 935216427X; ISBN-13: 978-9352164271
2	Theory of structures	Khurmi, R. S. , S. Chand and Co., New Delhi.	ISBN 10: 812192829X ISBN 13: 9788121928298
3	Structural Analysis Vol-1	Bhavikatti, S S , Vikas Publishing House Pvt Ltd.New Delhi.	ISBN 10: 8125942696 ISBN 13: 9788125942696
4	Mechanics of structures, Volume-I and II	Junnarkar, S. B. , Charotar Publishing House, Anand.	ISBN :9789385039270988 ISBN 978-93-85039-02-7
5	Theory of Structures	Pandit, G.S. and Gupta, S.P., Tata McGraw Hill, New Delhi.	ISBN : 0074634933, 9780074634936

**E-References:**

1. <http://www.coursera.org>
2. <http://www.newcastle.edu.au>
3. <http://www.elsevier.com>
4. <http://www.civilenggforall.com>
5. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	--	1	--	1	1	--	--
CO2	3	3	3	--	1	--	1	1	--	--
CO3	3	3	3	--	1	--	1	1	--	--
CO4	3	3	3	--	1	--	1	1	--	--
CO5	3	3	3	--	1	--	1	1	--	--

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. D. Deshpande	Principal	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>AM19402</b>				Course Title: <b>Concrete Technology</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	<b>02</b>	<b>--</b>	<b>06</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>--</b>	<b>25</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

Concrete is most widely used construction material in all types of Civil Engineering Structures. The Civil Engineering technician has to plan, supervise and ensure the quality of final product of concrete, i.e. its durability, strength, tolerance, appearance & finish. To discharge his duties effectively, he must be able to supervise the concrete construction at all stages of concrete chain, which broadly consists of making of concrete and interaction of its various ingredients both in plastic and hardened stage. For this purpose, a technician must know the basic properties of concrete as well as of its ingredients like cement, aggregates, water and admixtures, etc. He should learn and practice the basic principles governing the strength, durability and workability of concrete. He should understand the basic principles of mix-design and develop supervisory skills required for various operations in concrete construction.

**Course Outcomes:** Student should be able to

CO1	Use different types of cement and aggregates in concrete .
CO2	Prepare concrete of desired compressive strength.
CO3	Prepare concrete of required specification.
CO4	Maintain quality of concrete under different conditions.
CO5	Apply relevant admixtures for concreting.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<b>Cement, Aggregates and Water:</b> 1.1 Physical properties of Cement: fineness, standard consistency, setting time, soundness, compressive strength. Relevant BIS codes 1.2 Testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement.

	<p>1.3 BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Portland slag, Composite slag, High Alumina and White cement.</p> <p>1.4 Aggregates: Requirements of good aggregate, Classification according to size and shape.</p> <p>1.5 Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383. Concept of crushed Sand, manufactured sand, slag sand.</p> <p>1.6 Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specifications, Replacement of metal as GGBFS.</p> <p>1.7 Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.</p> <p><b>Course Outcome: CO1      Teaching Hours : 14 hrs      Marks: 14 (R-6, U-6, A-2)</b></p>
2	<p><b>Concrete:</b></p> <p>2.1 Concrete: Different grades of concrete, provisions of IS 456.</p> <p>2.2 Duff Abraham water cement (w/c) ratio law, significance of w/c ratio, selection of w/c ratio for different grades, maximum w/c ratio for different grades of concrete for different exposure conditions as per IS 456.</p> <p>2.3 Properties of fresh concrete: Workability: Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer, flow table test. Value of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures.</p> <p>2.4 Properties of Hardened concrete: Strength, Durability, Impermeability, hydration of cement.</p> <p><b>Course Outcome: CO2      Teaching Hours: 12 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>
3	<p><b>Concrete Mix Design and Testing of Concrete:</b></p> <p>3.1 Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262 (only procedural steps).</p> <p>3.2 Testing of concrete, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results, relation between cylinder strength and cube strength.</p> <p>3.3 Non- destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS13311 (part 1 and 2), Importance of NDT tests.</p> <p><b>Course Outcome: CO3      Teaching Hours: 12 hrs      Marks: 10 (R-2, U-4, A-4)</b></p>
4	<p><b>Quality Control of Concrete:</b></p> <p>4.1 Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete.</p> <p>4.2 Forms for concreting: Different types of form works for beams, slabs, columns, materials used for form work, requirement of good form work. Stripping time for removal of form works per IS 456.</p> <p>4.3 Curing methodology.</p> <p>4.4 Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.</p> <p>4.5 Durability of concrete.</p> <p><b>Course Outcome: CO4      Teaching Hours: 10 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>

<b>5</b>	<b>Chemical Admixture, Special Concrete and Extreme Weather concreting:</b>		
	5.1 Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers (Ligno, SMF, SMI, PCE). Micro silica fume.		
	5.2 Special Concrete: Properties, advantages and limitation of following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete Self-compacting concrete and light weight concrete, geopolymer concrete.		
	5.3 Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition.		
	5.4 Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition.		
5.5 Mass concreting.			
<b>Course Outcome: CO5      Teaching Hours: 12 hrs      Marks: 12 (R-4, U-4, A-4)</b>			

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Cement, Aggregates and Water	6	6	2	12
2	Concrete	4	4	4	12
3	Concrete Mix Design and Testing of Concrete	2	4	4	10
4	Quality Control of Concrete	4	4	4	12
5	Chemical Admixture, Special Concrete and Extreme Weather concreting	4	4	4	12
<b>Total</b>		<b>20</b>	<b>22</b>	<b>18</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	01	CO1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.	02
2	01	CO1	Determine specific gravity, standard consistency, initial and final setting times of cement.	02
3	01	CO1	Determine compressive strength of cement.	02
4	01	CO1	Determine silt content in sand.	02
5	01	CO1	Determine bulking of sand, bulk density of sand and coarse aggregate	02
6	01	CO1	Determine water absorption of fine and coarse aggregates.	02
7	01	CO1	Determine Fineness modulus of fine aggregate by sieve analysis.	02
8	01	CO1	Determine impact value of aggregate.	02
9	01	CO1	Determine crushing value of aggregate.	02
10	01	CO1	Determine abrasion value of aggregate.	02

11	01	CO1	Determine elongation and flakiness index of coarse aggregates.	02
12	02	CO2	Determine workability of concrete by slump cone test.	02
13	02	CO2	Determine workability of concrete by compaction factor test.	02
14	03	CO3	To prepare concrete mix of a particular grade and determine compressive strength of concrete for 7 and 28 days.	02
15	05	CO5	Demonstration of NDT equipments .	02
		<b>Total</b>		<b>30</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Concrete Technology	Gambhir, M.L., Tata McGraw Hill Publishing Co. Ltd., Delhi.	ISBN-13 9781259062551
2	Concrete Technology	Shetty, M.S., S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.	ISBN : 978-81-219-0003-4
3	Concrete Technology	Santhakumar, A. R., Oxford University Press, New Delhi.	ISBN-10: 0199458529; ISBN-13: 978-0199458523
4	Concrete Technology	Neville, A. M. and Brooks, J.J., Pearson Education Pvt. Ltd.	ISBN 10: 9353436559 ISBN 13: 9789353436551
5	Laboratory Manual in Concrete Technology	Sood, H., Kulkarni P. D., Mittal L. N., CBS Publishers, New Delhi.	ISBN : 8123909411, 9788123909417
6	IS 456 : 2000	BIS, New Delhi	---
7	IS 383	BIS, New Delhi	---
8	IS 4031	BIS, New Delhi	---

**E-References:**

- <http://www.cement.org>
- <http://www.j-act.org>
- <http://www.indianconcreteinstitute.org>
- <http://econcretetech.com>
- <http://theconstructor.org>
- <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	--	3	2	--	--	--	3	--
CO2	3	2	--	3	2	1	1	--	3	--
CO3	3	2	3	3	2	1	1	--	3	--
CO4	3	2	1	3	2	1	2	--	3	--

<b>CO5</b>	3	2	--	3	3	--	2	--	3	--
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**Industry Consultation Committee:**

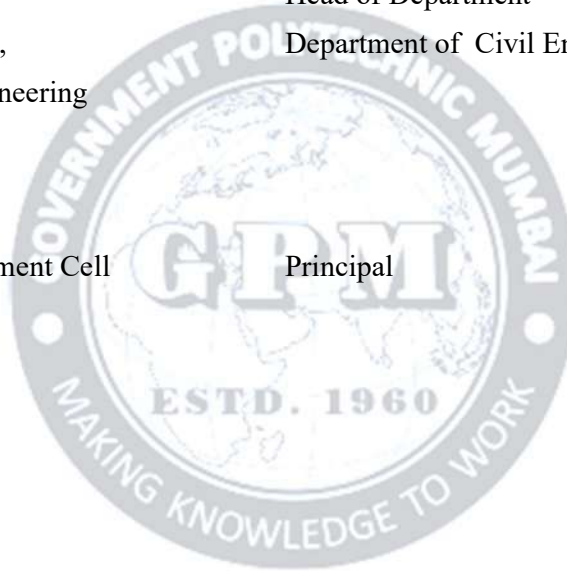
<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S.D.Deshpande	Principal	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19401</b>				Course Title: <b>Hydraulics</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	<b>02</b>	<b>--</b>	<b>05</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>25</b>	<b>--</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

This course is classified under basic technology course and describes facts, concepts, principles and techniques of scientific investigation in the given field. This subject deals with behavior of static or flowing water which is important liquid to be studied in Irrigation Engineering., Water Supply Engineering., and Transportation Engineering. because its behaviour affects design and construction techniques of Civil Engineering structures in Irrigation, Water Engineering and Highway Engineering Building construction is a core course in civil engineering.

**Course Outcomes:** Student should be able to

CO1	Understand various terms associated with hydraulics.
CO2	Measure pressure and determine total hydrostatic pressure for different conditions.
CO3	Understand various parameters associated with fluid flow.
CO4	Determine head loss of fluid flow through pipes.
CO5	Find the fluid flow parameters in open channels.
CO6	Select relevant hydraulic pumps for different applications.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Technical terms used in Hydraulics :</b></p> <p>1.1 Fluid, fluid mechanics, hydraulics, hydrostatics, hydrokinematics, hydrodynamics, ideal and real fluid, application of hydraulics.</p> <p>1.2 Physical properties of fluid – density-specific volume, specific gravity, surface tension, capillarity, viscosity-Newton’s law of viscosity.</p> <p><b>Course Outcome: CO1 Teaching Hours : 3 hrs Marks: 04 (R- 2, U-2, A- 0)</b></p>
2	<p><b>Pressure measurement and Hydrostatic pressure :</b></p> <p>2.1 Various types of pressure – Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure. Concept of Pressure head and its unit, Pascal’s law of fluid pressure and its uses.</p> <p>2.2 Measurement of differential Pressure by different methods.</p> <p>2.3 Variation of pressure with depth, Pressure diagram, hydrostatic pressure and center of</p>

	<p>pressure on immersed surfaces and on tank walls.</p> <p>2.4 Determination of total pressure and center of pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical surface in contact with liquid on either side.</p> <p><b>Course Outcome: CO2    Teaching Hours : 10 hrs    Marks: 12 (R- 2, U-4, A- 6)</b></p>
3	<p><b>Fluid Flow Parameters</b></p> <p>3.1 Types of flow – Gravity and pressure flow, Laminar, Turbulent, Uniform, Non-uniform, Steady, Unsteady flow. Reynolds number.</p> <p>3.2 Discharge and its unit, continuity equation of flow.</p> <p>3.3 Energy of flowing liquid: potential, kinetic and pressure energy.</p> <p>3.4 Bernoulli's theorem : statement, assumptions, equation.</p> <p><b>Course Outcome: CO3    Teaching Hours : 8 hrs    Marks: 10 (R-2 , U-8, A-0)</b></p>
4	<p><b>Flow through pipes</b></p> <p>4.1 Major head loss in pipe: Frictional loss and its computation by Darcy's Weisbach equation, Use of Moody's Diagram and Nomograms.</p> <p>4.2 Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement and fittings.</p> <p>4.3 Flow through pipes in series, pipes in parallel and Dupuit's equation for equivalent pipe.</p> <p>4.4 Hydraulic gradient line and total energy line. Water hammer in pipes: Causes and Remedial measures.</p> <p>4.5 Discharge measuring device for pipe flow: Venturi meter - construction and working.</p> <p>4.6 Discharge measurement using Orifice, Hydraulic Coefficients of Orifice.</p> <p><b>Course Outcome: CO4    Teaching Hours : 10 hrs    Marks: 12 (R- 4, U-2, A- 6)</b></p>
5	<p><b>Flow through Open Channel</b></p> <p>5.1 Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius for rectangular and trapezoidal channel section.</p> <p>5.2 Determination of discharge by Chezy's equation and Manning's equation.</p> <p>5.3 Conditions for most economical rectangular and trapezoidal channel section.</p> <p>5.4 Discharge measuring devices: Triangular and rectangular Notches. • Velocity measurement devices: current meter, floats and Pitot's tube.</p> <p>5.5 Specific energy diagram, Froudes number.</p> <p><b>Course Outcome: CO5    Teaching Hours : 10 hrs    Marks: 12 (R- 2, U-4, A- 6)</b></p>
6	<p><b>Hydraulic Pumps</b></p> <p>6.1 Concept of pump, Types of pump - centrifugal, reciprocating, submersible.</p> <p>6.2 Centrifugal pump: components and working of Reciprocating pump: single acting and double acting, components and working.</p> <p>6.3 Suction head, delivery head, static head, Manometric head</p> <p>6.4 Power of centrifugal pump.</p> <p>6.5 Selection and choice of pump</p> <p><b>Course Outcome: CO6    Teaching Hours : 4 hrs    Marks: 08 (R- 4, U-4, A-0 )</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Technical terms used in Hydraulics Introduction	4	2	--	06

2	Pressure measurement and Hydrostatic pressure	2	4	6	12
3	Fluid Flow Parameters	2	8	--	10
4	Flow through pipes	4	2	6	12
5	Flow through Open Channel	2	4	6	12
6	Hydraulic Pumps	4	4	--	08
<b>Total</b>		<b>18</b>	<b>24</b>	<b>18</b>	<b>60</b>

