GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CIVIL ENGINEERING
PROGRAMME CODE	01
COURSE TITLE	Concrete Technology
COURSE CODE	AM 31202
PREREQUISITE COURSE CODE & TITLE	

I. LEARNING&ASSESSMENTSCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL &TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	Concrete Technology	DSC	03	00	02	01	06	03	3hrs	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Term: Hrs

Abbreviations: **CL**-Classroom 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,*# - Online Examination,@S - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assigniments/other activities.

II. RATIONALE:

The contents of course will focus on learning about quality of concrete. It will also provide guidelines for effective supervision and quality control of concreting work.

Students can acquire knowledge and skills for carrying out various tests on concreting materials and quality of concrete works.

III. COMPETENCY

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

Use concrete technology for various types of constructions.

IV. COURSE-LEVEL LEARNING OUTCOMES (CO'S) :

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

CO1 :Use relevant types of cement in different applications.

CO2 :Use relevant aggregates for specified concrete works.

CO3 :Use relevant types of concrete for different applications.
CO4 :Test different types of concrete.
CO5 :Ensure the quality of concrete.
CO6 :Use admixtures in concrete for extreme weather conditions.

V. THEORY LEARNING OUTCOMES AND COURSE CONTENT

Sr. No	Theory Learning Outcomes(TLO'S) alignedtoCO's.	Learningcontentmappedwith TLO's.	SuggestedLearningPedagogies	Relevant COs
	UNIT-I Properties of Cement (CL Hrs-04, Marks-10)			
1.	TLO 1.1 .Describe the given types of cement and their relevant use with justification. TLO 1.2 .Describe the practical significance of the given types of cements for the given conditions. TLO 1.3.Suggest the method to judge the quality of the given type of cement with justification.	1.1 Hydration of cement, physical properties of cement – fineness, standard consistency, initial & final setting times, compressive strength & soundness, different grades of opc 33, 43 , 53 & their specification of physical properties as per relevant I. S. codes. 1.2 Adulteration of cement (field test), storing, effect of storage of cement on properties of cement . 1.3 Types of Cement & field application of the following types of cement i) Rapid hardening cement Ii) Low heat cement Iii) Pozzolana Portland cement Iv) Sulphate resisting cement Vi) Blast furnace slag cement Vii) White cement .	Demonstration Assignment Video Demonstrations Chalk-Board Presentations	CO1
	UNIT-II Properties of Aggregates (Hrs-08,Marks-14)			
2	TLO 2.1. Identify the type of given aggregate samples based on and source shape and size. TLO2.2 Explain the methodology to suggest suitability of given fine aggregate. TLO 2.3. Explain the methodology to suggest suitability of given coarse aggregate. TLO 2.4 Justify the use of sea water for mixing concrete	2.1 Concept of size, shape, surface texture, strength, specific gravity, bulk density , water absorption, surface moisture of fine and coarse aggregates soundness, bulking impurities 2.2 Determination of fineness modulus & grading zone of sand by sieve analysis, determination of silt content in sand & their specification as per IS 383. 2.3 Bulking of sand, phenomenon of bulking, its effect on concrete mix proportion. 2.4 coarse aggregates :,i) soundness of coarse aggregates ii) Determination of fineness modulus of coarse aggregate by sieve analysis, iii) Grading of Coarse Aggregates 2.5 Determination of crushing value, impact value & abrasion value of coarse aggregate, flakiness index & elongation index of coarse aggregate and their specification.	Demonstration Assignment Video Demonstrations Chalk-Board Presentations	CO2

