Government Polytechnic, Mumbai

Department of Civil Engineering

P-23 Curriculum
(Sandwich Pattern)

Semester-IV
(Course Contents)

File C

Government Polytechnic, Mumbai

(Academically Autonoums Institute, Government of Maharashtra)

Name of the Programme: Diploma In Civil Engineering (Sandwitch Pattern)

With Effect From : 2023-24

Teaching and examination Scheme (P23) Duration : 16 WEEKS

Duration Of Programme : 6 Semester Scheme : (P23)

Semester : FOURTH

Sr No	Course Title	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme: Actual Contact Hrs. / Week			Self-Learning (Term Work + Assignments) Hrs./Week	Notional Learning Hrs./Week	Credits	Paper Duration (hrs.)	Assessment Scheme: Theory: FA-TH		SA-TH		Total		Based on LL & TL Practical: FA-PR		SA-PR				Based on Self Learning: SLA		Total Marks
					CL	TL	LL	SLH	NLH			T1 Max	T2 Max	Max	Min	Max	Min	Max	Min	Max PR	Max OR	Min		Max	Min	
1	THEORY OF STRUCTURES	DSC	AM23104	4	4	1	-	3	8	4	2 Hrs. 30 min.	20	20	60	10	100	40	-	-	-	-	-		25	10	125
2	CONCRETE TECHNOLOGY	DSC	AM23105	4	4	-	2	2	8	4	2 Hrs. 30 min.	20	20	60	10	100	40	25	10	-	25	10		25	10	150
3	HYDRAULICS	DSC	CE23112	4	3	-	2	2	6	3	2 Hrs. 30 min.	20	20	60	10	100	40	25	10	-	-	-		25	10	150
4	ENVIRONMENTAL ENGINEERING	DSC	CE23106	4	4	-	2	2	8	4	2 Hrs. 30 min.	20	20	60	10	100	40	25	10	-	25#	10		25	10	175
5	COMPUTER AIDED DRAFTING	AEC	CE23502	2	-	-	4	-	4	2	-	-	-	-		-	-	50	20	50#	-	20		-	-	100
6	ELECTIVE I (ANY ONE)			3	4	-	-	2	6	3	2 Hrs. 30 min.	20	20	60	10	100	40	-	-	-	-	-		25	10	125
	REPAIRS & REHABILITATION OF BUILDING	DSC	CE23107	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-	-
	BUILDING SERVICES & MAINTENANCE	DSC	CE23108	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-	-
	SAFETY & QUALITY CONTROL	DSC	CE23109	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-	-
		Total		21	19	1	10	11	40	20	12	100	100	300	50	500	200	125	50	50	50	40		125	50	825

Abbreviations: CL-Classroom Learning, TL-Tutorial Learning, LL- Laboratory Learning, FA-Formative Assessment, SA-Summative Assessment, IKS-Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note: 1. FA-TH represents addition of two-20 marks class tests conducted during the semester.

2. If candidate is not securing minimum passing marks in FA-PR of any course, then the candidate shall be declared as "Detained" in that semester.

3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

4. Notional Learning hours for the semester are (CL+TL+LL+SL) hours X 16 Weeks

5. 1 credit is equivalent to 30 Notional hrs.

6. *Self-learning hours shall not be reflected in the Time Table.

7. Students must secure a **minimum of 40 marks out of 100** for passing the course. It shall be **mandatory to obtain a minimum of 10 marks out of 60** in the End Term Theory Examination separately.

Course Category: Discipline Specific Core Course (DSC): 4, Discipline Specific Elective (DSE):0, Value Education Course (VEC):0, Intern. /Apprentice. /Project /Community (INP):1, Ability Enhancement Course (AEC): 1, Skill Enhancement Course (SEC): 0, Interdisciplinary Elective (IDE): 3

APPROVED COPY

CDC Co-ordinator
G. P. Mumbai

Department Coordinator,
Curriculum Development,Dept. of Civil Engineering

Head of Department,
Dept. of Civil Engineering

In-Charge
Curriculum Development Cell

Principal,
Government Polytechnic Mumbai

Programme : Diploma in Civil Engineering(Sandwich Pattern)													
Course Code: AM 23104					Course Title: Theory of Structures								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
3	1	-	3	8	4	20	20	60	-	-	-	25	125

Total IKS Hrs. for course: 4

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents marks of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Civil Engineering structures consist of several structural members/elements like slabs, beams columns etc. and these members/elements are subjected to various types of loadings resulting the development of various types of stresses and the deflections. These are to be calculated and the members elements are to be designed to take care of these stresses and deflections. Hence analysis of these structural members which is taught in this subject is very essential for the safe design of civil engineering structures.

II. Industry / Employer Expected Outcome

Select a building/infrastructure project where student has to pick up certain structural members say like slabs, beams columns etc. and analyze those by the actual loading on the site and verify.

III. Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Analyze stresses induced in vertical members subjected to direct and bending loads.
CO2	Analyze the fixed and continuous beam to know the shear and bending stresses at any section of these beams by drawing SF and BM diagrams
CO3	Analyze the continuous beams by Moment Distribution Method
CO4	Compute slope and deflection of cantilever and simply supported beams subjected to concentrated and uniformly distributed loads by various methods
CO5	Analyze the simple trusses by method of joints and method of sections

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO1.1** Explain Direct and Bending Stresses in vertical members **TLO1.2** Explain and solve numericals for rectangular and circular cross sections, chimneys, dams, middle third rule, limit of eccentricity, core of section.	**Direct and Bending Stresses in vertical members :** 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. 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. 1.3 Chimneys of circular cross section subjected to wind pressure, Maximum and minimum stresses, resultant stresses and distribution diagram at base. 1.4 Analysis of dams subjected to horizontal water pressure, conditions of stability, Maximum and minimum stresses, resultant stresses and distribution diagram at base. **Course Outcome: CO1 Teaching Hours : 12 hrs Marks: 12 (R- 4, U-4, A-4)**
2	**TLO2.1** Explain concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam. **TLO2.2** Explain principle of superposition, Fixed end moments from first principle for beam subjected to point load, UDL over entire span. **TLO2.3** Apply standard formulae in finding end moments, end reactions and drawing S.F. and B.M. diagrams for a fixed beam. **TLO2.4** Understand definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical examples. **TLO2.5** Understand and apply 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. **TLO2.6** Draw SF diagrams showing point of contraflexure, shear and BM diagrams showing net BM and point of contraflexure for continuous beams.stresses.	**Fixed and Continuous Beam :** 2.1 Concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam. 2.2 Principle of superposition, Fixed end moments from first principle for beam subjected to point load, UDL over entire span. 2.3 Application of standard formulae in finding end moments, end reactions and drawing S.F. and B.M. diagrams for a fixed beam. 2.4 Definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical examples. 2.5 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. 2.6 Drawing SF diagrams showing point of contraflexure, shear and BM diagrams showing net BM and point of contraflexure for continuous beams. **Course Outcome: CO2 Teaching Hours:16 hrs Marks: 14 (R- 4, U- 4, A- 6)**
3	**TLO3.1** Introduce moment distribution method, sign convention, Carry over factor, stiffness factor, distribution factor. **TLO3.2** Apply 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.	**Moment distribution method :** 3.1 Introduction to moment distribution method, sign convention, Carry over factor, stiffness factor, distribution factor. 3.2 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. 3.3 Introduction to portal frames – Symmetrical and unsymmetrical portal frames with the concept of Bays and stories.