**List of experiments:**

/Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	2	CO2	Use piezometer to measure pressure at a given point.	2
2	2	CO2	Use Bourdon's Gauge to measure pressure at a given point.	2
3	2	CO2	Use U tube differential manometer to measure pressure difference between two given points.	2
4	3	CO2	Find the resultant pressure and its position for given situation of liquid in a tank.	2
5	3	CO3	Use Reynold's apparatus to determine type of flow.	2
6	3	CO3	Use Bernoulli's apparatus to apply Bernoulli's theorem to get total energy line for a flow in a closed conduit of varying cross sections	2
7	4	CO4	Use Friction factor Apparatus to determine friction factor for a given pipe	2
8	4	CO4	Determine minor losses in pipe fittings due to sudden contraction and sudden enlargement.	2
9	4	CO4	Determine minor losses in pipe fitting due to Bend and Elbow.	2
10	4	CO4	Calibrate Venturimeter to find out the discharge in a pipe	2
11	4	CO4	Calibrate the Orifice to find out the discharge through a tank	2
12	4	CO4	Use Pitot tube to measure the velocity of flow of water in open channel.	2
13	5	CO5	Use triangular notch and Rectangular notch to measure the discharge through open channel.	4
14	6	CO6	Determine the efficiency of centrifugal pump.	2
<b>Total</b>				<b>30</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Hydraulics and Fluid Mechanics	Modi, P. N. and Seth, S.M., Standard book house, Delhi.	ISBN;8189401262



2	A text book of Fluid mechanics and Hydraulic Machines	R.K.Bansal Laxmi publication pvt.ltd,ninth edition ,2005	ISBN;8131808157
3	Fluid Mechanics and Fluid Machines	Ramamrutham, and Narayan, R., Dhanpat Rai publishing Company	ISBN;9788187433842
4	Fluid Mechanics & Hydraulic Machines,	Khanna Book Publishing Co., New Delhi	ISBN;9788187433842

**E-Reference :**

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3. www.shiksha.com, IIT, Roorkee
4. [www.blackwellpublishing.com](http://www.blackwellpublishing.com)
5. [www.hrpwa.org](http://www.hrpwa.org)
6. www.creativeworld9.com vii.nptel.iitm.ac.in
7. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping :**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	1	3	1
CO2	2	3	3	3	2	3	2	1	3	3
CO3	2	3	3	3	2	3	2	1	3	3
CO4	2	3	3	3	2	3	2	1	3	3
CO5	2	3	3	3	2	3	2	1	3	3
CO6	2	3	3	3	2	3	2	1	3	2

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Smt.Meera Anserwadekar	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19402</b>				Course Title: <b>Environmental Engineering</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	<b>02</b>	<b>--</b>	<b>06</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>25*</b>	<b>25</b>	<b>150</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

Water is a basic need of everyday living. With growing need of water for irrigation, industry, drinking water, hydropower, pollution free water has assumed greater importance. Similarly waste in form of solid and liquid if not treated and disposed of in a scientific and hygienic manner ,may lead to health hazards, The job of civil engineer is to conduct survey, collect data, prepare drawings, and supervise construction of water and waste water treatment plants .This subject is intended to teach the students concepts, principles and procedures of Environmental Engineering which will enable him to apply this knowledge for construction, supervision, execution of Environmental Engineering projects

### Course Outcomes: Student should be able to

CO1	Calculate quantity and analyze quality of water.
CO2	Select type of treatment required to raw water.
CO3	Perform execution and maintenance of distribution system
CO4	Perform execution and maintenance of sewerage system
CO5	Decide treatment of sewage and its safe disposal
CO6	Prepare layout plan for building drainage system.

### Course Content Details:

No	Topics / Sub-topics
1	<p><b>Water Works, Quantity and Quality of water</b></p> <p>1.1 <b>Water works:</b> Necessity and importance of water works, components in water works, Components in water supply scheme</p> <p>1.2 <b>Quantity of water:</b> Per capita demand, factors affecting rate of demand, fluctuations in demand and its effects on design of water supply units. Types of demand-Domestic, Public, Industrial, Fire fighting, Compensate losses and waste. Design period, Population forecasting- Methods of population forecasting. Sources of Water- Surface &amp; subsurface sources, choice of source, Intake works – types, factors affecting location.</p>

	<p><b>1.3 Quality of water:</b> Potable/ Wholesome water, Impurities in water, water sampling, Water analysis – Physical, Chemical, Bacteriological test and their significance. Water quality standards. Water borne diseases.</p> <p><b>Course Outcome: CO1      Teaching Hours :12    Marks:12 (R-4 , U- 4 , A- 4)</b></p>
2	<p><b>Treatment of Water</b></p> <p>2.1 Components in water treatment plant:- Object of water treatment, Flow diagram of water treatment plant, Functions of each unit, constructional details of screens chamber , aerators, grit chamber, sedimentation units, flash mixer , clariflocculator.</p> <p>2.2 Filtration – Theory of filtration, Types – slow sand; rapid sand &amp; pressure filter.</p> <p>2.3 Disinfection:-Object of disinfection, Methods of disinfection. Chlorination- Properties of chlorine, action of chlorine. Forms of chlorination, Break point chlorination-its importance, residual chlorine. Tests for residual chlorine.</p> <p><b>Course Outcome: CO2      Teaching Hours :10    Marks:10 (R-2 , U- 4 , A- 4)</b></p>
3	<p><b>Conveyance and Distribution of water</b></p> <p>3.1 Conveyance: Meaning, pipes used in conveyance of water. Laying and testing of pipes.</p> <p>3.2 Distribution system: Gravity, Pumping and Dual system. Layouts of distribution system – dead end, grid iron, radial &amp; ring. Requirements of a good distribution system.</p> <p>3.3 Valves- Sluice valve, air relief valve, pressure relief valve, non-return valve</p> <p>3.4 Service reservoirs- functions, types, location &amp; capacity.</p> <p>3.5 System of supply Continuous &amp; intermittent.</p> <p>3.6 Layout of building water supply arrangement.</p> <p>3.7 Maintenance of distribution system.</p> <p><b>Course Outcome:CO3      Teaching Hours :8    Marks:08 (R- 2, U- 2 , A- 4)</b></p>
4	<p><b>Sewerage systems, Design and Maintenance of sewer</b></p> <p>4.1 Definition of terms: Sewage, sullage, refuse, garbage, sanitary sewage, storm water. Methods of sewage collection -Conservancy &amp; water carriage system.</p> <p>4.2 Systems of sewerage: Separate, combined &amp; partially separate systems.</p> <p>4.3 Quantity of sewage – Factors affecting quantity of sewage, peak flow, minimum flow,</p> <p>4.4 Types of sewer based on material of construction and shapes of sewer.</p> <p>4.5 Design of sewers: Peak flow, non-scouring velocity, self-cleansing velocity, gradient of sewer, size of sewer, Laying and testing of sewers.</p> <p>4.6 Sewer appurtenances: Manholes-types, purpose, location. Inlets, Ventilation of sewers.</p> <p>4.7 Maintenance of sewers. Safety precautions during maintenance of sewers.</p> <p><b>Course Outcome:CO4      Teaching Hours : 12    Marks:12 (R-4 , U-4, A-4)</b></p>
5	<p><b>Characteristics, Treatment &amp; Disposal of Sewage</b></p> <p>5.1 Characteristics of sewage: Physical, Chemical and biological. Strength of sewage.</p> <p>5.2 Aerobic and anaerobic decomposition, Importance of BOD and its significance, COD and its significance</p> <p>5.3 Treatment of sewage- Layout of STP, Preliminary treatment - Screening; grit removal; grease removal, Primary treatment – sedimentation &amp; chemical precipitation, Secondary treatment – Trickling filter &amp; activated sludge process.</p> <p>5.4 Sludge &amp; effluent disposal-Types of sludge, method of sludge disposal. Natural &amp; artificial methods of disposal of effluent, Miscellaneous treatment – oxidation pond &amp; ditch,</p>

	aerated & anaerobic lagoons. <b>Course Outcome:CO5 Teaching Hours :12 Marks:12 (R- 2 , U- 4 , A-6 )</b>
6	<b>Building Drainage System</b> 6.1 Systems of plumbing- Single stack, One pipe and One pipe partially ventilated, Two pipe system. 6.2 Components of house drainage system- Traps, Inspection chamber, Sanitary fittings, Layout of building drainage system, Recycling of waste water <b>Course Outcome:CO6 Teaching Hours :6 Marks:06 (R- -- , U-2 , A-4 )</b>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Water Works, Quantity and Quality of water	4	4	4	12
2	Treatment of Water	2	4	4	10
3	Distribution of water	2	2	4	08
4	Sewerage systems, Design and Maintenance of sewer.	4	4	4	12
5	Characteristics, Treatment & Disposal of Sewage	2	4	6	12
6	Building Drainage System	-	2	4	06
<b>Total</b>		<b>14</b>	<b>20</b>	<b>26</b>	<b>60</b>

**List of experiments/ Assignments:**

Sr. No.	Unit No	COs	Title of the Experiments/Assignment	Hours
1	1	CO1	Conduct test on water sample to determine its 1) pH 2) Turbidity	2
2	2	CO2	Conduct test on water sample for determination of optimum dose of coagulant.	2
3	3	CO3	Study of different fixtures used in building water supply arrangement at G.P.Mumbai and prepare report.	2
4	4	CO4	Assignment on maintenance of sewers.	2
5	5	CO5	Conduct test on sewage sample to determine its 1) pH 2) Turbidity	2
6	6	CO6	Visit to residential/ public building to study different systems of plumbing and sanitary fittings and prepare report.	2
7	1	CO1	Collecting data regarding population of city/town and forecast population and find out total water demand.	2
8	1	CO2	Visit to Water Treatment plant to study various treatment units and their function. Prepare detail visit report.(Compulsory)	8
9	2	CO5	Visit to Sewage Treatment plant to study various treatment units and their function. Prepare detail visit report.(Compulsory)	8
<b>Total</b>				<b>30</b>

**Note: All experiments are compulsory.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Elements of Public Health Engg.	K.N. Duggal, S. Chand & Co. Delhi.	9788121900126
2	Water Supply & Waste water Engg. (Two vol.)	S. K. Garg, Khanna Publisher, Delhi	13:978-8174091208, 8174092307
3	Water Supply & Sanitary Engg	G.S. & J. S. Biridie, Dhanpat Rai & Sons,, Delhi	13:978-8787433798, 9789352165773
4	Environmental Engg	A. Kamala & D.L. Kanth Rao Tata Mc-Graw-Hill publishing co. Ltd., Delhi.	0074517082, 9780074517086
5	Water Supply & Sanitary Engg.	S.C.Rangwala India Publishing house Delhi.	9789385039201
6	Water Supply & Waste Water Engg. (Two vol.)	Dr. B.C.Punmia & Jain Laxmi Publication, Jodhpur	13:978-8131807033, 13:978-8131805961
7	Water Supply & Waste Water Engg. (Two vol.)	B. S. N. Raju Tata Mc-Graw-Hill publishing co. Ltd., Delhi.	0074518739
8	Water Supply Engg. Volume – I & II	P. N. Modi Standard book house, Delhi	13:9788190089326

**E-References:**

1. [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)
2. [www.icivilengineer.com](http://www.icivilengineer.com)
3. [www.epa.net](http://www.epa.net)
4. [www.mud/cpheeo.in](http://www.mud/cpheeo.in)
5. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	2	2	3
CO2	3	3	3	2	2	1	2	2	2	3
CO3	3	3	2	2	2	1	2	2	2	3
CO4	3	3	3	2	2	2	2	2	2	3
CO5	3	3	3	3	2	1	2	2	2	3
CO6	3	2	3	3	2	1	2	2	2	2

**Industry Consultation Committee:**

<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Mr. D. K. Fad	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engg.

Head of Department  
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19403</b>				Course Title: <b>Computer Aided Drafting</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>01</b>	<b>04</b>	--	<b>05</b>	--	--	--	<b>50</b>	--	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

As diploma engineer student must know more about computer operation & its applications. In order to work in software engineering fields in Civil Engineering the student must know drafting methodologies and their applications to various Civil Engineering fields. Using CAD software it is easy to create and modify drawings. In civil engineering industry operating skills are required for computer aided drafting, handling of printers & plotters.

**Course Outcomes:** Student should be able to

CO1	Understand the importance of CAD.
CO2	Use different CAD commands for drawing.
CO3	Draw, edit and modify 2D drawings.
CO4	Understand organize the drawing.
CO5	Understand various latest software packages being used in Civil Engineering.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Introduction :</b></p> <p>1.1 Introduction to CAD, Applications, Advantages of CAD, CAM, CAE, pre-requisite (hardware and software).</p> <p>1.2 CAD Packages available in market, Auto CAD, Omega Designer, P-CAD, Robo CAD, Felix CAD, IntelliCAD, LisCAD.</p> <p>1.3 Auto CAD and manual drafting, advantage. System requirements, CAD peripherals, 1.4 Opening screen, functional and control keys, WCS, UCS.</p> <p><b>Course Outcome: CO1 Teaching Hours: -- Marks: 08 (R- NA, U-NA, A- NA)</b></p>
2	<p><b>Draw and Enquiry commands :</b></p> <p>2.1 Line, circle, arc, Redraw, Erase, Undo, Redo, Osnap, Ellipse, Polygon, copy move, setting up of drawing, Paper sizes, limits, layers, Grid, snap zoom, pan, Region, Color,</p>

	Array, Rotate, Scale, Trim, Break, Extend, Fillet, Chamfer, Text, mirror, Stretch, Line mode, Arc mode, area list  <b>Course Outcome: CO2 Teaching Hours: -- Marks:12 (R- NA, U-NA, A- NA)</b>
3	<b>Dimensioning Commands :</b> 3.1 Drawing, Dim, Dim scale, Linear, Angular, Adjustable, Geometric dimension, Editing dimension text and variables.  <b>Course Outcome: CO3 Teaching Hours: -- Marks: 12 (R- NA, U-NA, A- NA)</b>
4	<b>Organization Drawing :</b> 4.1 Layers, layer state creating new layer Changing object properties. 4.2 Drawing set up – Controlling unit display, sizing the drawing sheet, creating new drawing with Wizards and Templates.  <b>Course Outcome: CO4 Teaching Hours: -- Marks:12 (R- NA, U-NA, A- NA)</b>
5	<b>Study of latest software packages used in Civil Engineering:</b> 5.1 For drafting and modeling :- Auto CAD, Microstation, Smart sketch, Revit, Inroads, Speedicon, Triforma, ZCADD 5.2 For analysis:- STADPRO, GTSTRUDD, Tekla, SDS2, Auto CAD plant 3D-2019 <b>Course Outcome: CO5 Teaching Hours: -- Marks: 06 (R- NA, U-NA, A- NA)</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Assignment on introduction , Applications & advantages of CAD	02
2	2,3,4	CO2, CO3	<b>Practice exercises for following topics</b> 1. Set the initial view. 2. Use of Draw command. 3. Use of Edit command. 4. Use of Modify command. 5. Apply dimensions.	08
3	2,3,4	CO2, CO3, CO4	Drawing of 2 BHK – Plan of building, Elevation, Section, Isometric view of any object, etc.	18
4	2,3,4	CO2, CO3, CO4	To prepare, drawing for any civil engineering, RCC/ Steel structure using any available CAD package.	18
5	2,3,4	CO2, CO3, CO4	To prepare General Arrangement drawing- GAD to show services details such as furniture arrangements, electric points, water line, drainage line)	14
		<b>Total</b>		<b>60</b>



**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Auto CAD Practice 2018	BPB Publication, New Delhi	ISBN 9789386551870
2	Bently Software and Intigraph	--	--
3	Applying AutoCAD 2008	McGraw Hill , New Delhi	ISBN 9780078801532

**E-References:**

1. [www.udemy.com](http://www.udemy.com)
2. <http://www.quora.com>
3. <http://thesourcecad.com>
4. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	3	--	--
CO2	3	3	3	2	1	1	3	3	--	--
CO3	3	3	3	2	1	1	3	3	--	--
CO4	3	3	3	2	1	1	3	3	--	--
CO5	3	3	3	2	1	1	3	3	--	--

**Industry Consultation Committee:**

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3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code:CE19404				Course Title: <b>Repairs &amp; Rehabilitation of Building</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

In present scenario advent of advanced analysis and design techniques, the safety margin has decreased considering slender sections of structural elements than before. This economics choice has increased the importance of vigilant supervision in maintenance, accurate workmanship in maintenance and good management for safety and serviceability of the structures more than before.