Sr. No	Theory Learning Outcomes(TLO'S) alignedtoCO's.	Learningcontentmappedwith TLO's.	SuggestedLearningPedagogies	Relevant COs
	UNIT-III Properties of Concrete (Hrs-11,Marks-11)			
3	TLO 3.1 Justify use of different grades of concrete and their properties for different applications. TLO 3.2 Select w/c for a given grade of concrete. TLO 3.3 Interpret the data obtained from test on fresh and hardened Concrete sample. TLO 3.4 Describe the factors affecting over all durability of concrete .	3.1 Introduction to concrete - Definition of concrete, necessity of supervision for concreting operation, different grades of concrete (ordinary concrete, standard concrete & high strength concrete as per provisions of IS 456- 2000), minimum grade of concrete for different exposure conditions,and for R.C.C., water retaining structure & in sea water construction, etc. 3.2 Water cement ratio. Definition of w/c ratio, Duff Abraham w/c law, significance of w/c ratio, selection of w/c ratio for different grades of concrete prepared from different grades of OPC as per graphs specified in IS 10262.Also maximum w/c ratio for different grades of concrete for different exposure conditions. 3.3 Properties of fresh concrete. Definition of workability, factors affecting workability of concrete. Determination of workability of concrete by slump cone test, compaction factor test, Range values of workability requirement for different types of concrete works, 3.4 Cohesiveness, segregation, bleeding in case of concrete. 3.5 Properties of hardened concrete. Definition of compressive strength, impermeability, elastic properties of concrete, Creep, factors affecting creep,and shrinkageof concrete. 3.6 Concrete mix design Objectives of mix design, list of different method of mix design ,Steps of mix design procedure by I.S.method as per I.S.10262. 3.7 Testing of concrete Significance of testing, determination of compressive strength of concrete cubes at different ages, interpretation & co-relation of test results 3.8 Non- destructive testing of concrete Importance of NDT, methods of NDT-rebound hammer test & ultrasonic pulse velocity test,	Demonstration Assignment Video Demonstrations Chalk-Board Presentations	CO3
	UNIT-IV Quality Control of Concrete (Hrs-11,Marks-16)			
	TLO 4.1 . Explain the procedural steps of mix design as per I.S.10262.	4.1 Batching, Different Types of Mixers & Vibrators. Volume & weight batching, Batching for nominal mixes and for design mix concrete,		CO4

Sr. No	Theory Learning Outcomes(TLO'S) alignedtoCO's.	Learningcontentmappedwith TLO's.	SuggestedLearningPedagogies	Relevant COs
	TLO 4.2. Interpret the data obtained from test on hardened concrete. TLO 4.3. Describe the need of NDT for give field situation. TLO 4.4. Interpret the data obtained from NDT on existing structures.' TLO 4.5. Identify the type of Construction joint to be used in given situations of concreting works TLO 4.6 Select suitable method of waterproofing for given situation.	Types of mixers (tilting & non-tilting type) Different types of vibrators - needle vibrator, surface vibrator, table vibrator, principle &application of each type of vibrator 4.2 Formwork : formwork for concreting, different types of formworks for different works such as beams, slabs, columns, well foundation, materials used for formwork, requirement of good formwork, stripping time for the removal of formwork as per I.S. 456- 2000 provisions for different structural members. 4.3 Transportation, placing, compaction & finishing of concrete: Modes of transportation of concrete , Precautions to be taken during transportation and placing of concrete in formwork.Compaction of concrete, Methods of compaction, Care to be taken during compaction, Purpose of finishing, Types of finishing & methods of application (surface treatment, expose aggregate finish, applied finish, colored finish), Requirement of good finish. 4.4 Curing of concrete: Definition of curing, Necessity of curing, Different methods of curing and their application (spraying water, membrane curing, steam curing, curing by infra red radiations, curing by wet gunny bags, ponding methods). 4.5 Waterproofing of concrete & joints in concrete construction: Importance & need of waterproofing, Methods of waterproofing & materials used for waterproofing, Types of joints, joining old & new concrete, Methods of joining, materials used for filling joints.	Demonstration Assignment Video Demonstrations Chalk-Board Presentations	
UNIT-V Extreme weather concreting &chemical Admixture in concrete (Hrs-6,Marks-10)				
	TLO 5.1. Explain the sequential operations of concreting as per standardization. TLO 5.2 .Explain the types of form works and stripping time depending on weather	5.1 Extreme weather concreting Effect of cold weather on concrete, effect of hot weather on concrete, Precautions to be taken while concreting in hot & cold weather condition. 5.2 Chemical admixture in concrete. Properties & application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixture, air entraining admixture & super plasticizers.	Demonstration Assignment Video Demonstrations Chalk-Board Presentations	CO6

VII. SUGGESTED MICROPROJECT/ ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING/ SKILLS DEVELOPMENT (SELF-LEARNING)

Microproject:

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain PROs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***15 (Fifteen)student engagement hours*** during the course.