	TLO3.3 Introduce portal frames – Symmetrical and unsymmetrical portal frames with the concept of Bays and stories.	**Course Outcome: CO3 Teaching Hours: 12 hrs Marks: 12 (R-2 ,U- 4, A- 6)**
4	**TLO4.1** Explain/Describe concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation). **TLO4.2** Explain 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. **TLO4.3** Explain Macaulay's method for slope and deflection, application to cantilever and simply supported beam subjected to concentrated and uniformly distributed load on entire span.	**Slope and Deflection:** 4.1 Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation). 4.2 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. 4.3 Macaulay's method for slope and deflection, application to cantilever and simply supported beam subjected to concentrated and uniformly distributed load on entire span. **Course Outcome: CO4 Teaching Hours: 12 hrs Marks: 12 (R -2, U- 4, A- 6)**
5	**TLO5.1** Explain/Describe Types of trusses and their suitability (Simple, Fink, compound fink, French truss, pratt truss, Howe truss North light truss, King post and Queen post truss) **TLO5.2** Calculate support reactions for trusses subjected to point loads at joints **TLO5.3** Calculate forces in members of truss using Method of joints and Method of sections.	**Simple trusses:** 5.1 Types of trusses and their suitability (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. **Course Outcome: CO5 Teaching Hours: 8 hrs Marks: 10 (R-2, U- 2, A- 6)**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences. Not applicable

Sr No	Laboratory Learning Outcomes (LLO)	Tutorial Titles	Number of hrs.	Relevant COs
1	Understand Direct and Bending Stresses in vertical members	Direct and Bending Stresses in vertical members	1	1
2	Solve numericals on the topic	Direct and Bending Stresses in vertical members	2	1
3	Understand and learn the principle of superposition and Clapeyron's theorem of three moment for	Fixed and Continuous Beam	1	2

	analyzing fixed and continuous beam			
4	Solve numericals on the topic of fixed and continuous beam	Fixed and Continuous Beam	2	2
5	Understand Moment distribution method	Moment distribution method	1	3
6	Solve numericals on the topic of Moment distribution method	Moment distribution method	2	3
7	Understand Slope and Deflection Unit	Slope and Deflection	1	4
8	Solve numericals on the topic of Slope and Deflection	Slope and Deflection	2	4
9	Understand Simple trusses topic	Simple trusses	1	5
10	Solve numericals on the topic Simple trusses	Simple trusses	2	5

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. **Assignment NO. 1: Ten Numericals on topic 1 given by subject teacher**
2. **Assignment NO. 2: Ten Numericals on topic 2 given by subject teacher**
3. **Assignment NO. 3: Ten Numericals on topic 3 given by subject teacher**
4. **Assignment NO. 4: Ten Numericals on topic 4 given by subject teacher**
5. **Assignment NO.5: Ten Numericals on topic 5 given by subject teacher**
6. **Assignment NO.6: Introduction to STADD software and solving simple problems**
7. **Visit to BMC Material Testing Lab, Worli and a report on that.**

Formative assessment (Assessment for Learning) for PR and SLA

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (__marks)

8. Suggested COs - POs Matrix Form

Course	Programme Outcomes (POs)	Programme Specific Outcomes (PSOs)

Outcomes (COs)	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	2	1	--	3	2	2	3
CO2	3	3	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	2	3	3	3	--	--	2	3	2	3

Legends: - High:03, Medium:02, Low:01, No Mapping: --

9. Suggested Learning Materials / 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

10. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://www.civilenggforall.com	
2	http://www.coursera.org	
3	http://www.newcastle.edu.au	
4	http://www.elsevier.com	

11. Academic Consultation Committee/Industry Consultation Committee:

Sr.	Name	Designation	Institute/Organization

No			
1	Shri. S D Borkar	Deputy Engineer	PWD
2	Shri. Sudhir Nimbalkar	Assistant Engineer	BMC
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr D K Gupta	HOD in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engineering

Head of Department
Department of Civil Engineering
विभागप्रमुख
स्थापत्य अभियांत्रिकी विभाग,
शासकीय तंत्रनिकेतन, मुंबई.

I/C, Curriculum Development Cell

Principal

Programme : Diploma in Civil Engineering(Sandwich Pattern)													
Course Code: AM 23105						Course Title: Concrete Technology							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	-	2	2	8	4	20	20	60	25	25	-	25	175

Total IKS Hrs. for course: 4

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents marks of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. 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, she/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/she should learn and practice the basic principles governing the strength, durability and workability of concrete. She/he should understand the basic principles of mix-design and develop supervisory skills required for various operations in concrete construction.

II. Industry / Employer Expected Outcome

Select a building/infrastructure project where student has to pick up certain structural members say beams etc. and analyze those by the actual loading on the site and verify.

III. Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Use different types of cement and aggregates in concrete.
CO2	Know the grade of concrete, terms and laws related to concrete, properties of fresh and hardened concrete
CO3	Design and prepare concrete of required specification.

CO4	Maintain quality of concrete under different conditions.
CO5	Apply relevant admixtures for concreting.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO1.1** Understand physical properties of Cement: fineness, standard consistency, setting time, soundness, compressive strength. Relevant BIS codes **TLO1.2** Understand and Explain testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement **TLO1.3** Explain 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. **TLO1.4** Explain aggregates: Requirements of good aggregate, Classification according to size and shape. **TLO1.5** Explain 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. **TLO1.6** Explain 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. **TLO1.7** Explain Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.	**Cement, Aggregates and Water:** 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 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. 1.4 Aggregates: Requirements of good aggregate, Classification according to size and shape. 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. 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. 1.7 Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456. 1.8. Emerging trends in concrete technology. **Course Outcome: CO1 , Teaching Hours : 14 hrs Marks: 14 (R-6, U-6, A-2)**
2	**TLO2.1** Explain Concrete: Different grades of concrete, provisions of IS 456. **TLO2.2** Explain 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. **TLO2.3** Understand and explain 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.	**Concrete:** 2.1 Concrete: Different grades of concrete, provisions of IS 456. 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. 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

	TLO2.4 Explain Properties of Hardened concrete: Strength, Durability, Impermeability, hydration of cement.	2.4 Properties of Hardened concrete: Strength, Durability, Impermeability, hydration of cement. **Course Outcome: CO2 Teaching Hours : 12** **Marks: 12 (R-4, U-4, A-4)**
3	**TLO3.1** Explain Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262 (only procedural steps). **TLO3.2** Explain 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. **TLO3.3** Explain the 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.	**Concrete Mix Design and Testing of Concrete:** 3.1 Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262 (only procedural steps). 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. 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. **Course Outcome:CO3 Teaching Hours : 12 Marks:10 (R- 2 , U- 4 , A- 4)**
4	**TLO4.1** Explain Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete. **TLO4.2** Explain 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. **TLO4.3** Explain Curing methodolgy. **TLO4.4** Explain Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints **TLO4.5** Explain Durability of concrete	**Quality Control of Concrete:** 4.1 Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete. 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. 4.3 Curing methodolgy. 4.4 Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints. 4.5 Durability of concrete. **Course Outcome:CO4 Teaching Hours :10 Marks:12 (R- 4 , U- 4 , A-4)**
5	**TLO5.1** Explain/Describe 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. **TLO5.2** Explain/Describe 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. **TLO5.3** Explain Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition.	**Chemical Admixture, Special Concrete and Extreme Weather concreting:** 5.1Admixtures 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.

	TLO5.4 Explain Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition	5.4 Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition. **Course Outcome:CO5 Teaching Hours :12 Marks:12 (R- 4 , U- 4 , A- 4)**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.** Fineness of cement by Blaine's air permeability apparatus Or by sieving.	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.	2	CO1
2	**LLO2.** Specific gravity, standard consistency, initial and final setting times of cement.	Determine specific gravity, standard consistency, initial and final setting times of cement.	2	CO1
3	**LLO 3.** Compressive strength of cement.	Determine compressive strength of cement.	2	CO1
4	**LLO 4.** Silt content in sand.	Determine silt content in sand.	2	CO1
5	**LLO 5.** Bulking of sand, bulk density of sand and course aggregate	Determine bulking of sand, bulk density of sand and course aggregate	2	CO1
6	**LLO 6.** Water absorption of fine and coarse aggregates.	Determine water absorption of fine and coarse aggregates.	2	CO1
7	**LLO 7** Fineness modulus of fine aggregate by sieve analysis.	Determine Fineness modulus of fine aggregate by sieve analysis.	2	CO1
8	**LLO 8.** Impact value of aggregate.	Determine impact value of aggregate.	2	CO1
9	**LLO 9** Determine crushing value of aggregate.	Determine crushing value of aggregate.		
10	**LLO 10.** Abrasion value of aggregate.	Determine abrasion value of aggregate.	2	CO1
11	**LLO 11** Elongation and flakiness index of coarse aggregates.	Determine elongation and flakiness index of coarse aggregates.	2	CO1
12	**LLO 12.** Workability of concrete by slump cone test.	Determine workability of concrete by slump cone test.	2	CO2
13	**LLO 13.** Workability of concrete by compaction factor test.	Determine workability of concrete by compaction factor test.	2	CO2

14	**LLO 14.** Concrete mix of a particular grade	To prepare concrete mix of a particular grade	2	CO3
15	**LLO 15.** Awareness of NDT equipments .	Demonstration of NDT equipments .	2	CO5
Total				

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. **Assignment NO. 1: Visit a material testing lab of a professional organization and write a report**
2. **Assignment NO. 2: Visit an actual site of construction where mass concreting is going on and write a report on it**
3. **Assignment NO. 3: Write a report how the quality of concrete is controlled on actual site**
4. **Assignment NO. 4: Design any of the concrete mix with the help of a professional lab**
5. **Assignment NO. 5: Write a report on NDT equipments how to use these**
6. **Assignment NO. 6: Write a report on different grades and types of formwork**
7. **Assignment NO. 7: Write a report on form finish work and stamped concrete**