In a well-managed building, maintenance work in fact should continue throughout the year under an adequate preventive maintenance policy. "The prevention is better than cure" is an axiom well applicable to maintenance of building also.

**Course Outcomes:** Student should be able to

CO1	Decide which type of maintenance is needed for a given damaged structure.
CO2	Assess causes of damages various types of structures.
CO3	Select the relevant material for repair of the given structure.
CO4	Apply relevant method of retrofitting for re-strengthening of structures.
CO5	Suggest relevant technique to restore the damages of the given structural elements.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Basics of maintenance :</b></p> <p>1.1 Types of Maintenances - repair, retrofitting, re-strengthening, rehabilitation and restoration.</p> <p>1.2 Necessity, objectives and importance of maintenance.</p> <p>1.3 Approach of effective management for maintenance.</p> <p>1.4 Periodical maintenance: check list, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, corrective maintenance procedures and sources. Pre- and post- monsoon maintenance.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 8 hrs Marks: 10 (R- 6, U-4, A-0)</b></p>

2	<p><b>Causes and detection of damages :</b></p> <p>2.1 Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, deterioration, termites, pollution and foundation settlement.</p> <p>2.2 Various aspects of visual observations for detection of damages.</p> <p>2.3 Load test and non-destructive tests (brief description). NDT tests on damaged structure such as rebound hammer, ultrasonic pulse velocity, rebar locator, crack detection microscope, digital crack measuring gauge.</p> <p>2.4 Chemical test - Chloride test, sulphate attack, carbonation test, pH measurement, resistivity method, Half-cell potential meter (Introduction and demonstration only).</p> <p><b>Course Outcome: CO2 , Teaching Hours :12 hrs Marks: 12 (R- 4, U-6, A-2 )</b></p>
3	<p><b>Materials for maintenance and repairs :</b></p> <p>3.1 Types of repair material, material selection.</p> <p>3.2 Essential parameters for maintenance and repair materials such - bond with substrate, durability.</p> <p>3.3 Waterproofing materials based on polymer modified cement slurry, UV resistant acrylic polymer, ferro-cement.</p> <p>3.4 Repairing materials for masonry: plastic/aluminum nipples, non-shrink cement, polyester putty or 1:3 cement sand mortar, galvanized steel wire fabrics and clamping rods, wire nails, ferro-cement plates.</p> <p>3.5 Repairing materials for RCC: epoxy resins, epoxy mortar, cement mortar impregnated with polypropylene, silicon, polymer concrete composites, sealants, fiber reinforcement concrete, emulsions and paints.</p> <p><b>Course Outcome: CO3 , Teaching Hours : 14 hrs Marks: 14 (R-4, U-6, A-4)</b></p>
4	<p><b>Maintenance and repair methods for masonry Construction :</b></p> <p>4.1 Causes of cracks in walls - bulging of wall, shrinkage, bonding, shear, tensile, vegetation.</p> <p>4.2 Probable crack location: junction of main and cross wall, junction of slab and wall, cracks in masonry joints.</p> <p>4.3 Repair methods based on crack type - For minor &amp; medium cracks (width 0.5 mm to 5mm): grouting and for major cracks (width more than 5mm): fixing mesh across cracks, RCC band, installing ferro-cement plates at corners, dowel bars, propping of load bearing.</p> <p>4.4 Remedial measures for dampness &amp; efflorescence in wall.</p> <p><b>Course Outcome: CO4, Teaching Hours :12hrs Marks: 12 (R- 4, U-4, A- 4)</b></p>
5	<p><b>Maintenance and repair methods for RCC Construction :</b></p> <p>5.1 Repair stages such as concrete removal and surface preparation, fixing suitable formwork, bonding/passive coat and repair application, various methods of surface preparation.</p> <p>5.2 Repair options such as grouting, patch repairs, carbonated concrete, cleaning the corroded steel, concrete overlays, latex concrete, epoxy bonded mortar and concrete, polymer concrete, corrosion protection such as jacketing.</p> <p>5.3 Building cracks and its prevention, common methods for dormant crack repairs such as Epoxy injection, grooving and sealing, stitching, grouting and guniting/shotcreting.</p> <p>5.4 Strengthening methods for live cracks such as addition of reinforcements, Jacketing, brackets, collars, supplementary members i.e. shoring, underpinning and propping of framed structure.</p> <p>5.5 FRP, Micro Concrete &amp; its methodology.</p> <p><b>Course Outcome: CO5 , Teaching Hours :14 hrs Marks: 12 (R-4, U-4, A-4)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Basics of maintenance	6	4	--	10
2	Causes and detection of damages	4	6	2	12
3	Materials for maintenance and repairs	4	6	4	14
4	Maintenance and repair methods for masonry Construction	4	4	4	12
5	Maintenance and repair methods for RCC Construction	4	4	4	12
<b>Total</b>		<b>22</b>	<b>24</b>	<b>14</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Building Repair and Maintenance Management	Gahlot, P. S., Sharma, S., CBS Publishers & Distributors Pvt. Ltd., New Delhi	ISBN: 9788123912431
2	Maintenance and Repairs of Buildings	Guha, P. K., Maintenance and Repairs of Buildings, New Central Book Agencies	ISBN 10: 8173810737 ISBN 13: 9788173810732
3	Maintenance and Repairs of Buildings	Hutchin Son, B. D., Maintenance and Repairs of Buildings, Newnes-Butterworth	ISBN 10: 0408001917 ISBN 13 : 9780408001915
4	Relevant BIS codes	BIS New Delhi	--

**E-Reference :**

1. <http://www.acea.be/industry-topics/repairs-and-maintenance>
2. <http://theconstructor.org>
3. <http://www.nqr.gov.in>
4. <http://www.researchgate.net>
5. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping :**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	3	3	--	--	3	2	1	3	--
CO2	3	3	3	2	2	3	2	1	3	--

<b>CO3</b>	3	3	3	3	2	3	2	1	3	--
<b>CO4</b>	3	3	3	3	2	3	2	1	3	--
<b>CO5</b>	3	3	3	3	2	3	2	1	3	--

**Industry Consultation Committee:**

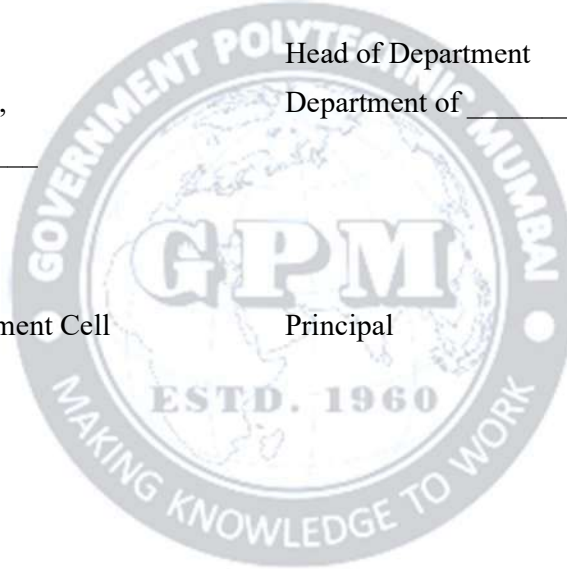
<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Mr. P.A. Pisal	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19405</b>				Course Title: <b>Building Services &amp; Maintenance</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

Building Services and its maintenance is a crucial course, as its having a great demand from building industry. AS buildings are becoming more complex and more modern, building services like plumbing, HVAC, fire safety, lighting & acoustics are necessary to include in Civil Engineering curriculum. This is important course as it include 20 % of construction cost. The students should able to classify various types of building services as per requirements. He can justify the necessity of designing the various building services.

**Course Outcomes:** Student should be able to

CO1	Classify various types of building services as per functional requirements.
CO2	Propose the fire safety requirements for multi-storeyed building.
CO3	Devise suitable water supply and sanitation system for given type of building.
CO4	Evaluate the potential of rain water harvesting and solar water heater system for the given type of building.
CO5	Justify the necessity of designing the system of lighting, ventilation and acoustics for the given type of building.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Overview of Building Services :</b></p> <p>1.1 Introduction to building services, Classification of buildings as per National Building code, Necessity of building services, Functional requirements of building, Different types of building services i.e. HVAC (Heat, Ventilation and Air Conditioning), Escalators and lifts, fire safety, protection and control, plumbing services, rain water harvesting, solar water heating system, lighting, acoustics, sound insulation and electric installation etc.</p> <p>1.2 Role and responsibility of Building Service Engineer, Introduction to BMS (Building Management Services), Role of BMS, concept of smart building.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 8 hrs Marks: 10 (R- 6, U-4, A-0)</b></p>

2	<p><b>Modes of vertical communication :</b></p> <p>2.1 Objectives and modes of vertical communication in building.</p> <p>2.2 Lifts: Different types of lifts and its uses, Component parts of Lift- Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push etc., Design provisions for basic size calculation of space enclosure to accommodate lift services, Safety measures.</p> <p>2.3 Escalators: Different Types of Escalators and its Uses, Components of escalators, Design provisions for basic size calculation of space enclosure to accommodate escalator services, Safety measures.</p> <p>2.4 Ramp: Necessity, design consideration, gradient calculation, layout and Special features required for physically handicapped and elderly.</p> <p><b>Course Outcome: CO2 , Teaching Hours :12 hrs Marks: 12 (R- 4, U-4, A-4 )</b></p>
3	<p><b>Fire Safety :</b></p> <p>3.1 Fire protection requirements for multi-storeyed building, causes of fire in building, Fire detecting and various extinguishing systems, Working principles of various fire protection systems.</p> <p>3.2 Safety against fire in residential and public buildings (multi-storeyed building), National Building Code provision for fire safety, Fire resisting materials and their properties, Fire resistant construction, procedures for carrying out fire safety inspections of existing buildings, Provisions for evacuation.</p> <p><b>Course Outcome: CO3 , Teaching Hours : 12 hrs Marks: 12 (R-4, U-6, A-2)</b></p>
4	<p><b>Plumbing Services :</b></p> <p>4.1 Importance of plumbing, AHJ (Authority Having Jurisdiction) approval, Plumbing Terminology and fixtures: Terms used in plumbing, Different types of plumbing fixtures, shapes/ sizes, capacities, situation and usage, Traps, Interceptors.</p> <p>4.2 System of plumbing for building water supply: storage of water, hot and cold water supply system.</p> <p>4.3 System of plumbing for building drainage: Types of drainage system such as two pipe system, one pipe system, types of Vents and purpose of venting, Concept of grey water and reclaimed water.</p> <p>4.4 Different pipe materials, and jointing methods, fittings, hanger, supports and valves used in plumbing and their suitability.</p> <p><b>Course Outcome: CO4, Teaching Hours :14 hrs Marks: 14 (R- 4, U-6, A- 4)</b></p>
5	<p><b>Lighting, Ventilation and Acoustics :</b></p> <p>5.1 Concept of SWH (Solar water heating), component parts of SWH, various system of SWH (heat transfer, propulsion, passive direct system, active direct system, Do-it-yourself), installation and maintenance.</p> <p>5.2 Concept of lighting, types of lighting (natural and artificial), factors influencing the brightness of room, factors affecting selection of artificial lighting, installation of light (direct, half-direct, indirect, half-indirect and direct-indirect), types of light control (manual switch, remote switch, timer switch and photo-electric cell switch), types of lamps (incandescent, tungsten halogen and electric discharge), Lamp selection as per room sizes. Hymas light</p> <p>5.3 Concept of ventilation, necessity and Types of ventilation.</p> <p>5.4 Building Acoustic, Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator)</p> <p><b>Course Outcome: CO5 , Teaching Hours :14 hrs Marks: 12 (R-4, U-4, A-4)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Overview of Building Services	6	4	--	10
2	Modes of vertical communication	4	4	4	12
3	Fire Safety	4	6	2	12
4	Plumbing Services	4	6	4	14
5	Lighting, Ventilation and Acoustics	4	4	4	12
<b>Total</b>		<b>22</b>	<b>24</b>	<b>14</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Building Services	Patil, S. M., Seema Publication, Mumbai.	ISBN: 9788175259805
2	The A to Z of Practical Building Construction and its Management	Mantri and Sandeep.Satya Prakashan, New Delhi.	ISBN-10: 9351921417; ISBN-13: 978-9351921417
3	Fire Services in India: History, Detection, Protection, Management	Bag S P, Mittal Publications, New Delhi.	ISBN-10: 8170995981
4	Plumbing Design and Practice	Deolalikar, S. G., McGraw-Hill	ISBN-10: 9339221311
5	Principles of Fire Safety Engineering: Understanding Fire and Fire Protection	Akhil Kumar Das., PHI Learning Pvt. Ltd, New Delhi.	ISBN : 9789389347234
6	Practical handbook on building maintenance	Gupta M K, Civil works, Nabhi Publications.	ISBN : 8172746903, 9788172746902
7	Solar panel installation guide & user manual	Shraman N L, The Memory Guru of India.	ISBN: 978-0-9942464-1-7
8	National Building Code Part1, 4, 8, 9	BIS New Delhi	--
9	IS 12183(Part 1):1987 Code of practice for plumbing in multistoried buildings	BIS New Delhi	--
10	2008 Uniform plumbing code – India (UPC-I	BIS New Delhi	--

**E-Reference :**

1. <http://www.cibse.org>
2. <http://wbdg.org>
3. [http://www.designingbuilding.co.uk/wiki/buiding\\_services](http://www.designingbuilding.co.uk/wiki/buiding_services)
4. <http://www.premierschoolofbuilding.com>
5. <http://www.nationallibrary.gov.in>



**CO Vs PO and CO Vs PSO Mapping :**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	--	3	--	2	3	3	--	3	--
CO2	3	3	3	--	2	3	3	--	3	--
CO3	3	3	2	1	3	3	3	--	3	--
CO4	3	2	3	1	3	3	3	--	3	--
CO5	3	3	3	1	3	3	3	--	3	--

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Mr. P.A. Pisal	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19406</b>				Course Title: <b>Material Management</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

This course deals with management of materials. Smooth running of any industry depends upon the interdepartmental relations and planning for execution of work jointly. Efficiency of production department also depends upon the availability of raw material of required quality and quantity. Therefore there should be proper co-ordination between production department, production planning, stores department and purchase department. Incorrect materials planning can also lead to higher inventories and high cost.

