



**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,  
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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>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:**

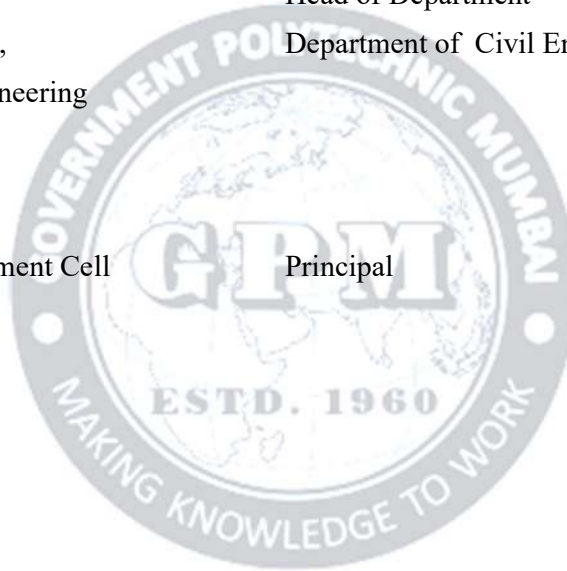
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3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S.D.Deshpande	Principal	Govt. Polytechnic Mumbai

Coordinator,  
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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 :**

1. [www.waterbouw.tudelft.nl/](http://www.waterbouw.tudelft.nl/)
2. [www.learnrstv.com](http://www.learnrstv.com)
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>
<b>6</b>	<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,</p> <p>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:**

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 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 :**

- <http://www.acea.be/industry-topics/repairs-and-maintenance>
- <http://theconstructor.org>
- <http://www.nqr.gov.in>
- <http://www.researchgate.net>
- <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:**

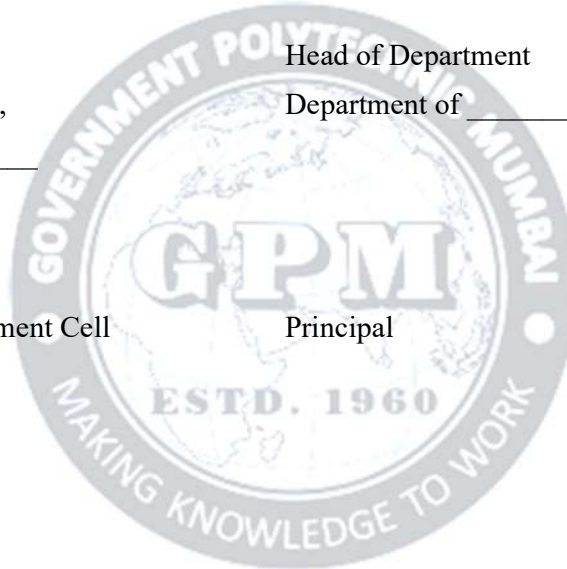
<b>Sr. No</b>	<b>Name</b>	<b>Designation</b>	<b>Institute/Organisation</b>
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Mr. P.A. Pisal	Sr. Lecturer in Civil Engg.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

Coordinator,  
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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:**

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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
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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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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
1	<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:**

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
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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.....