Formative assessment (Assessment for Learning) for PR and SLA

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (__marks)

8. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	2	1	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	3	2
CO4	2	2	3	2	1	1	3	3	2	2

CO5	3	3	3	3	1	1	2	2	2	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

9. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Concrete Technology	Gambhir, M.L., Tata McGraw Hill	ISBN-13 9781259062551
2	Concrete Technology	Shetty, M.S., S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.	ISBN : 978-81-2190003-4
3	Concrete Technology	Santhakumar, A. R., Oxford University Press, New Delhi.	ISBN-10: 0199458529; ISBN-13: 9780199458523
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	--

10. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://econcretetech.com	
2	http://www.cement.org	
3	http://www.j-act.org	
4	http://www.indianconcreteinstitute.org	

11. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Shri. S D Borkar	Deputy Engineer	PWD
2	Shri. Sudhir Nimbalkar	Assistant Engineer	BMC
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr D K Gupta	HOD in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engineering

Head of Department
Department of Civil Engineering

विभागप्रमुख
स्थापत्य अभियांत्रिकी, विभाग,
शासकीय तंत्रनिकेतन, मुंबई.

I/C, Curriculum Development Cell

Principal

Concrete Technology
(AM 23105)

APPROVED COPY

Approved Copy

CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in civil engineering												
Course Code: CE23112						Course Title : HYDRAULICS						
Compulsory / Optional:												
Teaching Scheme and Credits						Examination Scheme						
CL	TL	LL	SLH	NLH	Credits	FA-TH	SA-TH (3 Hrs.)	FA-PR	SA		SLA	Total
									PR	OR		
O3	-	02	02	06	03	40	60	25	-	-	25	150

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Hydro means water and Hydraulics is a branch of engineering science deals with behavior of fluids at rest as well as in motion. While constructing any of the hydraulic structures like dam, construction of canals and hydroelectric power station, design of water supply system, etc; a Civil Engineer must have the knowledge about the properties of fluids, water pressure, types of flows and different hydraulics machine.

II. Industry / Employer Expected Outcome:

To understand the types of equipment driven by **hydraulic** fluid power. To understand how **hydraulic** fluid power works. **Apply the principles of hydraulics in given situation to solve the civil engineering** problem. To gain knowledge on the fundamental aspects of fluid flow physics and properties of fluid flow and selection of hydraulic machinery for relevant applications. . To learn various flow measurement techniques.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Know about the properties of fluid

CO2	e principle of pressure measuring devices.
CO3	Compute the total hydro static pressure & center of pressure
CO4	Identify the concept of fluid flow, types of flow and water pressure
CO5	Compute the loss of water flowing through pipes required to consider while designing water supply system

Course Content Details:

Unit No	**Topics / Sub-topics**
TLO 1.1Explain the terms associated with Hydraulics TLO 1.2Clarify different properties of liquid TLO1.3. Describe different types of pressure and methods of measurement	1.Properties Of Fluid: 1.1 Definition of fluid, Introduction to fluid mechanics and hydraulics, Importance of Hydraulics with respect to Irrigation and Environmental engineering. 1.2 Physical properties of fluid - Mass density, Weight density, Specific volume, Specific gravity, Surface tension and capillarity, Compressibility, Viscosity 1.3 Introduction to smart hydraulics 1.4 Emerging trends in hydraulics. . **Course outcome:01 teaching hours :4 hrs marks:06**
TLO2.1 Explain the Relationship between pressure and depth of liquid TLO2.2 Compute total Pressure and Centre of pressure TLO1.3. Describe different types of pressure and methods of measurement	2.Pressure and its measurement: 2.1 Definition of pressure and its SI unit, Hydrostatic pressure at point- Pascal's law, Variation of pressure in static liquid. Numerical problems. 2.2 Total pressure and center of pressure, vertical plain surface submerged in liquids, and Horizontal plain surface submerged in liquid, Inclined plain surface submerged in liquid. Numerical problems. 2.3 Absolute, gauge, atmospheric & vacuum pressure, measurement of pressure-manometers and mechanical gauges. Numerical on Piezometer and U tube manometer **Course outcome:02 teaching hours :8hrs marks:09**
TLO3.1 Explain different types of flow TLO3.2. Derive Continuity Equation TLO3.3 Explain different kinds of energy TLO3.4 Apply Bernoulli's theorem to measure the pressure and discharge.	3.Hydrodynamics and hydrokinematics: 3.1 Types of flow - Laminar --Turbulent --Uniform -- Non-uniform –Steady--Un-steady –Rotational and irrotational --One, Two and Three Dimensional flow 3.2 Reynold's number 3.3 Continuity Equation 3.4 Types of Energy – Potential, Pressure and kinematics 3.5 Bernoulli's Equation and its applications.

	3.6 Momentum Equation **Course outcome:03 teaching hours :12hrs marks:17**
TLO4.1 Compute different Hydraulic Coefficient for different types of orifice TLO4.2. Identify types of Notches and weirs . TLO4.3. Calculate discharge through notches and weirs.	4. Flow through orifice, notches and weirs: 4.1 Definition and types of orifice 4.2 Various Hydraulic Coefficient and its relation - Coefficient of Contraction, Velocity, Discharge. 4.3 Types of notches and weirs 4.4 Computation of discharge through notches 4.4.1 Rectangular Notch 4.4.2 V -Notch. 4.5 Computation of discharge through weirs ,venturimeter. 4.5.1 Discharge through narrow crested and broad Crested weir. 4.5.2 Discharge through Cipolletti weir. **Course outcome:04 teaching hours :12hrs marks:16**
TLO5.1 Explain Energy (Head) losses TLO5.2 Draw Hydraulic Gradient Line (HGL) and Total Energy Line (TEL) TLO5.3 Design Pipeline	5. Flow through pipes: 5.1 Characteristics of flow through pipes 5.2 Major and Minor Energy (Head) losses in pipe Flow- frictional loss, loss of head at entry , exit, Sudden enlargement and contraction and at bend. 5.2.1 Computation of major head by Darcy Weisbach Equation. 5.3 Hydraulic Gradient Line (HGL) and Total Energy **Course outcome:05 teaching hours :12hrs marks:12**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	To study the Hydrostatics Law	2	C02
2	Verification of Bernoulli's equation	2	C03

3	Determination of coefficient of discharge for a given Venturimeter.	4	C04
4	Determination of coefficient of discharge for a given Orificemeter or Nozzle meter.	6	C04
5	Determination of Minor losses in pipes	4	C05
6	Determination of coefficient of discharge for given rectangular or triangular notch.	6	C04
7.	Determine loss of head in various diameter of pipes and effect of material of pipe on loss of head	4	C05
8.	Demonstrate use of Reynold's number	2	C03

Note: if any

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

Following is the list of proposed student activities like: .

1. Student will Survey an industry / Department for handling or using pressure measuring devices.
2. Student will visit nearby Canal Structure and Submit report consisting flow data, cross sections, hydraulic data etc. for the same
3. Student will carry out market survey for pipes of different materials

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Properties of fluid	2	4	0	06
2	Pressure and its measurement:	3	2	4	09
3	Hydro kinematics & Hydrodynamics	4	6	7	17
4	Flow through orifice, notches and weirs	2	14 5	9	16
5	Flow through pipes	4	4	4	12
	Total	**15**	**21**	**24**	**60**

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Rubrics for continuous assessment based on process and product related performance indicators (___ marks)

- (TH 40 marks + 25PR) Two-unit tests of 20 marks. For Practical learning 25 marks.

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (__marks)

End term examination, Viva-voce, Workshop performance (60 TH + 25 OR marks)

- End semester assessment of 25 marks for OR (Based on Practical learning) End semester assessment of 60 marks through end semester examination.

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	2	2	2	1	-	-	2	1	1	-
CO2	2	3	2	-	1	-	1	2	2	1
CO3	3	3	3	2	2	1	2	3	2	-
CO4	2	3	2	2	3	2	3	2	2	1
CO5	2	2	-	2	3	2	2	3	2	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	Dr. R .K. Bansal	1. Fluid Mechanics and Hydraulic Machines	Edition 9th 2005 Publisher- Laxmi Publications Pvt. Ltd., New Delhi
2	S. K. Likhi	2. Hydraulics	Publisher- T.T.T.I. Chandhigrah
3	A.K.JAIN	3. Fluid mechanics	Khanna publishers

4	R.K.BANSAL	4.Hydraulics, Fluid mechanics and Hydraulic machine	S. Chand publishers
5.	S.C.GUPTA	5.Fluid mechanics and hydraulics	Pearson education publisher

X. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	www.blackwellpublishing.com	
2	www.learnrstv.com	
3	www.shiksha.com , IIT, Roorkee	
4	nptel.iitm.ac.in	

XI.Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Shri.S.R.Kulkarni	rcc consultant, surveyor	private organization
2	Shri. Dipak kulkarni	structural audit, surveyor,RCC consultant	private organization
3	Shri.Sudhir Nimbalkar	Assitant Engineer	BMC
4.	Dr.D.K.Gupta	HOD, Civil Engg.Dept.	Government polytechnic, Mumbai.