**Course Outcomes:** Student should be able to

CO1	Performs functions of material management.
CO2	Manage inventory of materials by various inventory management techniques.
CO3	Buy Materials by following particular procedure and price forecasting.
CO4	Prepare requisition of materials along with specifications.
CO5	Materials management using latest techniques.
CO6	Negotiation using different techniques and management of obsolete surplus and scrap materials.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Importance of Material Management :</b></p> <p>1.1 Growing importance of material management, Scope, Objectives, Organizing for Materials Management.</p> <p>1.2 Importance of specifications in Materials Management.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 6 hrs Marks: 06 (R- 4, U-2, A-0)</b></p>
2	<p><b>Inventory Management :</b></p> <p>2.1 Selective control – ABC Analysis – Purpose and objectives of ABC Analysis Mechanics</p> <p>2.2 Advantages and limitations of ABC Analysis</p> <p>2.3 Order point – Lead Time, Safety stock , re-order point , standard order and</p>

	Economic order 2.4 Quantity (EOQ) , Graphical & Analytical Method. <b>Course Outcome: CO2 , Teaching Hours : 10 hrs Marks:10 (R- 2, U-4, A-4 )</b>
3	<b>Buying Procedure :</b> 3.1 Sourcing Buy or lease 3.2 Purchase systems 3.3 Problems in relations with supplier 3.4 Value Analysis - Definition & Scope 3.5 Selection of products for value analysis 3.6 Value analysis framework 3.7 Implementation & Methodology. 3.8 Ethics in purchasing. <b>Course Outcome: CO3 , Teaching Hours : 12 hrs Marks: 14 (R-4, U-6, A-4)</b>
4	<b>Inventory Control &amp; Cost reduction techniques</b> 4.1 Inventory turns ratios 4.2 Standardization need & importance 4.3 Codification – concept benefits 4.4 Value engineering & Value analysis concept & process 4.5 Inventory of recycled materials for the various constructions. <b>Course Outcome: CO4, Teaching Hours :12 hrs Marks: 10 (R- 4, U-6, A-0)</b>
5	<b>Latest Techniques in Materials Management</b> 5.1 Just in Time ( JIT) zero inventory concept 5.2 Integrated computerized management systems in Materials Management. 5.3 Introduction to SAP <b>Course Outcome: CO5 , Teaching Hours :10 hrs Marks: 10 (R-4, U-4, A-2)</b>
6	<b>Management of obsolete Surplus and Scrap Material</b> 6.1 Definitions, Reasons for generation and accumulation of obsolete Surplus and scrap, Survey committee, presale preparations, sale auction sale by tender. 6.2 Interlinking between material management and construction planning. <b>Course Outcome: CO5 , Teaching Hours :10 hrs Marks: 10 (R-4, U-4, A-2)</b>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Importance of Materials Management	4	2	--	06
2	Inventory Management	2	4	4	10
3	Buying procedure	4	6	4	14
4	Inventory control & Cost reduction techniques	4	6	--	10
5	Latest Techniques in Materials Management	4	4	2	10

6	Management of obsolete Surplus and Scrap material	4	4	2	10
<b>Total</b>		<b>22</b>	<b>26</b>	<b>12</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Materials Management	Ammer Deans S., R.D. Irwin Hllions	ISBN-10: 0256021465; ISBN-13: 978-0256021462
2	Materials Management An Integrated Approach	P. Gopalkrishan and M. Sundaresan, Prentice – Hall of India Pvt. Ltd. New Delhi.	ISBN 10: 8120300270 ISBN 13 : 9788120300279
3	An Integrated concept of Materials Management	M.M. Shah, Tata McGraw Hill Publisher Co. Ltd. New Delhi	ISBN 97893 8116 2538

**E-Reference :**

1. <http://www.iimmmumbai.org>
2. <http://www.wikipedia.com>
3. <http://www.constructionmaterials.org.in>
4. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping :**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	--	--	--	3	2	--	3	--
CO2	3	3	3	2	2	3	2	--	3	--
CO3	3	3	3	3	2	3	2	--	3	--
CO4	3	2	3	3	2	3	2	--	3	--
CO5	3	3	3	3	3	3	2	--	3	--

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Coordinator,  
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Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code:CE19407				Course Title: <b>Safety and Quality Control</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

Success of any industry depends on quality of their products. With the changing scenario of industries are adapting system standardization & concept of quality is changed to quality is not to be inspected but to be built in, quality is not the responsibility of any one department and evaluation of the quality control programmed of that industry. The subject imparts knowledge so that student understands & performs his nature of job related to quality control effectively.

This subject deals with the scope of safety in construction operations as well as in the demolition operation. It also deals with importance of safety with regards to storage, stocking and handling of materials of construction.

### Course Outcomes: Student should be able to

CO1	Understand safety measures and causes of accidents in construction.
CO2	Understand Safety practices to be adopted during Construction operation.
CO3	Safety practices to be adopted during demolition operation.
CO4	Understand Safety practices to be adopted during stocking and storage.
CO5	Study statutory obligations about safety and accident prevention.
CO6	Analyse the aspects of quality such as quality in design, quality in conformance and quality in performance.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<p><b>Meaning and scope of safety in construction:</b></p> <p>1.1 Basic philosophy peculiarities and parameters governing the safety in construction such as site planning and layout, safe access, good house-keeping.</p> <p>1.2 Accidents and hazards- their causes and effects.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 4hrs Marks: 04 (R- 2, U-2, A-0)</b></p>

2	<p><b>Safety in construction operation:</b></p> <p>2.1 Safety in the use of construction machineries.</p> <p>2.2 Movement of construction machinery- heavy/ long items, earth moving equipments. Railway wagons, motor trucks, materials, vehicles, etc.</p> <p>2.3 Safety in prevention &amp; protection at work site including the collapsing of the structure.</p> <p>2.4 Safety in use of explosives- open cast machinery, quarrying.</p> <p>2.5 Project management and safety in construction- Introduction, manpower utilization, utilization of material, equipment and tools. Temporary installation and structures.</p> <p>2.6 Special precautions for works of engineering, construction like distilling/fractioning columns, chimney, silos-oil and gas installation, transmission/communication lines, cable car installation, air fields.</p> <p>2.7 Tolerance</p> <p><b>Course Outcome: CO2 , Teaching Hours :15hrs Marks: 12 (R- 2, U-4, A-6)</b></p>
3	<p><b>Safety in Demolition operation:</b></p> <p>3.1 Planning and permit.</p> <p>3.2 Planning the sequence of demolition.</p> <p>3.3 Safety precaution to be taken for and during demolition carrying out repairs, additions and alterations.</p> <p><b>Course Outcome: CO3 , Teaching Hours :6hrs Marks: 06 (R- 0, U-2, A- 4)</b></p>
4	<p>4.1 <b>Safety with regard to storage, stocking and handling of materials of construction:</b>-Health hazards while handling construction materials and chemicals; safety measures with respect to handling of materials such as cement, limes, aggregates, flyash, timber, steel, glass, paint, varnishes, petroleum products, chemicals used in construction, plastic &amp; PVC materials, etc.</p> <p>4.2 <b>Accident prevention:</b> - Occupational health hazards, occupational diseases relating to construction work. Safety in the use and maintenance of personal protective equipment's specific to construction industry, health and welfare measures, emergency medical treatment of injuries and rehabilitation at construction site.</p> <p><b>Course Outcome: CO4, Teaching Hours :12hrs Marks: 12(R- 0, U-4, A- 8)</b></p>
5	<p><b>Introduction to statutory obligations:-</b></p> <p>5.1 Regulations of employment and condition of work in construction.</p> <p>5.2 Construction safety law, IS and NB codes, local building and development.</p> <p>5.3 Accident investigation and reporting, structure stability and precautions to be taken</p> <p><b>Course Outcome: CO5 , Teaching Hours :8hrs Marks: 08 (R- 2, U-4, A-2)</b></p>
6	<p><b>Quality control:</b></p> <p>6.1 Meaning of Quality control, difference between quality of design, quality of conformance (QC) and Quality of performance (QA), concept of reliability and maintainability.</p> <p>6.2 Quality policy, Quality objectives, economics of Quality, cost and value of Quality specification.</p>

<p>6.3 Quality control, assurance, checklist, standard procedures and Quality audit, maintenance, calibration of testing equipment for quality assurance –AMIL equipment</p> <p>6.4 Vender rating, organization setup for Quality management.</p> <p>6.5 Difference between Quality control and inspection.</p> <p>6.6 Inspection objectives and types.</p> <p>6.7 Quality compliance.</p> <p>6.8 New trends in Quality management: Quality circles- basic concept, purpose &amp; functioning, Concept of TQM, concept of KAIZEN, concept of PLKA YOKE, ISO 9000, various aspects of certification, application &amp; advantages.</p> <p><b>Course Outcome: CO6 , Teaching Hours :15hrs Marks: 18 (R- 4, U-8, A-6)</b></p>
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**NOTE:** - Visit and case study of different structures- enabling, erection, construction, occupancy, during repairs, demolition.

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Meaning and scope of safety in construction	2	2	0	4
2	Safety in construction operation	2	4	6	12
3	Safety in Demolition operation	--	2	4	6
4	Safety with regard to storage, stocking and handling of materials of construction	--	4	8	12
5	Introduction to statutory obligations	2	4	2	8
6	Quality control	4	8	6	18
<b>Total</b>		<b>10</b>	<b>24</b>	<b>26</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Construction Safety	Jimmie W. ,Hinze,Prentice hall central Labour Institute	ISBN:0133779122
2	Structural Renovation Building	Alexander Newoman,Mcgraw Hill Publications,2001	ISBN: 978-0070471627
3	Design and renovation	Donald Friedman. W. Nortan & Company,1997	ISBN: 978-0393730142
4	Metrology and Quality ontrol	R. K. Jain ,Khanna Publishers-Delhi	ISBN: 978-81-7409-153-6
5	Quality Control	M. S. Mahajan, Dhanpat Rai and co. ltd	ISBN-10: 8177000659



**E-Reference :**

1. <http://www.learningconstruction.com/>
2. <http://www.understandconstruction.com/>
3. <http://www.constructionknowledge.net/>
4. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping :**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	1	3	1
CO2	2	3	3	3	2	3	2	1	3	3
CO3	2	3	3	3	2	3	2	1	3	3
CO4	2	3	3	3	2	3	2	1	3	3
CO5	2	3	3	3	2	3	2	1	3	3
CO6	2	3	3	3	2	3	2	1	3	2

**Industry Consultation Committee:**

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3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Smt.Meera Anserwadekar	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal

**CE 19408 QCAD**

**1. Introduction to QCAD (Foss: QCAD – English)**

**Outline:** Introduction to QCAD Menu Items and Toolbar Drawing Objects Snapping Tools Using Layers.....

**2. Drawing methods in QCAD**

**Outline:** Drawing Methods in QCAD Cartesian Coordinate System Using Command line to Draw Objects Drawing Methods....

**3. Using Modification Tools I**

**Outline:** Using Modification Tools Trim Copy Move Rotate.....

**4. Modification Tools to Stretch and mirror**

**Outline:** Using Modification Tools to Stretch and Mirror in QCAD Stretch Mirror.....

**5. Modification Tools to Scale and Roate**

**Outline:** Using Modification Tools to Scale and Rotate in QCAD Scale Rotate Two.....



**Government Polytechnic, Mumbai**

*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

**Semester-V  
(Course Contents)**

**GOVERNMENT POLYTECHNIC MUMBAI**  
(Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme (P19)**  
With effect from AY 2019-20

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - V**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
AM19501	Design of Reinforced Concrete and Steel Structures	4	4	--	8	8	60	20	20	--	25*	25	150
CE19501	Estimation and Costing	4	2	--	6	6	60	20	20	--	--	25	125
CE19502	Contracts, Accounts and Valuation	4	2	--	6	6	60	20	20	--	25*	--	125
CE19503	Irrigation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
	Elective – II (Any one)	4	--	--	4	4	60	20	20	--	--	--	100
AM19502	Prestressed & Precast Concrete	--	--	--	--	--	--	--	--	--	--	--	--
CE19504	Construction Management	--	--	--	--	--	--	--	--	--	--	--	--
AM19503	Advanced Geotechnical Engineering	--	--	--	--	--	--	--	--	--	--	--	--
CE19505	Solid Waste Management	--	--	--	--	--	--	--	--	--	--	--	--
CE19506	Project	--	4	--	4	4	--	--	--	--	50*	50	100
CE19507	Entrepreneurship (NPTEL)	--	4 <sup>#</sup>	--	4	4 <sup>#</sup>	--	--	--	--	--	--	--
	<b>Total</b>	<b>19</b>	<b>16</b>	<b>--</b>	<b>35</b>	<b>35</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>--</b>	<b>100</b>	<b>100</b>	<b>700</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,  
Curriculum Development,  
Dept. of Civil Engineering

Head of Department  
Dept. of Civil Engineering

In-Charge  
Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code:AM19501				Course Title: <b>Design of Reinforced Concrete &amp; Steel Structures</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (3Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	<b>04</b>	--	<b>08</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	<b>25*</b>	<b>25</b>	<b>150</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

In this course, the student will study elements of RCC & Steel structures. They will be introduced to basic structural elements such as beams/tension members, columns/compression members along with the concepts of their designs.

Basic Principles of designing RCC shall be helpful for students in supervising and executing construction activities effectively. Steel is commonly used as a construction material for various steel structures such as steel girders, steel bridges, steel trusses, columns, towers, railway bridges, industrial building, etc. For the design of steel structures, the properties of steel, different sections, various grades and strength characteristics of steel are required. This will be useful for developing insight for the design concepts and will help student in effective supervision and quality control on site.