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

Undertake any one micro-project (Group of 4 to 6 students)

a) Prepare cast in situ concrete of given grade. It includes visit to site, observations, recording, field tests of cement, sand and coarse aggregate.
b) Use IS:10262 code method of mix design to obtain ingredients of concrete and prepare concrete.
c) Visit to site under construction where special concreting work is in progress and observe the following parameters i) Method of concreting operations ii) Special equipments used iii) Admixtures used iv) Type of form work used viii) Specification of materials used ix) Safety measures taken.
d) Prepare comparative study report at selected site on a) Methods of Batching, Mixing, and Transportation, Placing, Compaction and curing of concrete.
e) Compare physical properties of conventional and recent type of cement available in market (e. g. Green cement, Geo cement).
f) Visit to different sites (e.g. Building, road, bridge, dam canal, pipe line, pre cast and pre-stressed concrete) where concreting work is in progress and prepare a report on equipments used with specifications, problems faced while using machinery and problems overcome(m/c concrete mixers, vibrators, transpiration equipments RMC etc.)
g) Prepare a report on how quality of concrete changes according to change in properties of concrete in plastic and harden stage.
h) Prepare comparative study report of problems faced at site for concreting work of multi story building, bridge, dam and concrete road for following parameters.
i) Workability ii) Water cement ratio iii) Joints' in concreting work iv) Formworks and Supports v) Temperature of concrete and weather conditions vi) Total concreting operations.

Note: Any other relevant micro project suggested by subject teacher.

Suggested Student Activities (SLA)

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

i) Market survey to select type of cement for various types of construction works.
ii) Visit to site under construction to collect detail information about the ingredients of concrete mix.
iii) Visit to nearby RMC plant and draw flow chart.
iv) Visit to site under construction to observe concreting operations.
v) Visit to site under construction to observe the quality of fresh concrete.
vi) Visit to site under construction to observe form work, scaffolding used and joints in concrete.

Sr. No	Theory Learning Outcomes(TLO'S) alignedtoCO's.	Learningcontentmappedwith TLO's.	SuggestedLearningPedagogies	Relevant COs
	UNIT-VI Properties of Special Concrete(Hrs- 5,Marks-09)			
	TLO 6.1. Explain the properties, Advantages of Special concrete TLO 6.2. Limitation of the types of Special concrete	6.1 Properties, Advantages & Limitation of the following types of Special concrete i) Ready mix Concrete ii) Reinforced Concrete iii) Prestressed Concrete iv) Fiber Reinforced Concrete v)Precast Concrete vi)High performance Concrete	Demonstration Assignment Video Demonstrations Chalk-Board Presentations	CO5

VI. LABORATORYLEARNINGOUTCOMEANDALIGNEDPRACTICAL/TUTORIALEXPERIENCES.

Sr. No	Practical/Tutorial/LaboratoryLearningOutcome(LLO)	Laboratory Experiment / Practical Titles /TutorialTitles	Number ofhrs.	Relevant COs
1	LLO 1.1 Identify suitability and age of cement	Use 90 micron sieve to determine fineness of cement as per IS: 4031(part 1)	02	CO1
2	LLO 2.1 find the quantity of water for std consistancy of cement.	Use Vcat's apparatus to determine standard consistency, initial and final setting time of cement as per IS: 4031(part 4 and 5)	02	CO1
3	LLO 3.1Perform compression test on cement	Use compression testing machine to determine compressive strength of cement. as per IS:4031 (part 6)	02*	CO1
4	LLO 4.1Perform silt content test fine aggregates	Use measuring cylinder to determine silt content of fine aggregate as per IS: 2386 (part 2 and 3).	02*	CO2
5	LLO 5. Determine F M of fine aggregates	Use sieve shaker to determine fineness modulus of fine aggregate by sieve analysis as per IS: 2386 (part 4).	02*	CO3 CO4
6	LLO 6.1Determine F M of course aggregates	Use sieve shaker to determine fineness modulus of coarse aggregate by sieve analysis as per IS: 2386 (part 4).	04	CO2
7	LLO 7.1Perform soundness test on aggregates	Use aggregate Impact or Los Angeles abrasion machine to determine aggregate impact value and abrasion value respectively as per IS: 2386 (part 4	02*	CO2
8	LLO 8.1Conduct slump test on concrete for workability	Use slump cone and compaction factor apparatus to determine workability of concrete as per IS: 1199	02	CO3 CO4
9	LLO 9.1Perform compression test on concrete	Use compression testing machine to determine compressive strength of concrete as per IS: 516.	04*	CO3CO5
10	LLO 10.1Conduct Non distructive compression test on concrete	Use rebound hammer and ultrasonic pulse velocity meter to determine strength of concrete.	02*	CO5 CO4