Coordinator,
Curriculum Development,
Department of civil Engineering

I/C Curriculum Development Cell

Head of Department
Department of civil Engineering
विभागप्रमुख
स्थापत्य अभियांत्रिकी, विभाग,
शासकीय तं. निकेतन, मुंबई.

Principal

APPROVED COPY
Approved Copy
CDC Co-ordinator
G.P. Mumbai

Programme : Diploma in Civil Engineering													
Course Code:CE23106						Course Title : Environmental Engineering							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (3 Hrs.)	FA-PR	SA		SLA	Total
						TS1	TS2			PR	OR		
4	---	2	2	8	4	20	20	60	25	---	25#	25	175

Total IKS Hrs. for course: 4 hrs /sem

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# on Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale:

II. Industry / Employer Expected OutcomeThis course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified outcome expected from this course and they can execute quality supply of potable and wholesome water to the society and safe disposal of sewage water from the locality.

Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Calculate quantity and analyze quality of water.
CO2	Select type of treatment required to raw water.
CO3	Identify various accessories for efficient conveyance and distribution of water
CO4	Decide treatment of sewage and its safe disposal
CO5	Identify various accessories for efficient conveyance of sewage water

		4.5 Design of sewers: Peak flow, non-scouring velocity, self-cleansin velocity, gradient of sewer, size of sewer, Laying and testing of sewers. 4.6 Sewer appurtenances: Manholes-types, purpose, location. Inlets, Ventilation of sewers. 4.7 Maintenance of sewers. Safety precautions during maintenance of sewers 4.8 Building Drainage System: Systems of plumbing- Single stack, One pipe and One pipe partially ventilated Two pipe systems. 4.9 Components of house drainage system- Traps, Inspection chamber, Sanitary fittings, Layout of building drainage system, Recycling of waste water. 4.10 Emerging trends in Waste water treatment Course Outcome:CO4 Teaching Hours :12 hrs Marks:12 (R- 4 , U 4, A-4)
	TLO5.1. Evaluate the characteristics of Sewage TLO5.2. Analyze the sewage TLO5.3.Suggest methods for treatment or Sewage TLO5.4 Examine the quality of treated sewage as per given norms of MPCB TLO5.5. Draw flow diagram for sewage treatment plant for the given data. TLO 5.6. Select the relevant method of treatment of sewage in the given situation	Characteristics, Treatment & Disposal of Sewage 5.1 Characteristics of sewage: Physical, Chemical and biological. Strength of sewage. 5.2 Aerobic and anaerobic decomposition, Importance of BOD and its significance, COD and its significance, MPCB norms for the discharge of treated sewage. 5.3Treatment of sewage- Layout of STP, Preliminary treatment - Screening; grit removal; grease removal, Primary treatment – sedimentation & chemical precipitation, Secondary treatment – Trickling filter & activated sludge process. 5.4Sludge & effluent disposal-Types of sludge, method of sludge disposal. Natural &artificial methods of disposal of effluent, Miscellaneous treatment – oxidation pond & ditch,septic tank details 5.5 Course Outcome:CO5 Teaching Hours : 14 hrs Marks: 14 (R- 4, U- 6, A- 4)

I. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Suggest the type of population forecasting method to a particular city.	Collecting data regarding population of city/town and forecast population and find out total water demand.	04	1
2	LLO 1.2 Suggest the type of water according to I.S codes with justification with respect to pH	Determine the pH value of given sample of water	02	2
3	LLO 1.3 Suggest the type of water according to I.S codes with justification w.r.t turbidity	Determine the turbidity of the given sample of water	02	2
4	LLO1.4 Determine the optimum dose of Coagulant by jar test	Conduct test on water sample for determination of optimum dose of Coagulant.	02	2
5	LLO1.5 Suggest the method of maintenance	Assignment on maintenance of sewers.	02	4
6	LLO1.6 Suggest the type of sewage water according to I.S codes with respect to pH.	Conduct test on sewage sample to determine its pH	02	4
7	LLO 1.7 Suggest the type of sewage water according to I.S codes with respect to turbidity	Conduct test on sewage sample to determine its turbidity.	02	4,5

For Practical learning 25 marks.

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (60 TH + 25 OR marks)

End semester assessment of 25 marks for OR (Based on Practical learning)

End semester assessment of 60 marks through end semester examination.

Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	2	3	3	3	3	3	2	2	3	1
CO2	2	3	3	3	3	3	2	2	3	2
CO3	2	3	3	3	3	3	2	1	3	2
CO4	2	3	3	3	3	3	2	1	3	1
CO5	2	3	3	3	3	3	2	1	3	1
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

V. Suggested Learning Materials / Books

r.No	Author	Title	Publisher
1	Water Supply & Waste water Engg. (Two vol.)	S. K. Garg,	13:978-8174091208, 8174092307
2	Water Supply & Sanitary Engg	G.S. & J. S. Biridie, Dhanpat Rai & Sons,, Delhi	13:978-8787433798,
3	Environmental Engg	A. Kamala & D.L. Kanth Rao	0074517082, 9780074517086
4	Water Supply & Waste Water Engg. (Two vol.)	Dr. B.C.Punmia & Jain Laxmi Publication,Jodhpur	13:978-8131807033,

VI. Learning Websites & Portals

Sr.No	Link / Portal	Description

Programme: Diploma in Civil Engineering (Sandwich Pattern)													
Course Code: CE23502						**Course Title: COMPUTER AIDED DRAFTING**							
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2:30 Hrs.)**	**FA-PR**	**SA**		**SLA**	**Total**
						TS1	**TS2**			**PR**	**OR**		
-	-	4	-	4	2	-	-	-	50	50#	-	--	100

Total IKS Hrs for Course: 02 Hrs
Abbreviations: CL- Class Room Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment.

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal OnlineExamination

Note:
1. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
2. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
3. 1 credit is equivalent to 30 Notional hrs.

I. Rationale

With the advent of technology, the process of drafting and design has transitioned from manual techniques to digital methods. The study of Computer Aided Drawing and Drafting (CADD) is representing the forefront of this evolution, providing designers with powerful tools to streamline the creation, modification, and visualization of technical drawings.

II. Industry / Employer Expected Outcome

Create technical drawings using CADD software accurately and efficiently according to industry standards in multidisciplinary teams.

III. Course Outcomes

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Use basic commands in CADD software.
CO2	Draw complex 2D drawings in CADD software using draw and modify tools.
CO3	Draw isometric drawings using CADD software.
CO4	Use software to dimension and write text on 2D geometric entities.
CO5	Plot given 2D entities using proper plotting parameters in CADD.

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO 1.1** Fundamentals: various drafting software for Civil engineering applications. System requirement for drawing software. Advantages of computer aided drawing over traditional method of drawing. **TLO 1.2** Set the CADD workspaceand interface. **TLO 1.3** Prepare drawing usingUser Coordinate System (UCS)and World Coordinate System (WCS) **TLO 1.4** Apply different object selection methods in a given situation. **TLO 1.5** Use various commands in application menu bar.	**Fundamentals of CAD Drawing:** 1.1 Fundamentals: various drafting software for Civil engineering Applications. System requirement for drawing software. Advantages of computer aided drawing over traditional method of drawing. 1.2 Fundamentals of Computer Aided Draftingand its applications, Various Software for Computer Aided Drafting. 1.3 CADD Interface: Application Menu, Quick Access Toolbar, Ribbons, Info Center, CommandWindow, Graphical Area, Status Bar. 1.4 CADD initial setting commands: Snap, grid,Ortho, Osnap, Dynamic input, Limits, Units, Lt scale, Object tracking. 1.5 Co-ordinate System- Cartesian and Polar,Absolute and Relative mode, Direct DistanceEntry, UCS, WCS. 1.6 Object Selection methods- picking, window,crossing, fence, last and previous. 1.7 Opening, saving and closing a new andexisting drawing. Course Outcome: CO1 Teaching Hours : 16 hrs
2	**TLO 2.1** Use viewing commands. **TLO 2.2** Apply formatting commands. **TLO 2.3** Draw simple 2D entitiesusing given draw commands. **TLO 2.4** Determine coordinates, distance, area, length, centroid ofthe given 2D entity.	**Zoom, Draw, Formatting andEnquiry Commands :** 2.1 Zoom Commands – all, previous, out, in,extent, Real time, dynamic, window, pan. 2.2 Draw Command - Line, Polyline, arc, circle,rectangle, polygon, ellipse, spline, block, hatch. 2.3 Formatting commands - Layers, block,line type, line weight, color. 2.4 Enquiry commands – distance, area. Course Outcome: CO2 Teaching Hours :12 hrs
3	**TLO 3.1** Draw given complex 2Dentities using modify commands. **TLO 3.2** Use grip command to manipulate given 2D entity.	**Modify and Edit Commands:** 3.1 Modify Command - Erase, trim, extend, copy,move, mirror, offset, fillet, chamfer, array, rotate, scale, lengthen, stretch, measure, break, divide, explode, align. 3.2 Editing Objects by Using Grips - Moving,Rotating, Scaling, Mirroring and Stretching. Course Outcome: CO3 Teaching Hours : 12 hrs