**Course Outcomes:** Student should be able to

CO1	Design of singly and doubly reinforced RCC beam.
CO2	Design of RCC beam for shear and development length.
CO3	Design of short and long RCC columns.
CO4	Design of steel tension and compression member.
CO5	Design of steel I and Channel sections.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Design of Reinforced Concrete Beams by Limit State Method:</b></p> <p>1.1 Concept of Limit state, Stress block diagram, Introduction to singly and doubly reinforced sections, IS 456</p> <p>1.2 Design of singly reinforced beam, concept of under reinforced, over reinforced and balanced section, Simple numerical problem on ultimate moment of resistance and design of beam section</p> <p>1.3 Design of doubly reinforced sections, stress and strain diagrams, depth of neutral axis,</p>

	<p>simple numerical problems on ultimate moment of resistance of reinforced beam, Calculation of Ast and Asc.</p> <p><b>Course Outcome: CO1      Teaching Hours : 14 hrs      Marks: 14 (R-4, U-4, A-6)</b></p>
2	<p><b>Shear, Bond and Development length in Design of RCC member:</b></p> <p>2.1 Nominal shear stress in RCC section, Design shear strength of concrete, Design of shear reinforcement, Minimum Shear Reinforcement, Provisions of IS 456, forms of shear reinforcement</p> <p>2.2 Types of bond, Bond stress, check for bond stress, Determination of Development length in tension and compression members and check as per codal provisions, Anchorage value of 90° hook, Lapping of bars.</p> <p>2.3 Simple numericals on: Shear reinforcement, Adequacy of section for shear.</p> <p>2.4 Introduction to serviceability limit state check</p> <p><b>Course Outcome: CO2      Teaching Hours: 13 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>
3	<p><b>Design of axially loaded RCC Column :</b></p> <p>3.1 Definition and classification of column, Limit state of compression members, Effective length of column.</p> <p>3.2 Provisions of IS 456 for minimum steel, cover, maximum steel, spacing of ties etc.</p> <p>3.3 Design of axially loaded short column - Square, Rectangular, and Circular only.</p> <p><b>Course Outcome: CO3      Teaching Hours: 10 hrs      Marks: 10 (R-2, U-4, A-4)</b></p>
4	<p><b>Design of Steel Tension and Compression Members (Limit State Method) :</b></p> <p>4.1 Types of sections used for Tension members.</p> <p>4.2 Strength of tension member by- yielding of section, rupture of net cross-section and block shear.</p> <p>4.3 Design of axially loaded single angle and double angle tension members with bolted and welded connections.</p> <p>4.4 Types of sections used as compression member, Calculation of effective length, Radius of gyration and slenderness ratio, Permissible values of slenderness ratio as per IS 800, Design compressive stress.</p> <p>4.5 Introduction to built up sections, lacing and battening (Meaning and purpose), Diagrams of single and double lacing and battening system. (No numerical problems).</p> <p>4.6 Design of axially loaded single and double angle struts connected by bolted and welded connections with gusset plate.</p> <p><b>Course Outcome: CO4      Teaching Hours: 15 hrs      Marks: 14 (R-4, U-4, A-6)</b></p>
5	<p><b>Design of Steel beams (Limit State Method) :</b></p> <p>5.1 Standard beam sections, Bending stress calculations.</p> <p>5.2 Design of simple I and channel section.</p> <p>5.3 Check for shear as per IS 800.</p> <p><b>Course Outcome: CO5      Teaching Hours: 8 hrs      Marks: 10 (R-2, U-4, A-4)</b></p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Design of Reinforced Concrete Beams by Limit State Method	4	4	6	14
2	Shear, Bond and Development length in Design of RCC member	4	4	4	12
3	Design of axially loaded RCC Column	2	4	4	10

4	<b>Design of Steel Tension and Compression Members (Limit State Method)</b>	4	4	6	14
5	<b>Design of Steel beams (Limit State Method)</b>	2	4	4	10
<b>Total</b>		<b>16</b>	<b>20</b>	<b>24</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1,2	CO1, CO2	Draw cross section, strain diagram & stress diagram for singly reinforced section.	04
2	1,2	CO1, CO2	Draw cross section, strain diagram & stress diagram for doubly reinforced section.	04
3	3	CO3	Draw sketches of different types of column footings.	02
4	1,2,3	CO1, CO2, CO3	Interpret the actual RCC Structural Drawings used on site with reference to reinforcement details of various structural elements.	02
5	1,2,3	CO1, CO2, CO3	Prepare a checklist for reinforcement provided from actual drawings used on site for various structural elements.	02
6	1,2,3	CO1, CO2, CO3	Prepare a detailed report of site visit for reinforcement detailing of structural elements like beams, columns, staircase & footing.	08
7	5	CO5	Design simply supported I section steel beam for udl.	06
8	4	CO4	Draw any five commonly used rolled steel sections and five built up sections.	02
9	4,5	CO4, CO5	Summarize the provisions of IS 800 required for the design of tension member in report form.	04
10	4,5	CO4, CO5	Compile relevant clauses from IS 800 required for the design of a compression member and submit it in report form.	04
11	4	CO4	Draw sketches for single & double lacing of given built up columns.	02
12	4	CO4	Draw sketches for battening of given built up columns.	02
13	4,5	CO4, CO5	Prepare a report on the IS 800 provisions pertaining to design of lacing & battening along with its significance.	04
14	4,5	CO4, CO5	Design beams section for shear as per IS 800 provisions.	06
15		CO4, CO5	Prepare a detailed report of site visit for study of rolled steel tension & compression members used in various structures.	08
		<b>Total</b>		<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Limit State Theory and Design of Reinforced Concrete Structures	Shah, V. L., and Karve, S.R., Structures Publications, Pune,2014.	ISBN-10: 819037172X
2	Fundamentals of Reinforced Concrete	Sinha N.C., and Roy S.K., S. Chand & Co., New Delhi.	ISBN-10: 8121901278; ISBN-13: 978-8121901277
3	Reinforced Concrete Design Principles and Practice	Krishna Raju, and N. Pranesh, R.N., New Age International, Mumbai.	ISBN: 9788122414608, 8122414605
4	Limit State Design of Steel Structures	Shah, V. L., and Gore, V., Structures Publications, Pune.	ISBN : 4567170962, 1234567170961
5	Design of Steel Structures	Subramanian N., Oxford University Press.	ISBN-10: 0195676815
6	IS 456 : 2000 Plain and Reinforced Concrete	BIS	---
7	IS 800 : 2007 Steel Code	BIS	---

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2. <http://www.irjet.net>
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**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	--	2	2	3	3	2	--
CO2	3	3	3	--	2	2	3	3	2	--
CO3	3	3	3	--	2	2	3	3	2	--
CO4	3	3	3	--	2	2	3	3	2	--
CO5	3	3	3	--	2	2	3	3	2	--

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm



3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S.D.Deshpande	Principal	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19501</b>				Course Title: <b>Estimation &amp; Costing</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (3Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	<b>02</b>	<b>--</b>	<b>06</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>--</b>	<b>25</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

This is a core technology course which will enable the students to learn core facts, concepts, principles & procedures in Estimating & Costing. With this knowledge and skill, students will be able to prepare estimate before start of construction and systematically procure materials during execution using specifications for ensuring appropriate type of construction process & quality of engineering products in specialized areas in Building Construction, Irrigation, Transportation and Environmental Engineering. In absence of market rates they can prepare their own rate and thereby prepare the detailed estimate.

**Course Outcomes:** Student should be able to

CO1	Select modes of measurements for different items of works.
CO2	Prepare approximate estimate of a civil engineering works.
CO3	Prepare detailed estimate of a civil engineering works.
CO4	Calculate quantity of earthwork.
CO5	Justify rate for given items of work using rate analysis techniques.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<b>Fundamentals of Estimating and Costing:</b> 1.1 Estimating and Costing – Meaning, purpose, Administrative approval, Technical Sanction and Budget provision. 1.2 Types of estimates – Approximate and Detailed estimate. 1.3 Types and Uses of Estimates: Revised estimate, Supplementary estimate, Revised & Supplementary Estimate, Repair and maintenance estimate. 1.4 Roles and responsibility of Estimator. 1.5 Checklist of items in load bearing and framed structure. 1.6 Standard formats of Measurement sheet, Abstract sheet, Face sheet. 1.7 Modes of measurement and desired accuracy in measurements for different items of

	<p>work as per IS:1200.          1.8 Rules for deduction in different category of work as per IS:1200.          1.9 Description / specification of items of building work as per PWD /DSR.  <b>Course Outcome: CO1      Teaching Hours : 12 hrs      Marks: 12 (R- 6, U-4, A-2)</b></p>
2	<p><b>Approximate Estimates:</b>          2.1 Approximate estimate - Definition, Purpose.          2.2 Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical bay method, Approximate quantity method (with simple numericals)          2.3 Approximate estimate for roads, Railways, bridges/culvert, irrigation projects and water supply projects.  <b>Course Outcome: CO2      Teaching Hours: 10 hrs      Marks: 12 (R-2, U- 4, A- 6)</b></p>
3	<p><b>Detailed Estimate :</b>          3.1 Detailed Estimate- Definition and Purpose, Data required for detailed estimate - Civil cost, GST, Contingencies, Supervision charges, Agency charges, Procedure for preparation of detailed estimate- Taking out quantities and Abstracting.          3.2 Methods of Detailed Estimate- Unit quantity method and total quantity method (with simple numericals)          3.3 Long wall and Short wall method, Centre line method.          3.4 Bar bending schedule for footing, column, beam, Lintel, chajja and slab elements.          3.5 Provisions in detailed estimate: contingencies, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc.          3.6 Prime cost, Provisional sum, Provisional quantities, Bill of quantities.  <b>Course Outcome: CO3      Teaching Hours:14 hrs      Marks: 14 (R- 2, U- 6, A- 6)</b></p>
4	<p><b>Estimate for Civil Engineering Works:</b>          4.1 Earthwork - Quantities for roads, Embankment and canal by – Mid sectional area method, mean sectional area method, Prismoidal and trapezoidal formula method.          4.2 Detailed estimate for septic tank, Community well.  <b>Course Outcome: CO4      Teaching Hours: 12 hrs      Marks: 10 (R- 2 ,U- 4, A- 4)</b></p>
5	<p><b>Rate Analysis:</b>          5.1 Rate Analysis: Definition, purpose and importance.          5.2 Lead (Standard and Extra), lift, overhead charges, water charges and contractors' profit.          5.3 Procedure for rate analysis.          5.4 Task work- Definition, types. Task work of different skilled labour for different items.          5.5 Categories of labours, their daily wages, types and number of labours for different items of work.          5.6 Transportation charges of materials - Lead and Lift, Hire charges of machineries and equipments.          5.7 Preparing rate analysis of different items of work pertaining to buildings.  <b>Course Outcome: CO5      Teaching Hours: 12 hrs      Marks: 12 (R- 2, U- 4, A- 6)</b></p>

#### Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Fundamentals of Estimating and Costing	6	4	2	12
2	Approximate Estimates	2	4	6	12

3	Detailed Estimate	2	6	6	14
4	Estimate for Civil Engineering Works	2	4	4	10
5	Rate Analysis	2	4	6	12
<b>Total</b>		<b>14</b>	<b>22</b>	<b>24</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	01	CO1	Prepare the list of items to be executed with units for detailed estimate of a given structure	02
2	01	CO1	Study of items with specification given in the DSR (for any 5 items).	02
3	02	CO2	Prepare approximate estimate for the given civil engineering works.	02
4	03	CO3	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR. (1BHK building with staircase)	06
5	03	CO3	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet.( 1BHK building with staircase)	05
6	03	CO3	Calculate the reinforcement quantities from the given set of drawings for a room size of 3m X 4m with bar bending schedule (footing, column, beam, lintel with chajja, slab)	05
7	04	CO4	Prepare quantity of earthwork of road of 500m.	04
8	05	CO5	Prepare rate analysis for the given 5 items of works.	04
<b>Total</b>				<b>30</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Estimating and Costing in Civil Engineering	Datta, B.N. UBS Publishers Distributors Pvt. Ltd. New Delhi.	ISBN-10: 8174767703; ISBN-13: 978-8174767707
2	Estimating construction cost (fifth edition)	Peurifoy, Robert L. Oberlender, Garold. McGraw Hill Education, New Delhi.	ISBN-13: 978-0071150842
3	Estimating and Costing	Rangwala, S.C. Charotar Publishing House PVT. LTD., Anand.	ISBN : 9789385039058 896
4	Estimating and Costing	Birdie, G.S. Dhanpat Rai Publishing Company(P) Ltd. New Delhi.	ISBN-10: 9384559512; ISBN-13: 978-9384559519

5	Estimating and costing, specification and valuation in civil engineering	Chakraborti, M. Monojit Chakraborti, Kolkata.	ISBN-10: 818530436X  ISBN-13 : 978- 8185304366
6	PWD Schedule of Rates.		
7	Ministry of Road Transport and Highways (MORT&H) Specifications and Analysis of Schedule of Rates.		

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2. <http://www.darshan.ac.in>
3. <http://www.sanfoundry.com>
4. <http://www.cmu.edu>
5. [www.yb.tl](http://www.yb.tl)
6. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	--	--	1	1	1	3	--
CO2	3	3	3	--	--	1	2	1	3	--
CO3	3	3	3	--	--	1	2	1	3	--
CO4	3	3	3	--	--	1	2	1	3	--
CO5	3	3	3	--	--	1	2	--	3	--

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3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code:CE19502				Course Title: <b>Contracts, Accounts &amp; Valuation</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	<b>02</b>	<b>--</b>	<b>06</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>--</b>	<b>25*</b>	<b>--</b>	<b>125</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

The students will learn concepts, principles and procedures of contracts, accounts and valuation. The student will know procedure for preparing tender documents and contracts. The students will understand the procedure for execution of Civil engineering works in Government and private sectors. The student calculate rent and prepare valuation of a civil structures.