vii) Visit to site under construction and make a check list of effect of each property ofCement and aggregate on quality of concrete.

viii) Search the software/freeware for the course content and prepare report stating their applications.

VIII. LABORATORY EQUIPMENT/ INSTRUMENTS/ TOOLS/ SOFTWARE REQUIRED

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

S. No.	Equipment Name with Broad Specifications	Exp. Sr. No.
1	Sieve no. IS 90 micron - IS Brass Sieve (200 mm diameter), 90 Micron size.	1
2	Vicat's apparatus with mould of dia. 80 mm and 40 mm high, glass base plate, initial setting time needle, final setting time needle. Consistency plunger M.S. base plate (non porous) of weight 300 gm. Vicat's mould split type with camping ring. as per IS: 4031(part 4 and 5)	2
3	Compression testing machine-2000 kN capacity, Cement mortar cube vibrator, mould size 50 cm^2 (7.07 cm x 7.07 cm) as per IS:4031 (part 6)	3& 9
4	Measuring cylinder of 1000 ml capacity as per IS: 2386 (part 2 and 3).	4
5	Measuring cylinder 1000 ml capacity as per IS: 2386 (part 2 and 3).	
6	Density basket as per IS specification as per IS: 2386 (part 3).	
7	I S sieve set (sizes- 80 mm, 40 mm, 20 mm, 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 µ, 300 µ. 150 µ and pan) , sieve shaker with adaptors as per IS: 2386 (part 4).	6
8	Aggregate impact testing m/c with mould, Los Angeles abrasion testing m/c as per IS: 2386 (part 4).	7
9	Elongation gauge and thickness gauge as per IS: 2386(part 1).	
10	Slump cone (top dia.100mm, bottom dia.200mm, Height 300mm) Compaction factor test apparatus as per IS: 1199.	8
11	Compression testing machine, Table vibrator, moulds (150mm x150mmx 150mm) as per IS: 516.	3 & 5
12	NDT apparatus – Rebound hammer IS:13311part(II), ultrasonic pulse velocity meter IS:13311part(I)	10

IX. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(SpecificationTable)

Sr.No	Unit	UnitTitle	AlignedCOs	LearningHours	R-Level	U-Level	A-Level	TotalMarks
1	I	Properties of Cement	CO1	04	2	4	4	10
2	II	Properties of Aggregates	CO2	08	2	4	8	14
3	III	Properties of Concrete	CO3	11	2	4	5	11
4	IV	Quality Control of Concrete	CO4	11	4	6	6	16
5	V	Extreme weather concreting &chemical Admixture in concrete	CO5	06	2	0	8	10
6	VI	Properties of Special Concrete	CO6	05	0	5	4	09
Grand Total				45	12	23	35	70

X. ASSESSMENT METHODOLOGIES/ TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessmentof Learning)
1. Practical and written examination	1. Oral examination