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

Unit No.	Theory Learning Outcomes (TLO)	Topic / Sub-topic
4	**TLO 4.1** Draw isometric entities. **TLO 4.2** Draw isometric object from given orthographic views. **TLO 4.3** Use Layers for 2D drawings. **TLO 4.4** Draw and modify blocksfor given 2D entities. **TLO 4.5** Use blocks in same and inanother given file.	**Isometric Drawings, Layers, andBlocks :** 4.1 Isometric drafting- Isometric grid & snap,Isometric axis & plane, Polyline, Isocircle. 4.2 Dimensioning Isometric drawings. 4.3 Text writing on Isometric drawing. 4.4 Layer, Layer properties and applications. 4.5 Blocks: create, modify and use in same fileand in another file. Course Outcome: CO4 Teaching Hours : 12 hrs
5	**TLO 5.1** Use various dimensioningstyles to drawn 2D entities. **TLO 5.2** Apply Geometric and dimension tolerance symbols onthe given entity. **TLO 5.3** Write text on given 2Dentity. **TLO 5.4** Insert table in drawing. **TLO 5.5** Prepare new template fordrawing as per requirement. **TLO 5.6** Plot given 2D entities using proper plotting parameters. **TLO 5.7** Use of plot/print command for the output of given drawing.	**Dimensioning, Text and PlotCommands :** 5.1 Dimensioning commands - Dimension styles,Dimensional Tolerances and Geometrical Tolerances, Modify dimension style. 5.2 Text commands - dtext, mtext command. 5.3 Insert table – table, tablestyle command. 5.4 Template Drawing- Standard template,loading template, create new template. 5.5 Plotting a drawing – adding plotter/printer,page setup, plot style commands. Course Outcome: CO5 Teaching Hours : 08 hrs

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr. No.	Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.1** Use basic commandsin CADD software. **LLO 1.2** Draw 2D entities inCADD software.	Draw 2-D entities like Line, Polyline, Circle, Rectangle, Polygon and Ellipse by using CADD software.	4	CO1 CO2

APPROVED COPY
Approved Copy
CDC Co-ordinator
G. P. Mumbai

Sr. No.	Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
2	**LLO 2.1** Use basic commands in CADD software. **LLO 2.2** Draw 2D entities inCADD software using Draw commands individually.	Draw a simple 2-D objects using any combination of2 or more commands, like polygon+circle, line+circle, etc. by using CAD Software.	4	CO1 CO2
3	**LLO 3.1** Use basic commandsin CADD software. **LLO 3.2** Draw 2D entities inCADD software using Draw,Edit and Modify commands.	Introduction and use of AutoCAD for making 2D Drawings and develop plan, Section and elevation of 2 rooms building./	4	CO1 CO2
4	**LLO 4.1** Use basic commandsin CADD software. **LLO 4.2** Draw 2D entities in CADD software using Draw, Edit and Modify commands. **LLO 4.3** Apply dimension and write text on 2D geometric entities.	Prepare Line plan of Residential Building with staircase Using CAD Software.	4	CO1 CO2 CO4
5	**LLO 5.1** Use basic commandsin CADD software. **LLO 5.2** Draw 2D entities inCADD software. **LLO 5.3** Apply dimension andwrite text on 2D geometric entities.	Prepare Line plan of Public Building with staircase with using CAD Software.	4	CO1 CO2 CO4
6	**LLO 6.1** Use basic commandsin CADD software. **LLO 6.2** Draw 2D entities inCADD software. **LLO 6.3** Apply dimension andwrite text on 2D geometric entities.	Draw a plan of Building and dimensioning using layers. a) Single storied buildings b) Multi storied buildings with using CAD Software.	4	CO1 CO2 CO4

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

Sr. No.	Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
7	**LLO 7.1** Use basic commandsin CADD software. **LLO 7.2** Draw 2D entities inCADD software. **LLO 7.3** Apply dimension and write text on 2D geometric entities.	Developing sections and elevations for given a) Single storied buildings b) Multi storied buildings with using CAD Software.	4	CO1 CO2 CO4
8	**LLO 8.1** Use basic commandsin CADD software. **LLO 8.2** Draw 2D entities inCADD software. **LLO 8.3** Apply dimension andwrite text on 2D geometric entities.	Drawing of building components like walls, lintels, Doors, and Windows with using CAD Software.	4	CO1 CO2 CO4
9	**LLO 9.1** Use basic commandsin CADD software. **LLO 9.2** Draw 2D entities inCADD software. **LLO 9.3** Apply dimension andwrite text on 2D geometric entities.	Drawing the plan, section and elevation for an industrial building with using CAD Software.	4	CO1 CO2 CO4
10	**LLO 10.1** Use basic commands in CADD software. **LLO 10.2** Draw 2D entities in CADD software. **LLO 10.3** Apply dimension and write text on 2D geometricentities.	Drawing, to the suitable scale of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing: a) Developed plan b) Elevation with using CAD Software	4	CO1 CO2 CO4
11	**LLO 11.1** Use basic commands in CADD software. **LLO 11.2** Draw 2D entities in CADD software. **LLO 11.3** Apply dimension and write text on 2D geometricentities.	Drawing an assembly drawing from the any given detailed drawing showing assembly dimensions, part number and bill of Material by using CAD Software.	8	CO1 CO2 CO4

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

Sr. No.	Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
12	**LLO 12.1** Use basic commands in CADD software. **LLO 12.2** Draw 2D entities in CADD software. **LLO 12.3** Apply dimension and write text on 2D geometricentities.	Draw Foundation with suitable scale of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing: a) Developed plan b) Elevation Using CAD Software.	8	CO1 CO2 CO4
13	**LLO 13.1** Use basic commands in CADD software. **LLO 13.2** Draw isometric drawings using CADD software.	Draw isometric drawing of simple objects –Straight Lines and edges (minimum 02 objects) using CAD Software.	8	CO1 CO3
14	**LLO 14.1** Use basic commands in CADD software. **LLO 14.2** Draw isometric drawings using CADD software	Draw isometric drawing of simple objects-Curved Edges (minimum 02 objects) using CAD Software.	8	CO1 CO3 CO4
15	**LLO 15.1** Use basic commands in CADD software. **LLO 15.2** Write text in title block.	Prepare a template for your institute of predefined paper size with title block and institute logo by using CAD Software.	4	CO1 CO4
16	**LLO 16.1** Use basic commands in CADD software. **LLO 16.2** Take printout by using plot option **LLO 16.3** Prepare 3-D view of given object.	Plot the drawings from Sr. 13 on Paper with title block and institute logo Developing a 3-D plan from a given 2-D plan by using CAD Software.	4	CO1 CO5

V. Suggested Micro Project / Assignment / Activities for Specific Learning /Skills Development (Self Learning):

Not Applicable

Note: Above is just a suggestive list of micro projects and assignments; faculty must prepare their own bank ofmicro Projects, assignments, and activities in a similar way.
The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
If a micro project is assigned, it is expected to be completed as a group activity.
SLA marks shall be awarded as per the continuous assessment record.
If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

Formative assessment (Assessment for Learning)

Term work Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product Continuous assessment based on process and product related performance indicators, laboratory experience.