**Course Outcomes:** Student should be able to

CO1	Understand various types of contract and when they are used.
CO2	Suggest the relevant type of contract for the given civil engineering work.
CO3	Prepare the typical Tender document for the given civil engineering work.
CO4	Decide type of payment for the executed work.
CO5	Justify the rent fixation and valuation of given civil structure.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Procedure to execute the work :</b></p> <p>1.1 Administrative approval, Technical sanction, budget provision, expenditure sanction.</p> <p>1.2 Methods for carrying out works- contract method, departmental method -rate list method, piece work method, day's work method, employing labours on daily wages basis.</p> <p><b>Course Outcome: CO1      Teaching Hours : 8 hrs      Marks: 04 (R-4, U-0, A-0)</b></p>
2	<p><b>Contracts :</b></p> <p>2.1 Definition of contract, objects of contract, requirements of contract, overview of Indian Contract Act.</p> <p>2.2 Types of engineering contract with advantages, disadvantages and their suitability - Lump sum contract, item rate contract, percentage rate contract, cost plus percentage, cost plus fixed fee, cost plus variable percentage and cost plus variable fee contract, labour contract, demolition contract, target contract, negotiated contract, Engineering Procurement Construction Contract (EPC), Annuity Contract.</p>

	<p>2.3 Introduction of FIDIC Conditions of contract.</p> <p>2.4 Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor.</p> <p>2.5 Build Operate Transfer (BOT) Project, BOT Toll contract, BOT (Annuity) contract, Design, Build, Finance, Operate and Transfer (DBFOT) contract, Hybrid Annuity contract, Operate Maintain and Transfer (OMT) contract, Operation &amp; Maintenance contract (Introduction only).</p> <p><b>Course Outcome: CO2      Teaching Hours: 10 hrs      Marks: 14 (R-6, U-6, A-2)</b></p>
3	<p><b>Tender and Tender Documents :</b></p> <p>3.1 Definition of tender, necessity of tender, types of tender- Local, Global, Limited.</p> <p>3.2 E -Tendering System – Online procedure of submission and opening of bids (Technical and Financial).</p> <p>3.3 Notice to invite tender (NIT)- Points to be included while drafting tender notice, Drafting of tender notice.</p> <p>3.4 Procedure of submitting filled tender Documents (Two envelope system), procedure of opening tender, comparative statement, scrutiny of tenders, award of contract, letter of award.</p> <p>3.5 Meaning of terms - Earnest Money Deposit (EMD), Performance Security Deposit, Validity period, corrigendum to tender notice and its necessity, Unbalanced bid.</p> <p>3.6 Tender documents – Index, tender notice, general instructions, special instructions, Schedule A, Schedule B, Schedule C etc.</p> <p>3.7 Terms related to tender documents – contract conditions- time limit, time extension, penalty, defective material and workmanship, termination of contract, suspension of work, subletting of contract, extra items, price variation clause(escalation), defect liability Period, liquidated Damages.</p> <p>3.8 Arbitration- Meaning, Qualification of an arbitrator, Appointment, Dispute and Settlement of disputes, Arbitration and Conciliation Act, Arbitration award.</p> <p><b>Course Outcome: CO3      Teaching Hours:16 hrs      Marks: 16 (R- 6, U- 6, A- 4)</b></p>
4	<p><b>Accounts :</b></p> <p>4.1 Various account forms and their uses – Measurement Books, E- Measurement book (E-MB), Nominal Muster Roll(NMR), Imprest Cash, Indent, Invoice, Bill, Vouchers, Hand receipt Cash Book, Temporary Advance. Heads of Accounts.</p> <p>4.2 Mode of Payment to the contractor and its necessity -Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E - payment.</p> <p><b>Course Outcome: CO4      Teaching Hours: 12 hrs      Marks: 12 (R- 6 ,U- 6, A- 0)</b></p>
5	<p><b>Introduction to Valuation :</b></p> <p>5.1 Definition and purpose of Valuation, role of valuer. Definition - Cost, Price and Value, Characteristics of Value, Factors Affecting Value.</p> <p>5.2 Types of Value - Book Value, Scrap Value, Salvage Value, Speculative Value, Distress Value, Market Value, monopoly Value, Sentimental Value. Factors affecting value.</p> <p>5.3 Depreciation, Obsolescence, Sinking Fund, Methods of Calculation of Depreciation – Straight Line Method, Sinking Fund Method, Constant Percentage Method.</p> <p>5.4 Fixation of rent, Lease – types of lease, lease hold property and free hold property. Mortgage – Mortgage deed, precautions to be taken while making mortgage.</p> <p><b>Course Outcome: CO5      Teaching Hours: 14 hrs      Marks: 14 (R- 4, U- 4, A- 6)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Procedure to execute the work	4	0	0	04
2	Contracts	6	6	2	14
3	Tender and Tender Documents	6	6	4	16
4	Accounts	6	6	0	12
5	Introduction to Valuation	4	4	6	14
<b>Total</b>		<b>26</b>	<b>22</b>	<b>12</b>	<b>60</b>

**List of experiments:**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	01	CO1	Assignment on procedure of execution of construction work.	03
2	02	CO2	Assignment on types of contracts.	02
3	02	CO2	Assignment on class of Contractor's registration with its limits and procedure of registration, documents required and upgradation as Contractor in PWD.	06
4	02	CO2	Assignment on BOT	04
5	03	CO3	Collection of any five tender notices.	02
6	03	CO3	Drafting of tender notice for Government and Private work.	04
7	04	CO4	Assignment on Interim payment, Secured Advance, Advance Payment, Petty Advance, Running Bill & Final Bill, Mobilization Advance.	03
8	05	CO5	Numericals on rent fixation and capitalized value of property.	06
<b>Total</b>				<b>30</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Estimating and Costing in Civil Engineering	Datta, B.N. UBS Publishers Distributors Pvt. Ltd. New Delhi.	ISBN-10: 8174767703; ISBN-13: 978-8174767707
2	Construction Management and Contract Practices	Raina, V. K., Shroff Publishers & Distributors Pvt. Ltd.	ISBN: 9789352137220
3	Estimating and Costing	Rangwala, S.C. Charotar Publishing House PVT. LTD., Anand.	ISBN : 9789385039058 896
4	Estimating and Costing	Birdie, G.S. Dhanpat Rai Publishing Company(P) Ltd. New Delhi.	ISBN-10: 9384559512; ISBN-13: 978-



			9384559519
5	Estimating and costing, specification and valuation in civil engineering	Chakraborti,M. Monojit Chakraborti, Kolkata.	ISBN-10: 818530436X ISBN-13 : 978- 8185304366
6	Civil Engineering Contracts and Estimates	Patil, B. S.,Orient Longman, Mumbai	ISBN-10: 9788173719578

**E-References:**

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2. <http://www.darshan.ac.in>
3. <http://www.sanfoundry.com>
4. <http://www.cmu.edu>
5. [www.yb.tl](http://www.yb.tl)
6. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	--	--	1	1	--	1	--
CO2	3	3	3	--	--	1	2	--	1	--
CO3	3	3	3	--	--	1	2	--	1	--
CO4	3	3	3	--	--	1	2	--	1	--
CO5	3	3	3	--	--	1	2	--	3	--

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4	Ms. P. A. Pisal	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19503</b>				Course Title: <b>Irrigation Engineering</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>03</b>	--	--	<b>03</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale:

India is basically an agricultural country and all its resources depend on the agricultural output. Water is evidently the most vital element in plant life. The total rainfall in a particular area may be either insufficient or ill timed. In order to get maximum yield it is essential to supply the optimum quantity of water and to maintain correct timing. This is possible only through a systematic irrigation system. Irrigation engineering, being an essential part of civil engineering has been included in the programme.

**Course Outcomes:** Student should be able to

CO1	State importance of irrigation, advantages, disadvantages in Indian context.
CO2	Discuss methods of water application to crops and types of crops in Maharashtra and evaluate duty and delta relation for crops.
CO3	Calculate the storage capacity of reservoirs.
CO4	State types of dams, spillway structures and their suitability conditions and identify different forces acting on gravity dam and conditions of stability of dam.
CO5	Describe types of canals, canals structures and cross drainage works and functions of regulating and cross drainage.
CO6	Classify different irrigation systems.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<b>Introduction to Irrigation engineering and Hydrology</b> 1.1 Irrigation Engineering: Definition, necessity of irrigation, Different Irrigation engineering systems, National Water Policy. 1.2 Hydrology: Concept of hydrology, Hydrologic cycle, Definition of rain fall, rainfall intensity. 1.3 Rain Gauges - Symon's rain gauge, automatic rain gauge, its construction and functioning, average rainfall, methods of calculating average rainfall. arithmetic average method, Thiessen's polygon method, isohyetal method. 1.4 Runoff: Definition, Factors affecting Run off, Computation of runoff Using Inglis formula, Stranges and Bennie's tables.

	<p>1.5 Maximum Flood Discharge (MFD): Concept of MFD, Computation of MFD by Inglis and Dicken's formula.</p> <p>1.6 Yield, dependable yield and calculation of yield.</p> <p>1.7 Simple numerical problems.</p> <p><b>Course Outcome: CO1 , Teaching Hours :4 hrs Marks: 06 (R-4, U-2, A-0)</b></p>
2	<p><b>Water requirement of crops :</b></p> <p>2.1 Cropping seasons and crops in Maharashtra.</p> <p>2.2 Definitions of terms - Crop season, crop period, base period crop rotation, Intensity of Irrigation, command area, Gross command area, Cultivable command area, Irrigable Command Area, Crop pattern.</p> <p>2.3 Duty &amp; Delta, Relation between duty &amp; delta, factors affecting duty, Methods of improving duty.</p> <p>2.4 Time factor, capacity factor.</p> <p>2.5 Determination of water requirements &amp; capacity of canal.</p> <p>2.6 Assessment of irrigation water.</p> <p>2.7 Numerical problems on water requirement of crops.</p> <p><b>Course Outcome: CO2 , Teaching Hours :8 hrs Marks: 08 (R- 4, U-4, A-0)</b></p>
3	<p><b>Reservoir planning :</b></p> <p>3.1 Investigating survey for reservoir planning and data collection.</p> <p>3.2 Area capacity curves- Construction and uses.</p> <p>3.3 Silting of reservoir, rate of silting, factors affecting silting, sediment control.</p> <p>3.4 Evaporation from reservoir, method of reducing evaporation.</p> <p>3.5 Fixing Control levels and respective storage in reservoir. Simple numerical problems on Fixing Control levels.</p> <p><b>Course Outcome: CO3 , Teaching Hours :6 hrs Marks: 08 (R- 2, U-0, A-6 )</b></p>
4	<p><b>Dams and Spillways :</b></p> <p>4.1 Definition, types - gravity dam (masonry and concrete), earthen dam, choice of type of a dam.</p> <p>4.2 Earthen Dam: Components and their function, typical cross section, seepage through embankment and foundation, seepage control through embankment and foundation. Phreatic line &amp; its characteristics. Slope protection, Downstream drainage system, Criteria for safe design of earthen dam, Causes of failure of earthen dam and condition of Stability. Construction of earthen dam.</p> <p>4.3 Gravity Dam: Forces acting on gravity dam, Conditions of stability, theoretical and practical profile, high &amp; low dams. Galleries- Function, Types. Control of cracking in gravity dams. Outlets in gravity dams.</p> <p>4.4 Definition, purpose, components parts, types of spillways - with &amp; without gates, ogee spillway, bar spillway Conditions favouring each type.</p> <p>4.5 Energy dissipation below spillways, stilling basin.</p> <p>4.6 Spillway crest gates - Radial and vertical lift gates.</p> <p><b>Course Outcome: CO3 , Teaching Hours :12 hrs Marks: 18 (R- 2,U-4,A-12)</b></p>
5	<p><b>Canal :</b></p> <p>5.1 Classification of canals according to alignment and position in the canal network.</p> <p>5.2 Canal alignments - ridge canal, contour canal, side slope.</p> <p>5.3 Cross section of canal in embankment and cutting, partial embankment and</p>

	<p>cutting, balancing depth. Design of most economical canal section.</p> <p>5.4 Canal lining - Purpose, material used and its properties. Advantages of canal lining</p> <p>5.5 CD works- Aqueduct , siphon aqueduct, super passage, level crossing</p> <p>5.6 Canal regulators- Head regulator, Cross regulator, Escape, Falls and Outlets. Canal maintenance.</p> <p><b>Course Outcome: CO4 , Teaching Hours : 8hrs Marks: 10 (R- 2, U-2, A- 6)</b></p>
6	<p><b>Diversion Head works and Minor and Micro Irrigation :</b></p> <p>6.1 Layout of diversion head works - component parts and their function - weir or barrage, divide wall, pocket, scouring sluices, silt excluder, silt Extractor, fish ladder.</p> <p>6.2 Weirs - Functions, site selection, types - sloping weir, vertical drop weir, K.T. Weir, situation favoring its Construction.</p> <p>6.3 Barrage - Components and their functions, layout of typical barrage, situation favouring Construction of barrage.</p> <p>6.4 Comparison between weir &amp; barrage.</p> <p>6.5 Bandhara-Construction and working Advantages and disadvantages of bandhara irrigation, layout and component parts, solid and open bandhara.</p> <p>6.6 Percolation Tanks – Need, selection of site, construction</p> <p>6.7 Lift irrigation scheme-Components and their functions ,lay out</p> <p>6.8 Drip and Sprinkler Irrigation- Need, components, Layout, operation and Maintenance.</p> <p><b>Course Outcome: CO6 , Teaching Hours :7 hrs Marks: 10 (R- 6,U-4, A-0)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Irrigation engineering and Hydrology	04	02	--	06
2	Water requirement of crops	04	04	--	08
3	Reservoir planning	02	--	06	08
4	Dams and Spillways	02	04	12	18
5	Canals	02	02	06	10
6	Diversion Head works & Minor and Micro Irrigation	06	04	--	10
<b>Total</b>		<b>20</b>	<b>16</b>	<b>24</b>	<b>60</b>

**References/ Books:**

Sr. No.	Name of Book	Author, Publisher, Edition and Year Of publication Author	ISBN
1	Irrigation Engineering and water power engineering	B.C Punmia,Pande B.B.Lal,Laxmi Publication,Ltd,12th Edition, Aug 1992 Distributors	ISBN-13: 978-8131807637

2	Irrigation and water power engineering	S.K Garg,Khanna Publication,Delhi-6	ISBN:8174090479
3	The Fundamental principles of Irrigation Engineering	Priyani V. B.,Charotkar Book Stall,Anand ,fifth edition	ISBN-13: C076000000005
4	Text book of Irrigation Engineering	Dahigaonkar J. G,Wheeler Publishing Allahabad	ISBN: 8185614458

**E-References :**

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2. <http://nptel.ac.in>
3. <http://wrd.maharashtra.gov.in>
4. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	1	3	1
CO2	2	3	3	3	2	3	2	1	3	1
CO3	2	3	3	3	2	3	2	1	3	1
CO4	2	3	3	3	2	3	2	1	3	1
CO5	2	3	3	3	2	3	2	1	3	1
CO6	2	3	3	3	2	3	2	1	3	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Smt.Meera Anserwadekar	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>AM19502</b>				Course Title: <b>Prestressed &amp; Precast Concrete</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

In today's system fast developing technology, use of prestressed and precast concrete is increasing with leaps and bounds. Due to several attractive and elegant features prestressed concrete and precast concrete is becoming popular in many fields, it has successfully replaced the conventional structural materials like R.C.C. and steel. All these revolution in area of structural engineering made it essential to specialize the engineering students in the subject of "Prestressed & Precast Concrete".