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Lab performance, Practical Exam of 25 marks

VI. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	-	1	-	-	1			
CO2	2	1	1	-	-	-	1			
CO3	2	1	1	-	-	-	1			
CO4	2	-	-	-	-	-	1			
CO5	1	-	-	1	1	1	1			

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

a. Suggested Learning Materials / Books :

Sr.No	Author	Title	Publisher with ISBN Number
1	Prof. Sham Tickoo	AutoCAD 2021 for Engineers & Designers, Basic & Intermediate	Publisher: BPB Publications, 21 February 2021, ISBN-10: 9389898986, ISBN-13: 978-9389898989
2	Sankar Prasad Dey	Autocad 2014 for Engineers Volume 1	Publisher: Vikas, 21 December 2021, ISBN-13: 978-9325983373
3	Prof. Sham Tickoo	AutoCAD 2024: A Problem-Solving Approach, Basic and Intermediate	Dreamtech Press publication, August 20, 2023, ISBN-10 1640571779, ISBN-13 978-1640571778
4	Kulkarni D.M	Engineering Graphics with AutoCAD	Publisher: Prentice Hall India Learning Private Limited, 1 January 2010, ISBN-10: 8120337832, ISBN-13: 978-8120337831
5	Cadfolks	AutoCAD 2021 For Beginners	Publication: Kishore, 5 May 2020, ISBN-10 819419539X ISBN-13: 978-8194195399
6	Luke Jumper, Randy H. Shih	AutoCAD 2024 Tutorial First Level 2D Fundamentals	SDC Publication, June 27, 2023, ISBN-10 1630575852, ISBN: 978-1-63057-585-4
7	Sharad K. Pradhan, K K Jain	Engineering Graphics , AICTE Prescribed Textbook	Khanna Book Publishing; First Edition, 1 January 2023, ISBN-10 9391505503, ISBN-13 978-9391505509

APPROVED COPY

CDC Co-ordinator
G. P. Mumbai

b. Learning Websites & Portals:

Sr.No	Link / Portal	Description
1	https://www.autodesk.com/education/online-learning	Tutorials, courses, and resources for AutoCAD
2	https://www.cadtutor.net/	Tutorials, articles, forums and downloadable resources covering various CAD software applications.
3	https://www.cadin360.com/	Video tutorials, articles, and downloadable resources to enhance CAD skills.
4	https://ocw.mit.edu/courses/mechanical-engineering/	Lectures, assignments and projects covering topics such as engineering design, CAD/CAM, and product development.
5	https://www.engineering.com/LearningCenter/CAD.aspx	Tutorials, articles, and videos covering CAD software, simulation tools, and engineering design concepts.
6	https://www.youtube.com/watch?v=cmR9cfWJRUU	Introductory tutorial for beginners to AutoCAD, covering topics such as interfacenavigation, basic drawing commands and setting up units and layers.
7	https://www.youtube.com/watch?v=QuR-VKis3jU	2D mechanical drawings in AutoCAD, including drawing parts, adding dimensions,annotations and creating detailed technical drawings.
8	https://www.youtube.com/watch?v=IWYKfzx-M1E	2D mechanical drawings in AutoCAD, including drawing parts, adding dimensionsand annotations, and creating detailed technical drawings.
9*	https://www.youtube.com/watch?v=RA0O6AZewTc	Isometric drawings in AutoCAD
10	https://www.youtube.com/playlist?list=PLYEkKxSL5Gt1hR6Jg0ZiQSlc7vn-HTd7h	Isometric drawings in AutoCAD
11	https://www.youtube.com/watch?v=PHSmwXQriIc	Isometric drawings in AutoCAD

c. **Academic Consultation Committee/Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organization
1	Shri S.R.Kulkarni	Director	S.R.Kulkarni,Engineer,Surveyor,R.C.C.Consultant
2	Shri Kiran More	Sr..Manager	NCCCL,Mumbai
3	Shri Bajirao K.Kakad	HOD in Applied Mechanics Engg.	Government Polytechnic,Mumbai
4	Shri C.R.Khaire	Lecturer in Mechanical Engg.	K.J.Somaiya Polytechnic,Mumbai

B.K.Kakad
Coordinator,
Curriculum Development,
Department of Civil Engineering

Head of Department
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

APPROVED COPY

CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Civil Engineering (Sandwich Pattern)	
Course Code: CE 23107	Course Title: REPAIRS & REHABILITATION OF BUILDINGS
Compulsory / Optional: Optional	

Teaching Scheme and Credits						Examination Scheme							
						FA-TH				SA			
CL	TL	LL	SLH	NLH	Credits	T1	T2	SA-TH (2:30 Hrs.)	FA-PR	PR	OR	SLA	Total
4	-	-	2	6	3	20	20	60	-	-	-	25	125

Total IKS Hrs. for course: 3

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents marks of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Maintenance of a building is the work done for keeping an existing building in a condition where it can continue to perform its intended functions. Proper maintenance not only improves functional and aesthetic value but also extends the life of building/structure and ensures safety of the users. Normally constructed building remains in a good shape for only for 40 to 50 years and starts deteriorating if not maintained properly. Inadequate maintenance and lack of repair works may lead to limited life span of buildings. However, with regular inspection and maintenance that enable timely identification of deteriorated elements and appropriate remedial measures, the life of normally constructed buildings/structures may be extended up to 100 years. Most of the modern buildings constructed in India are now becoming old as they have reached the age beyond 40 years and needs maintenance. Thus there is a great demand and employment potential in this area. This course is therefore introduced in the curriculum so that students can also develop competence in this area. The course deals with the maintenance of buildings, concrete repair chemicals, special materials used for repair and repair of various parts of a building, strengthening of reinforced concrete members by shoring, underpinning, plate bonding, RC jacketing, control on termites and fungus in buildings, etc. Knowledge and skills gained through this course may also prove helpful in upkeep and preservation of historical monuments.

Repairs & Rehabilitation of Buildings (CE23107)

structures and to extend their life.

II. Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Assess the health condition of structures.
CO2	Inspect and evaluate damage structures.
CO3	Test and assess the repairs materials for concrete structures.
CO4	Implement the techniques for repairing of concrete structures.
CO5	Dismantle and demolish structures which cannot be repaired in an environment friendly, with maximum saving of materials and in a safe way.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO 1.1** Explain the requirement of Maintenance in building. **TLO 1.2** Explain various types of maintenance in building. **TLO 1.3** Assess the quality aspects of existing building. **TLO 1.4** Assess the quality aspects of services in existing building.	**Introduction to Maintenance of Buildings:** 1.1 Introduction 1.2 Importance of maintenance 1.3 Types of maintenance - daily, weekly, monthly, Annually 1.4 General Maintenance - Painting of Buildings - Home Electricity System 1.5 Emerging trends in Repairs and Rehabilitation of buildings. **IKS:** Construction of historical buildings. **Course Outcome: CO1 Teaching Hours : 06 Marks: 6 (R- 2, U-4, A-0)**
2	**TLO**2.1 Explain Causes of distress. **TLO** 2.2. Explain types of distress. **TLO**2.3 Explain distress diagnostic techniques **TLO**2.4 Carry out inspection and evaluation of damaged structure.	**Causes and Detection of Damages:** 2.1 Causes of distress in structures 2.2 Construction and design failures 2.3 Condition assessment and distress-diagnostic techniques,NDT 2.4 Inspection and evaluating damaged structure. **Course Outcome: CO2 Teaching Hours : 12 Marks:10 (R-2 , U- 4 , A- 4)**
3	**TLO 3.1** Identify materials for repair in building. **TLO 3.2** Explain techniques for Repairs..	**Materials and Techniques For Repair:** 3.1 Materials for Repair - Special concretes and mortar , concrete chemicals , construction chemicals , Expansive cement ,polymer concrete ,sulphur infiltrated concrete , Ferro cement , Fibre reinforced concrete , Rust eliminators and polymers coating for rebars , foamed concrete , vacuum concrete , asphalt sheeting 3.2 Techniques for Repairs -Gunniting, grouting and Shotcrete , Epoxy injection , Jacketing, shoring and underpinning ,Methods of corrosion protection (a) corrosion inhibitors (b) corrosion resistant steels

3	**TLO 3.1** Identify materials for repair in building. **TLO 3.2** Explain techniques for Repairs..	**Materials and Techniques For Repair:** 3.1 Materials for Repair - Special concretes and mortar , concrete chemicals , construction chemicals , Expansive cement ,polymer concrete ,sulphur infiltrated concrete , Ferro cement , Fiber reinforced concrete , Rust eliminators and polymers coating for rebars , foamed concrete , vacuum concrete , asphalt sheeting 3.2 Techniques for Repairs -Gunniting, grouting and Shotcrete , Epoxy injection , Jacketing, shoring and underpinning ,Methods of corrosion protection (a) corrosion inhibitors (b) corrosion resistant steels **Course Outcome:CO3 Teaching Hours :16 Marks:18 (R- 4 , U- 6 , A- 8)**
4	**TLO 4.1** Explain the Repair work of various component in existing masonry building **TLO 4.2** Explain the Repair work of various component in existing concrete structure **TLO 4.3** Explain process /repairs on termites control. **TLO 4.1** Preparation of Retrofitting and Rehabilitation estimate	**Repair, Retrofitting and Rehabilitation:** 4.1 Repair of - stone, brick and block masonry (Cracks, dampness, efflorescence, joint separation, etc.) , Flooring , Roofs (sloping, flat, pitched, etc.) 4.2 Concrete members due to (i) Steel Corrosion (ii) Lack of Bond (iii) shear, tension, torsion, compression failure , Rainwater Leakage in Buildings , Leakage in Basement, toilet area . 4.3 Control on Termites (White Ants) in Buildings. 4.4 Estimation of Repair and retrofitting. **Course Outcome:CO4 Teaching Hours :16 Marks:18 (R- 2 , U- 8 , A-8)**
5	**TLO5.1** Explain demolition techniques for structures. **TLO5.2** Enlist safety measures to be followed during demolition. **TLO5.3** Explain Safety measures during demolition. **TLO5.4** Explain care to be taken in dismantling of buildings so that maximum resale value material is generated.	**Demolition and Dismantling Techniques:** 5.1Define: Demolition 5.2 Demolition techniques (a) Non Engineering Demolition - Manual Demolition (b) Engineering Demolition - Mechanical Method (i) Wrecking Ball Method (ii) Pusher Arm technique (iii) Thermic Lance Technique (iv) Non – Explosive Demolition (v) Concrete Sawing Method (vi) Deliberate Collapse Method (vii) Pressure Jetting 5.3 Safety measures during demolition operation 5.4 Dismantling of buildings and reuse of materials/fittings from environmental and financial point of view. **Course Outcome:CO5 Teaching Hours :10 Marks:08 (R- 2 , U- 2 , A- 4)**

III. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

- NIL-

Repairs & Rehabilitation of Buildings (CE 23107)

IV. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

i.Select a building repairs project where right from starting to end repair investigation and techniques used.

ii. Visit, inspect and evaluate damaged structures and give suggestion about repair techniques.(in a group of 3 to 4)

iii. Prepare estimate for repair the damaged structure visited.

iv. Take photographs of site visit

v. Each group may prepare a report and give seminar with Power Point Presentation

Formative assessment (Assessment for Learning) for PR

and SLA

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (__marks)

-

1. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	3	2	1	1	1	1	1	--	2	1
CO2	2	3	3	3	2	2	3	--	2	1
CO3	2	3	3	3	2	3	3	--	2	1
CO4	1	3	3	3	3	2	3	--	2	1
CO5	1	3	3	2	3	3	2	--	2	1
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

2. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Maintenance & Repair Of Civil Structures	B .L.Gupta STANDARD PUBLICATIONS	
2	Maintenance, Repair & DELHI Rehabilitation and Minor Works of Buildings	P. C. Varghese, PHI	
3	Building Repair and Maintenance Management	P. S. Gahlot, CBS Publishers and Distributors Pvt Ltd.	
4	Repair of Concrete structures	R.T.Allen and S.C.Edwards, Blakie and Sons, UK	
5	Handbook on Repairs and Rehabilitation of buildings	CPWD, Delhi	
6	Maintenance of Buildings	A.C. Panchdhari, New Age International	
7	Learning from failuresDeficiencies in design, Construction and Service	Raikar R., R & D centre (SDCPL) ,Raikar Bhavan, Bombay	
8	SP:25 Causes, Prevention and Remedies of Cracks in Building	I.S. PUBLICATIONS:	
9	National Building Code of India 2005	I.S. PUBLICATIONS:	

3. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	www.bis.org.in/sf/nbc.htm	
2	cpwd.gov.in/Units/handbook.pdf	
3	http://www.civilengineeringnews.tk/2014/07/methods-of-demolition-ofbuilding.html	
4	thecontractor.org	
5	http://www.nationallibrary.gov.in	

4. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Shri. S D Borkar	Deputy Engineer	PWD

2	Shri. Sudhir Nimbalkar	Assistant Engineer	BMC
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr D K Gupta	HOD in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engineering

Head of Department
Department of Civil Engineering
विभागप्रमुख
स्थापत्य अभियांत्रिकी विभाग,
शासकीय तंत्रनिकेतन, मुंबई.

I/C, Curriculum Development Cell

Principal

Repairs & Rehabilitation of Buildings (CE23107)

APPROVED COPY
Approved Copy
CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Civil Engineering													
Course Code:CE23108						Course Title :Building Services &Maintenance							
Compulsory / Optional: OPTIONAL													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH	SA-TH (3 Hrs.)	FA-PR	SA		SLA	Total
									PR	OR		
04	-	-	2	6	3	40	60	-	-	-	25	125

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. **Rationale: Building serve several** societal needs- primarily as shelter from weather, security , living,space,privacy, to store belongings, and to comfortably live and work. The knowledge of building services and maintenance is necessary to maintain the functional requirements of the building by a civil technologists. As building are boming more complexe and more modern , it is essential to include the same in the civil engineering curriculum.

II. **Industry / Employer Expected Outcome**: Advises about, designs, installs and maintains cost-effective energy-efficient systems for building services such as water, lighting, heating, air conditioning, lifts and telecommunications .

III. **Course Outcomes:** Students will be able to achieve & demonstrate the following COs on completion of course based learning

		Marks -14 10hrs
UNIT-III Fire safety	3a. justify the provision of the fire safety system. 3b. explain the working principle of the given type fire protection systems provided in the given type of building, 3c. select the relevant system of fire safety for the given structure with justification 3d. explain the NBC requirements of providing fire protection system for the given type of multi storeyed building.	3.1 Fire protection requirements for mutistoreyed buildings. Causes in building. Fire detecting and various extinguishing system . Working principles of various fire protection sytems. 3.2 Safety against fire in residential and public buindings, NBC provision for fire safety , Fire resisting materials and their properties, Fire resistant construction , Procedures for carrying out fire safety inspections of exiting buildings, Provision for evacuation. Marks- 12 10hrs
UNIT-IV Lighting, ventilation and acoustics.	4a.Select relevant system of lighting for the given building with justification. 4b. Suggest the lumen capacity required for the given size of the room. 4c. Describe the methods used for the ventilation purposes in the given type of building. 4d. Explain the significance of providing air conditioning system in the given type of building. 4e. Justify the need of acoustic treatment in the given type of building structure. 4f. Explain the relevant method of acoustic treatment for the given type of building structure.	4.1 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. Conversion from Lumen (unit of measurement indicating the visible light output of a light source) to Lux (the metric system of luminance) 4.2 Concept of ventilation , necessity and types of ventilation , Overview of Air Conditioning system for building. 4.3 Building Acoustic,Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator) Marks-14 10hrs
UNIT-V Water supply and sanitation services	5a. Explain the significance of AHJ approval in laying the plumbing system in the given type of building. 5b. Select the fixtures required for laying the plumbing system for the given type of building. 5c. Explain the governing principles of laying the	5.1 Importance of plumbing, AHJ(Authority Having Jurisdiction) approval, Plumbing Terminology and fixtures: Terms used in plumbing fixtures,

	plumbing services (water supply/drainage/vent) in the given type of building, 5d. Select the relevant type of valves, pipe material and fittings required for laying the water supply and drainage system for the given site condition with justification. 5e. Suggest the relevant plumbing system for the given type of building with justification.	shapes/sizes,capacities,situation and where used, Traps,Interceptors. 5.2 System of plumbing for building water supply: sources of water, storage of water, hot and cold water supply system. 5.3 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 gray water and reclaimed water. 5.4 Different pipe materials,and joining methods, fittings, hanger supports and valves used in plumbing and their suitability. Marks – 14 10hrs

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Submit your observations along with your comments on the specifications and working of the fire extinguisher by viewing the relevant video/simulation/ photographs.	-	C03
2	View the relevant video/simulation/ photographs. And then draw a line plan showing the provisions of fire safety system in any multi storied residential building/anyone public building in your lacality	-	C03
3	Submit your observations along with your comments on the laying of lighting system to be provided for the given size of room of a dwelling unit by viewing the relevant video/simulation/ photographs.	--	C04
4	Estimate the quantities of the electrical points,switches and wiring system required for the given type of dwelling unit and Prepare a budget for it with summarization of all relevant information in the form of a report	--	C04
5	Identify components of building services available in your institute building and prepare a report.	-	C01
6	Compute the space requirements for the escalator for the given type of building as per guidelines of national building code.	-	C02
7	Compute the space requirements for the lift for the given type of building as per guidelines of national building code.	-	C02

Note: if any

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. **Visit any** building certified by building management services to record the important features that has converted it in to green building and submit the report.
2. Collect the technical brochures of the different components of building services from local market / internet to present in the report form.
3. Under take micro- projects.
4. Give seminar on relevant topics.