**Course Outcomes:** Student should be able to

CO1	Select the relevant precast concrete element for a given type of construction.
CO2	Use relevant components for prefabricated structures.
CO3	Justify the relevance of prestressed element in a given situation.
CO4	Select relevant methods / systems for given construction work.
CO5	Propose suitable cable profile for the given prestressed concrete members.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Precast concrete Elements :</b></p> <p>1.1 Advantages and disadvantages of precast concrete members</p> <p>1.2 Non-structural Precast elements - Paver blocks, Fencing Poles, Transmission Poles, Manhole Covers, Hollow and Solid Blocks, kerb stones as per relevant BIS specifications</p> <p>1.3 Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles</p> <p>1.4 Testing of Precast components as per BIS standards</p> <p><b>Course Outcome: CO1      Teaching Hours : 12 hrs      Marks: 10 (R-4, U-6, A-0)</b></p>
2	<p><b>Prefabricated building :</b></p> <p>2.1 Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, staircase elements.</p>

	<p>2.2 Prefabricated building using precast load bearing and non load bearing wall panels, floor systems - Material characteristics, Plans &amp; Standard specifications</p> <p>2.3 Modular co-ordination, modular grid, and finishes</p> <p>2.4 Prefab systems and structural schemes and their classification including design considerations</p> <p>2.5 Joints – requirements of structural joints and their design considerations</p> <p>2.6 Manufacturing, storage, curing, transportation and erection of above elements, equipment needed</p> <p><b>Course Outcome: CO2      Teaching Hours: 14 hrs      Marks: 14 (R-4, U-6, A-4)</b></p>
3	<p><b>Introduction to Prestressed Concrete :</b></p> <p>3.1 Principles of pre-stressed concrete and basic terminology.</p> <p>3.2 Applications, advantages and disadvantages of prestressed concrete</p> <p>3.3 Materials used and their properties, Necessity of high-grade materials</p> <p>3.4 Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits and applications</p> <p><b>Course Outcome: CO3      Teaching Hours: 8 hrs      Marks: 10 (R-4, U-4, A-2)</b></p>
4	<p><b>Methods and systems of prestressing :</b></p> <p>4.1 Methods of prestressing – Internal and External pre-stressing, Pre and Post tensioning-applications</p> <p>4.2 Systems for pre tensioning – process, applications, merits and demerits - Hoyer system</p> <p>4.3 Systems for post-tensioning - process, applications, merits and demerits - Freyssinet system, Magnel Blaton system, Gifford Udall system.</p> <p>4.4 Prestressing force in Cable, Loss of prestress during the tensioning process - loss due to friction, length effect, wobbling effect and curvature effect, (Simple Numerical problems to determine loss of pre-stress), Loss of pre-stress at the anchoring stage.</p> <p>4.5 Loss of pre-stress occurring subsequently: losses due to shrinkage of concrete, creep of concrete, elastic shortening, and creep in steel, (Simple Numerical problems to determine loss of pre-stress).</p> <p>4.6 BIS recommendations for percentage loss in case of Pre and Post tensioning.</p> <p><b>Course Outcome: CO4      Teaching Hours: 14 hrs      Marks: 14 (R-4, U-6, A-4)</b></p>
5	<p><b>Analysis and design of Prestressed rectangular beam section :</b></p> <p>5.1 Basic assumptions in analysis of pre-stressed concrete beams.</p> <p>5.2 Cable Profile in simply supported rectangular beam section – concentric, eccentric straight and parabolic</p> <p>5.3 Effect of cable profile on maximum stresses at mid span and at support</p> <p>5.4 Numerical problems on determination of maximum stresses at mid spans with linear (concentric and eccentric) cable profiles only.</p> <p>5.5 Simple steps involved in Design of simply supported rectangular beam section (No numerical problems)</p> <p><b>Course Outcome: CO5      Teaching Hours: 12 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>

### Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Precast concrete Elements	4	6	--	12
2	Prefabricated building	4	6	4	12

3	<b>Introduction to Prestressed Concrete</b>	4	4	2	10
4	<b>Methods and systems of prestressing</b>	4	6	4	12
5	<b>Analysis and design of Prestressed rectangular beam section</b>	4	4	4	12
<b>Total</b>		<b>20</b>	<b>26</b>	<b>14</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Pre-stressed Concrete	Krishna Raju, N., Pre-stressed Concrete, Tata McGraw Hill, New Delhi.	ISBN : 0074622099, 9780074622094
2	Pre-stressed Concrete	Shrikant B. Vanakudre, Prestressed Concrete, Khanna Publishing House, New Delhi	ISBN-10: 938617331X; ISBN-13: 978-9386173317
3	Pre Cast and Pre Stress Technology: Process, Method and Future Technology	Marzuki, Nor Ashikin, Pre Cast and Pre Stress Technology: Process, Method and Future Technology, Createspace Independent Publication.	ISBN-10: 1499353391; ISBN-13: 978-1499353396
4	Handbook on Precast Concrete buildings.	Indian Concrete Institute.	ISBN, 8192062341, 9788192062341
5	IS 12592 Precast Concrete Manhole Cover and Frame	BIS, New Delhi.	--
6	IS 15658 Precast concrete blocks for paving - Code of Practice	BIS, New Delhi.	--
7	IS 15916 Building Design and Erection Using Prefabricated Concrete - Code of Practice	BIS, New Delhi.	--
8	IS 15917 Building Design and Erection Using Mixed/Composite Construction - Code of Practice	BIS, New Delhi.	--
9	IS 458 Precast Concrete Pipes (with and without reinforcement) — Specification	BIS, New Delhi.	--

**E-References:**

1. <http://www.pci.org>
2. <http://www.precast.org>
3. <http://www.indianconcrete.org>
4. <http://nitterhouseconcrete.com>



5. <http://precastblocks.com>
6. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	--	2	--	3	1	2	--
CO2	3	3	3	--	2	--	3	1	2	--
CO3	3	3	3	--	2	1	3	--	2	--
CO4	3	3	3	--	2	1	3	--	2	--
CO5	3	3	3	--	2	--	3	1	2	--

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S.D.Deshpande	Principal	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19505</b>				Course Title: <b>Construction Management</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

The Civil Engineer has to plan, manage and execute civil engineering works. He has to manage different resources. He should have knowledge of basic management and basic management process related to civil engineering field. The functions of construction management typically include the following: Specifying project objectives, scope, budgeting, scheduling, setting performance requirements, and selecting project participants.

**Course Outcomes:** Student should be able to

CO1	Understand the contract management.
CO2	Prepare and understand the nuances of executing the site layout.
CO3	Prepare networks and bar charts for the given construction project.
CO4	Understand the intricacies of disputes, related arbitration and settlement laws.
CO5	Apply safety measures at construction projects.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<p><b>Construction industry and management:</b></p> <p>1.1 Organization-objectives, principles of organization, types of organization: government/public and private construction industry, Role of various personnel in construction organization.</p> <p>1.2 Agencies associated with construction work- owner, promoter, builder, designer, architects.</p> <p>1.3 Role of consultant for various activities: Preparation of Detailed Project Report (DPR), monitoring of progress and quality, settlement of disputes.</p> <p><b>Course Outcome: CO1      Teaching Hours : 12 hrs      Marks: 12 (R- 6, U-6, A-0)</b></p>

<b>2</b>	<p><b>Site Layout:</b>            2.1 Principles governing site layout.            2.2 Factors affecting site layout.            2.3 Preparation of site layout.            2.4 Land acquisition procedures and providing compensation.</p> <p><b>Course Outcome: CO2      Teaching Hours: 10 hrs      Marks: 10 (R -2, U- 4, A- 4)</b></p>
<b>3</b>	<p><b>Planning and scheduling:</b>            3.1 Identifying broad activities in construction work &amp; allotting time to it, Methods of Scheduling, Development of bar charts, Merits &amp; limitations of bar chart.            3.2 Elements of Network: Event, activity, dummy activities, Precautions in drawing Network, Numbering the events.            3.3 CPM networks, activity time estimate, Event Times by forward &amp; backward pass calculation, start and finish time of activity, project duration. Floats: Types of Floats-Free, independent and total floats, critical activities and critical path,            3.4 Purpose of crashing a network, Normal Time and Cost, Crash Time and Cost, Cost slope, Optimization of cost and duration.            3.5 Material Management- Ordering cost, inventory carrying cost, Economic Order Quantity.            3.6 Store management, various records related to store management, inventory control by ABC technique, Introduction to material procurement through portals (e.g. <a href="http://www.inampro.nic.in">www.inampro.nic.in</a>)</p> <p><b>Course Outcome: CO3      Teaching Hours:16 hrs      Marks: 20 (R- 4, U- 6, A- 10)</b></p>
<b>4</b>	<p><b>Construction Contracts and Specifications:</b>            4.1 Types of Construction contracts.            4.2 Contract documents, specifications, general special conditions.            4.3 Contract Management, procedures involved in arbitration and settlement (Introduction only)</p> <p><b>Course Outcome: CO4      Teaching Hours:14 hrs      Marks: 10 (R- 6, U- 4, A- 0)</b></p>
<b>5</b>	<p><b>Safety in Construction:</b>            5.1 Safety in Construction Industry—Causes of Accidents, Remedial and Preventive Measures.            5.2 Labour Laws and Acts pertaining to Civil construction activities (Introduction only)</p> <p><b>Course Outcome: CO5      Teaching Hours: 8 hrs      Marks: 8 (R- 2, U- 4, A- 2)</b></p>

#### Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Construction industry and management	6	6	0	12
2	Site Layout	2	4	4	10
3	Planning and scheduling	4	6	10	20
4	Construction Contracts and Specifications	6	4	0	10
5	Safety in Construction	2	4	2	8
<b>Total</b>		<b>20</b>	<b>24</b>	<b>16</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Construction Engineering and Management	Sharma S. C. and Deodhar S. V. Khanna Book Publishing, New Delhi	ISBN: 978-81-7409-272-4
2	B.M Construction planning and management	Gahlot,P.S. and Dhir New Age International (P) Ltd. Publishers, New Delhi.	ISBN 10 8122404111 ISBN 13 9788122404111
3	Construction planning and management	Shrivastava, U.K. Galgotia Publication Pvt Ltd. New Delhi	ISBN : 817515246X, 9788175152465
4	The A To Z of Practical Building Construction and its Management	Mantri, S. Satya Prakashan New Delhi	ISBN-10: 9351921417; ISBN-13: 978-9351921417
5	Industrial Engineering and management	Khanna, O.P. Dhanpat Rai New Delhi	ISBN-10: 818992835X

**E-References:**

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2. <http://project-management.com>
3. <http://www.transit.dot.gov>
4. [www.inampro.nic.in](http://www.inampro.nic.in)
5. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	--	--	3	3	--	3	--
CO2	3	2	2	2	--	3	3	--	3	--
CO3	3	3	3	3	--	3	3	--	3	--
CO4	3	3	3	--	--	3	3	--	3	--
CO5	3	3	--	--	--	3	3	--	3	--

**Industry Consultation Committee:**

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1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

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Curriculum Development,  
Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>AM19503</b>				Course Title: <b>Advanced Geotechnical Engineering</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--	--	--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

### Rationale :

The loads from any structure have to be ultimately transmitted to a soil through foundation. Thus the foundation is an important part of a structure and the type and details of which can be decided upon only with the knowledge and application of the principles of soil mechanics. Knowledge of this course is a must for civil engineering students.

**Course Outcomes:** Student should be able to

CO1	Identify types of rocks and sub soil strata of earth.
CO2	Interpret the physical properties of soil related to given construction activities.
CO3	Use the results of permeability and shear strength test for foundation analysis.
CO4	Interpret soil bearing capacity results.
CO5	Compute optimum values for moisture content for maximum dry density of soil through various tests.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Overview of Geology and Geotechnical Engineering :</b></p> <p>1.1 Introduction of Geology, Branches of Geology, Importance of Geology for civil engineering structure and composition of earth, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks.</p> <p>1.2 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures.</p> <p>1.3 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.</p> <p><b>Course Outcome: CO1      Teaching Hours : 10 hrs      Marks: 10 (R-4, U-4, A-2)</b></p>

2	<p><b>Physical and Index Properties of Soil :</b></p> <p>2.1 Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index. Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer.</p> <p>2.2 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index.</p> <p>2.3 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.</p> <p><b>Course Outcome: CO2      Teaching Hours: 12 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>
3	<p><b>Permeability and Shear Strength of Soil :</b></p> <p>3.1 Definition of permeability, Darcy’s law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head tests, simple problems to determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (No numerical problems).</p> <p>3.2 Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear and vane shear test –laboratory methods.</p> <p><b>Course Outcome: CO3      Teaching Hours: 12 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>
4	<p><b>Bearing Capacity of Soil :</b></p> <p>4.1 Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi’s analysis and assumptions, effect of water table on bearing capacity.</p> <p>4.2 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888 &amp; IS:2131.</p> <p>4.3 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine’s theory and assumptions made for non-cohesive Soils.</p> <p><b>Course Outcome: CO4      Teaching Hours: 12 hrs      Marks: 12 (R-4, U-4, A-4)</b></p>
5	<p><b>Compaction and stabilization of soil :</b></p> <p>5.1 Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content(OMC), maximum dry density(MDD), Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. Suitability of various compaction equipments- smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer and Vibrator, Difference between compaction and consolidation.</p> <p>5.2 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization. California bearing ratio (CBR) test - Meaning and Utilization in Pavement Construction</p> <p>5.3 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.</p> <p><b>Course Outcome: CO5      Teaching Hours: 14 hrs      Marks: 14 (R-4, U-4, A-6)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	<b>Overview of Geology and Geotechnical Engineering</b>	4	4	2	10
2	<b>Physical and Index Properties of Soil</b>	4	4	4	12
3	<b>Permeability and Shear Strength of Soil</b>	4	4	4	12
4	<b>Bearing Capacity of Soil</b>	4	4	4	12
5	<b>Compaction and stabilization of soil</b>	4	4	6	14
<b>Total</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Soil Mechanics and Foundation Engineering	Punmia, B.C., Laxmi Publication, Delhi.	ISBN 81-7008-791-0
2	A text book of soil mechanics and foundation Engineering	Murthy, V.N.S., CBS Publishers & Distributors Pvt. Ltd., New Delhi.	ISBN 10: 8123913621 ISBN 13: 9788123913629
3	Geotechnical Engineering (Soil Mechanics)	Ramamurthy, T.N. & Sitharam, T.G., S Chand and Company LTD., New Delhi.	ISBN 10: 812192457X ISBN 13: 9788121924573
4	Soil Mechanics and Foundation Engineering	Raj, P. Purushothama, Pearson India, New Delhi.	ISBN:8131790819
5	Geotechnical Engineering	Kasamalkar, B. J., Pune Vidyarthi Griha Prakashan, Pune.	ISBN 9788170087915