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Overview of building services	02	04		06
2	Modes of vertical communication	04	04	06	14
3	Fire Safety	02	04	06	12
4	Lighting, ventilation and acoustics	04	04	06	14
5	Water supply and sanitation systems	04	04	06	14
6					
	Total	**16**	**20**	**24**	60

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators(_NIL__ marks

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (_NIL_marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	2	-	2	-	2	2	2	1	2	2
CO2	2	3	2	-	2	-	1	2	2	1
CO3	3	3	2	2	3	3	2	2	2	3
CO4	3	1	2	2	2	-	2	1	2	3
CO5	2	1	2	2	2	-	2	1	2	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	The A to Z of Practical Building Construction and its Management	Mantri, Sandeep	Satya Prakashan, New Delhi ISBN-13:978-8176849692
2	Plumbing Design and Practice	Deolalikar, S.G.	Mcgraw-Hill,New Delhi, 2004 ISBN: 9780074620694
3	Fire Services in India: History, Detection, Protection, Management	Bag, S.P.	Mcgraw-Hill, New Delhi, 1995, ISBN: 8170995981
4	Principles of Fire Safety Engineering: Understanding Fire and fire Protection	Akhil Kumar Das	PHI learning Pvt. Ltd.,New Delhi.2014 ,ISB-9788120350380
5	National Building Code Part1,4,8,9	BIS	Bureau of Indian
6	IS 12183 (Part1): 1987 Code	BIS	

	of practice for plumbing in multistoried buildings		Standard, New Delhi
7	2008 Uniform plumbing code-India (UPS-I)	BIS	

X. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://bis.org.in	
2	http://www.capterra.com	
3	http://bmsbuildingservice.com	
4	http://www.plumbingservices.com	

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Shri. S.R.Kulkarni	RCC Consultant , Surveyor	Private Organization
2	Shri. Dipak.Kulkarni	Structural audit, surveyor, RCC Consultant	Private Organization
3	Shr.i Sudhir Nimbalkar	Assitant Engineer	BMC
4	Dr.D.K.Gupta	HOD,Civil engg .dept.	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engineering

Head of Department
Department of Civil Engineering
विभागप्रमुख
स्थापत्य अभियांत्रिकी, विभाग,
शासकीय तं. निकेतन, मुंबई.

I/C, Curriculum Development Cell

Principal

APPROVED COPY

CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Civil Engineering													
Course Code : CE23109						**Course Title : SAFETY & QUALITY CONTROL**							
Compulsory / Optional : ELECTIVE I													
Teaching Scheme and Credits						**Examination Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2.30 Hrs.)**	**FA-PR**	**SA**		**SLA**	**Total**
						TS1	**TS2**			**PR**	**OR**		
04	--	--	02	06	03	20	20	60	--	--	--	25	125

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents marks of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. 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.

II. Industry / Employer Expected Outcome

Select a building/infrastructure project where right from starting to end, Safety & Quality control in construction operation needed to be taught and practiced.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

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	Analyse the aspects of quality such as quality in design, quality in conformance and quality in performance.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO1.1** Explain parameters governing the safety in construction **TLO1.2** Explain causes and effects accidents	**Meaning and scope of safety in construction:** 1.1 Basic philosophy peculiarities and parameters governing the safety in construction such as site planning and layout, safe access, good house-keeping. 1.2 Accidents and hazards- their causes and effects. **Course Outcome: CO1 , Teaching Hours : 4hrs Marks: 06 (R- 2, U-4, A-0)**
2	**TLO2.1** Explain safety while using construction machineries. **TLO2.2** Explain safety while movement of construction machinery **TLO2.3** Explain safety in prevention & protection at work site **TLO2.4** Explain safety in use of explosives **TLO2.5** Explain Project management and safety in construction **TLO2.6** Describe special precautions for works of engineering & Construction **TLO2.7** Explain Tolerance	**Safety in construction operation:** 2.1 Safety in the use of construction machineries. 2.2 Movement of construction machinery- heavy/ long items, earth moving equipment's. Railway wagons, motor trucks, materials, vehicles, etc. 2.3 Safety in prevention & protection at work site including the collapsing of the structure. 2.4 Safety in use of explosives- open cast machinery, quarrying. 2.5 Project management and safety in construction- Introduction, manpower utilization, utilization of material, equipment and tools. 2.6 Special precautions for works of engineering, construction like distilling/fractioning columns, chimney, silos-oil and gas installation, cable car installation, air fields. 2.7 Tolerance **Course Outcome: CO2 , Teaching Hours :12hrs Marks: 14 (R- 2, U-6, A-6)**
3	**TLO3.1** Explain planning and permit in Demolition operation **TLO3.2** Describe the sequence of demolition **TLO3.3** Explain safety precaution to be taken for and during demolition carrying out repairs, additions and alterations	**Safety in Demolition operation:** 3.1 Planning and permit. 3.2 Planning the sequence of demolition. 3.3 Safety precaution to be taken for and during demolition carrying out repairs, additions and alterations. **Course Outcome: CO3 , Teaching Hours :6hrs Marks: 06 (R- 0, U-2, A- 4)**

4	**TLO4.1** Explain safety with regard to storage, stocking and handling of materials of construction **TLO4.2** Explain accident prevention	**4.1 Safety with regard to storage, stocking and handling of materials of construction:-** 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 & PVC materials, etc. **4.2 Accident prevention: -** 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. **Course Outcome: CO4, Teaching Hours :12hrs Marks: 14(R- 2, U-4, A- 8)**
5	**TLO5.1** Explain meaning of Quality control, difference between quality of design **TLO5.2** Describe Quality policy, Quality objectives, economics of Quality, cost and value of Quality specification. **TLO5.3** Explain Quality control, assurance, checklist, standard procedures and Quality audit, maintenance, calibration of testing equipment for quality assurance –AMIL equipmen **TLO5.4** Explain vender rating, organization setup for Quality management. **TLO5.5** Explain Quality compliance. **TLO5.6** Explain new trends in Quality management	**Quality control: (By Expert lecture / Alumini)** 5.1 Meaning of Quality control, difference between quality of design, quality of conformance (QC) and Quality of performance (QA), concept of reliability and maintainability. 5.2 Quality policy, Quality objectives, economics of Quality, cost and value of Quality specification. 5.3 Quality control, assurance, checklist, standard procedures and Quality audit, maintenance, calibration of testing equipment for quality assurance –AMIL equipment 5.4 Vender rating, organization setup for Quality management. 5.5 Quality compliance. 5.6 New trends in Quality management: Quality circles-basic concept, purpose & functioning, Concept of TQM, concept of KAIZEN, ISO 9000, various aspects of certification, application & advantages. **Course Outcome: CO5 , Teaching Hours :14hrs Marks: 20 (R- 6, U-8, A-6)**

Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Prepare Safety manuals
2. Prepare report on safety practices in underground construction
3. Case studies on Healthy and Safety Planning
4. Prepare report on safety practices in use of explosives
5. Prepare report on Safety precaution to be taken for and during demolition carrying out repairs
6. Prepare various construction check lists for processes as well as for material quality
7. Visit ongoing construction site & prepare a report on quality checks

IV. Specification Table:

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	4	0	06
2	Safety in construction operation:	2	6	6	14
3	Safety in Demolition operation:	0	2	4	06
4	Safety with regard to storage, stocking and handling of materials of construction	2	4	8	14
5	Quality control	6	8	6	20
	Total	**10**	**24**	**26**	**60**

Sr.

V. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (marks)

VI. Suggested COs - POs Matrix Form

Course Outcomes (COs) 3	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO 3
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	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

VII. Suggested Learning Materials / Books

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

VIII. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://www.learningconstruction.com/	
2	http://www.understandconstruction.com/	
3	http://www.constructionknowledge.net/	
4	http://www.nationallibrary.gov.in	

IX.Academic Consultation Committee/Industry Consultation Committee:

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

Coordinator,
Curriculum Development,
Department of Civil Engineering

Head of Department
Department of Civil Engineering
स्थापत्य अभियांत्रिकी, विभाग,
शासकीय तं. निकेतन, मुंबई.

I/C, Curriculum Development Cell

Principal

APPROVED COPY

CDC Co-ordinator
G. P. Mumbai