**E-References:**

1. <http://www.masterportal.com>
2. <http://www.nptel.ac.in>
3. <http://www.adv-geosolutions.com>
4. <http://easyengineering.net>
5. <http://wwwen.uni.lu>
6. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	--	--	2	1	3	--	1	--
CO2	3	3	2	3	2	1	3	--	1	--
CO3	3	3	3	3	2	1	3	--	1	--



<b>CO4</b>	3	3	3	3	3	1	3	--	1	--
<b>CO5</b>	3	2	3	3	3	1	3	--	1	--

**Industry Consultation Committee:**

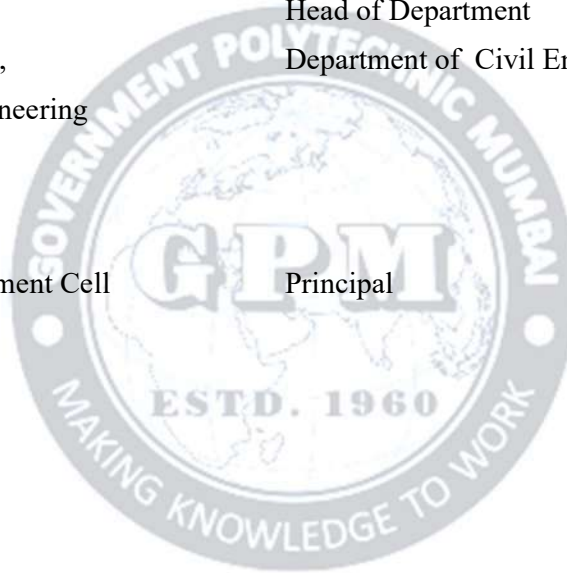
<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S.D.Deshpande	Principal	Govt. Polytechnic Mumbai

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Department of Civil Engineering

Head of Department  
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19505</b>				Course Title: <b>Solid Waste Management</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>04</b>	--	--	<b>04</b>	<b>60</b>	<b>20</b>	<b>20</b>	--		--	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

Industrialization and Urbanization is increasing day by day. As a result of this the generation of solid waste is a major problem all over the country within the urban as well as rural area. In view of this the management of solid waste produced including Bio-medical waste, E-waste etc. is of prime need to keep the environment safe and clean. Information on classification and characteristics of solid waste will enable to decide appropriate decision about the collection and transportation of waste produced. Various disposal methods of solid waste will enable to recommend suitable method of disposal of solid waste with economy and acceptable environmental constraints including reuse and recycle where ever applicable.

Thus the knowledge of solid waste management with the concept like recycling, recovering and reuse will lead to proper disposal with acceptability. This will further lead to keeping the natural resources contamination free.

**Course Outcomes:** Student should be able to

CO1	Classify the Solid Wastes.
CO2	Decide collection method and transportation of MSW
CO3	Use best disposal method for MSW
CO4	Use best collection and disposal method for Bio-medical waste.
CO5	Use best collection and disposal method for E-waste and Industrial waste.
CO6	Use best practices to avoid health hazards to peoples involved in process of SWM

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Introduction.</b></p> <p>1.1 Definition of Solid waste. Types of waste- Domestic, Commercial, Industrial, Market, Agricultural, Bio-medical and E-waste.</p> <p>1.2 Sources of solid waste. Classification of solid waste- Hazardous and non-hazardous.</p> <p>1.3 Characteristics of solid waste- Physical and Chemical.</p> <p>1.4 Impact of solid waste on environment.</p> <p>1.5 Solid waste management techniques, solid waste management hierarchy, solid waste prevention and reduction.</p>

	<p>1.6 Factors affecting on solid waste generation.</p> <p><b>Course Outcome: CO1 , Teaching Hours : 10      Marks: 10      (R-4, U-6, A- --)</b></p>
2	<p><b>Storage, Collection and Transportation of Municipal Solid Waste.</b></p> <p>2.1 Storage of municipal solid waste. Collection methods of municipal solid waste. Tools and equipment's used for storage and collection.</p> <p>2.2 Transportation of municipal solid waste. Vehicles used for transportation of waste.</p> <p>2.3 Role of rag pickers in waste management.</p> <p>2.4 Organization pattern of solid waste management.</p> <p><b>Course Outcome: CO2      Teaching Hours :10      Marks:12      (R-4 , U-4 , A-4 )</b></p>
3	<p><b>Disposal of Municipal Solid Waste</b></p> <p>3.1 Composting of solid waste, Principle of composting process, Factors affecting on composting process.</p> <p>3.2 Methods of composting- i) Manual composting ii) Mechanical composting iii) Vermi composting concept.</p> <p>3.3 Land fill method of disposal- Factors for site selection, Land filling methods, Advantages and dis advantages of land fill method.</p> <p>3.4 Incineration of solid waste- Types of incinerators, Advantages and dis advantages of incineration process.</p> <p><b>Course Outcome:CO3 Teaching Hours :10      Marks: 10      (R-2 , U-4 , A-4 )</b></p>
4	<p><b>Bio-Medical Waste Management</b></p> <p>4.1 Definition of Bio-medical waste.</p> <p>4.2 Sources and generation of Bio-medical waste.</p> <p>4.3 Classification of Bio-medical waste.</p> <p>4.4 Collection and management technologies.</p> <p><b>Course Outcome:CO4 Teaching Hours : 10      Marks:10      ( R- 2, U-4, A-4 )</b></p>
5	<p><b>E-Waste and Industrial Waste Management</b></p> <p>5.1 Definition of E-waste.</p> <p>5.2 Varieties of E-waste, Dangers of E-waste.</p> <p>5.3 Recycling and disposal of E-waste.</p> <p>5.4 Definition of Industrial waste. Varieties of industrial waste.</p> <p>5.5 Collection and disposal of industrial waste.</p> <p>5.6 Control measures and Recycling of industrial waste.</p> <p><b>Course Outcome:CO5 Teaching Hours :12      Marks:10      (R- 2 , U-4 , A-4 )</b></p>
6	<p><b>Health Aspect and Public Involvement in SWM</b></p> <p>6.1 Health aspect during handling and processing.</p> <p>6.2 Health problems during time of segregation, reuse, recovery, recycling of solid waste.</p> <p>6.3 Public involvement and participation in solid waste management.</p> <p><b>Course Outcome: CO6 Teaching Hours:08      Marks: 08      (R- 2 , U-6 , A- )</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction	4	6	--	10
2	Storage, Collection and Transportation of Municipal Solid Waste	4	4	4	12
3	Disposal of Municipal Solid Waste	2	4	4	10
4	Bio-Medical Waste Management	2	4	4	10
5	E-Waste and Industrial Waste Management	2	4	4	10
6	Health Aspect and Public Involvement in SWM	2	6	--	08
<b>Total</b>		<b>16</b>	<b>28</b>	<b>16</b>	<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Solid Waste Management	Dr. A.D.Bhide, Indian National Scientific Documentation Centre, New Delhi.	
2	Solid Waste Management	George Tchobanoglous, McGraw Hill Education Private Ltd. New Delhi	ISBN:10:0071356231
3	Solid Waste Management	K.Sasikumar, PHI Learning	ISBN 13:9788120338692
4	Environmental Studies	D.L.Manjunath, PEARSON Publication	ISBN 13:978- 8131709122
5	Environmental Pollution	Khopkar S.M., New Age International Limited	ISBN:8122415075, 9788122415070
6	Environmental Studies	Anindita Basak, PEARSON Publication	ISBN:8131785688, 9788131785683
7	Prospect and Perspectives of Solid Waste Management	B.B.Hosetti, NEW AGE International Limited	ISBN 13:9788171324934

**E-References:**

- a. [www.mpcb.gov.in](http://www.mpcb.gov.in)
- b. [www.cpcb.gov.in](http://www.cpcb.gov.in)
- c. [www.britanica.com](http://www.britanica.com)
- d. [www.downtoearth.org.in](http://www.downtoearth.org.in)
- e. [En.wikipedia.org](http://En.wikipedia.org)
- f. <http://www.nationallibrary.gov.in>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	3	2	2	3	3
CO2	3	3	3	3	2	2	2	2	3	2
CO3	3	3	2	3	2	3	2	2	3	2
CO4	3	3	3	3	2	3	2	2	3	2
CO5	3	3	3	3	2	3	2	2	3	2
CO6	3	2	3	3	2	3	2	2	3	3

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Curriculum Development,  
Department of Civil Engg.

Head of Department  
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19506</b>				Course Title: <b>Project</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	<b>4</b>	--	<b>04</b>	--	--	--	--	<b>50*</b>	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

The project work is included in the curriculum to encourage the students to undertake and tackle an independent problem related to Civil Engineering field. The project also comprises of literature survey of a problem assigned.

### Course Outcomes: Student should be able to

CO1	Identify, analyze and define the problems in Civil Engineering field.
CO2	Find different solutions to the problems by collecting data and select most appropriate solution using latest practices in Civil Engineering.
CO3	Use and integrate knowledge of different courses and data collected to make simple designs with the help of handbooks, standard data books, I.S. codes etc.
CO4	Work independently as a leader as well as member of a team.
CO5	Prepare and present report prepared.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Project Work:</b>            The students will select a topic related to any course in the curriculum, design various nits involved, prepare and present a report of the work done. The project work will be done by a group of 4 to 6 students. Oral will be based on term-work.</p> <p>Following is the list of some Civil Engineering suggestive areas for selection of project.</p> <ol style="list-style-type: none"> <li>1. Campus Development.</li> <li>2. Bridge/Fly over/Sky walk.</li> <li>3. Junction planning for city roads/planning for congested road areas/Parking studies.</li> <li>4. Municipal Solid waste management.</li> <li>5. Bio-Medical waste management.</li> <li>6. Recycling of resources.</li> <li>7. Concrete Mix design.</li> <li>8. Structural audit of an existing building.</li> <li>9. Manufacturing of Pre-cast concrete products.</li> <li>10. Non- conventional sources of energy.</li> </ol>

	<p>12. Transfer of technology to villages.  13. Planning and design for residential building/commercial complex.  14. Planning and design of water treatment plant for a given data.  15. Planning and design of water supply scheme for given lay-out.  16. Planning and design of sewage treatment plant for a given data.  17. Planning and design of sanitary scheme for given lay-out.  18. Lift Irrigation scheme.  19. Micro Irrigation- Drip/Sprinkler Irrigation.  20. Water shed development of small catchments.  22. Recent developments and new technologies in Civil Engg.  23. Entrepreneurship development.</p> <p>The project report shall contain the following as the case may be-</p> <p>a. Drawings  b. Design  c. Test results  d. Detailed estimate of project  e. Photographs</p>
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Principal

**CE 19507 Entrepreneurship (NPTEL)**

The course structure and content covers, over a period of 12 weeks, the following 15 modules

**Module 1:** Entrepreneurial Journey

**Module 2:** Entrepreneurial Discovery

**Module 3:** Ideation and Prototyping

**Module 4:** Testing, Validation and Commercialisation

**Module 5:** Disruption as a Success Driver

**Module 6:** Technological Innovation and Entrepreneurship – 1

**Module 7:** Technological Innovation and Entrepreneurship – 2

**Module 8:** Raising Financial Resources

**Module 9:** Education and Entrepreneurship

**Module 10:** Beyond Founders and Founder-Families

**Module 11:** India as a Start-up Nation

**Module 12:** National Entrepreneurial Culture

**Module 13:** Entrepreneurial Thermodynamics

**Module 14:** Entrepreneurship and Employment

**Module 15:** Start-up Case Studies





**Government Polytechnic, Mumbai**

*Department of Civil Engineering*

**P-19 Curriculum  
(Sandwich Pattern)**

**Semester-VI  
(Course Contents)**

**GOVERNMENT POLYTECHNIC MUMBAI**  
 (Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme (P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Civil Engineering (Sandwich Pattern)**

**Term / Semester - VI**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
CE19601	Inplant Training	--	40	--	40	20	--	--	--	--	100*	100*	200
	<b>Total</b>	--	<b>40</b>	--	<b>40</b>	<b>20</b>	--	--	--	--	<b>100</b>	<b>100</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours  
 Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,  
 Curriculum Development,  
 Dept. of Civil Engineering

Head of Department  
 Dept. of Civil Engineering

In-Charge  
 Curriculum Development Cell

Principal

Programme : <b>Diploma in Civil Engineering (Sandwich Pattern)</b>										
Course Code: <b>CE19601</b>				Course Title: <b>Inplant Training</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	<b>40</b>	--	<b>20</b>	--	--	--	--	<b>100*</b>	<b>100*</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination  
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

### Rationale:

We are in the era of skill development. Indian construction industry is passing through highly competitive and mechanized phase due to globalization and advancement. Inplant training has been established to provide students an opportunity to correlate theoretical knowledge with practical activities. They will also get an overview of construction process and site environment by exposing them to different aspects of construction processes, all under the guidance of skilled and experienced persons within the organization. This exposure will include all or most of the following aspects of business: management, personnel policy, financial, marketing and purchasing functions, legal and social aspects, materials and operations and other allied activities. This mechanism of inplant training also provides an opportunity for the construction industries to contribute during the formative period of student's development.

**Course Outcomes:** After the industrial training Student shall:

CO1	Get first-hand experience of working as an engineering professional, including the technical application of engineering methods.
CO2	Work with other engineering professionals and to experience the discipline of working in a professional organization and observe safety precautions on respective construction site.
CO3	Develop technical, interpersonal and communication skills, both oral and written.
CO4	Have interactions with other professional groups.
CO5	Observe the functioning and organization of business in construction industries.
CO6	Be exposed to management programs and systems, effective administration methods and documentation.

### CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	1	2	3

<b>CO2</b>	3	3	3	2	2	1	2	1	2	3
<b>CO3</b>	3	3	2	2	2	1	2	1	1	3
<b>CO4</b>	3	3	3	2	2	2	2	1	2	3
<b>CO5</b>	3	3	3	3	2	1	2	2	1	3
<b>CO6</b>	3	2	3	3	2	1	2	1	1	2

**Inplant training manual will be separately provided to each student. In manual all necessary instructions are given and required formats are provided.**

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