XI. CO-PO MAPPING

CourseOutcomes(COs)	ProgrammeOutcomes(POs)							ProgrammeSpecific outcomes*(PSOs)		
	PO-1 BasicandDiscipline-SpecificKnowledge	PO-2 Problem Analysis	PO-3 Design/ DevelopmentofSolutions	PO-4 Engineering Tools	PO-5 EngineeringPracticesforSociety,Sustainabilityand Environment	PO-6ProjectManagement	PO-7 LifeLong Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	2	1	1	3	1	2	NA
CO2	3	2	1	2	1	1	3	1	1	NA
CO3	3	1	1	2	1	1	3	1	1	NA
CO4	3	1	3	2	1	1	3	1	1	NA
CO5	3	3	3	2	1	3	3	1	1	NA

Legends:-High:03,Medium:02,Low:01,NoMapping:-
*PSOsaretobeformulatedatthe institutelevel

XII. SUGGESTEDLEARNINGMATERIALS/BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Gambhir M.L	Concrete Technology	Tata McGraw Hill Publishing Co. Ltd., New Delhi ISBN : 9780070583740
2	Shetty M.S..	Concrete Technology	S. Chand and Co. Pvt. Ltd., Ram Nagar, New Delhi-110055. ISBN: 9788121900034
3	Santhakumar A. R.	Concrete Technology	Oxford University Press, ISBN: ISBN: 9788121900034
4	A. M. Neville A.M. & Brooks J.J.	Concrete Technology	Pearson Education Pvt. Ltd., New Delhi ISBN: 978-0-273-73219–8.
5	Neville A. M	Properties of Concrete	Pearson Education Pvt. Ltd., New Delhi ISBN: 978-0273755807

XII. LEARNINGWEBSITES& PORTALS

Sr.No	Link/Portal	Description
1.	http://nptel.ac.in	
2.	www.w3schools.com	

Name &Signature:

Shri.H.P.Naiknavare
Lecturer in Applied Mechanics

(Course Experts)

25/02/26

Dr.K.B.Kale
HoD Applied Mechanics

Name & Signature:	Name & Signature:
(Programme Head)	(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE
PROGRAMME CODE	01
COURSE TITLE	THEORY OF STRUCTURES
COURSE CODE	AM41201
PREREQUISITE COURSE CODE & TITLE	AM31201 MECHANICS OF STRUCTURES

I. LEARNING&ASSESSMENTSCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL &TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
	THEORY OF STRUCTURES	DSC	4	1	–	1	6	3	4	30	70	100	40	–	–	–	–	25	10	125

Total IKS Hrs for Term: 0 Hrs

Abbreviations: **CL**-Classroom 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,*# - Online Examination,@$ - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that courser.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

This course is a continuation of the course Mechanics of Structures. It deals mainly with the analysis of statically indeterminate structures. Topic on slope and deflection in beams, long columns and direct and bending stresses are also included. The goal is to develop an insight into the structural behaviour of members under various loads.

III. COURSE-LEVELLEARNINGOUTCOMES(CO's)

Students will be able to achieve & demonstrate the following CO's on completion of the course-based learning

CO1: Evaluate resultant stresses on structures /members subjected to direct and bending stresses.
CO2: Determine buckling load for columns using Euler's and Rankine's theory.
CO3: Analyze fixed beams and continuous beams under different loading conditions and plot SFD and BMD.
CO4: Compute slopes and deflections of determinate beams using standard formulae and Macaulay's method

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT I: Direct and Bending Stresses : (CL Hrs-12, Marks - 14)			
1.	TLO1.1. Identify situations of eccentric load on the section. TLO 1.2 To calculate M.I. of section TLO 1.3 Calculate bending and direct stress for the section TLO 1.4 Calculate the maximum and minimum stresses for the section and show these with a neat sketch.	1.1 Concept of direct and eccentric loads. Condition for no or zero stress on extreme fibers, the limit of eccentricity 1.2 Maximum and minimum stresses, core of section for solid rectangular, square and circular sections only. (No derivation in the examination to be asked.) 1.3 Columns of uniform sections subjected to lateral wind pressure, Coefficient of wind pressure, stress distribution at base 1.4 Analysis of structures, retaining water and earth-level up to top level, calculation of maximum and minimum stresses at base.	Chalk & Board	CO1
	UNIT-II Columns (CL Hrs-10, Marks - 14)			
2	TLO 2.1 Classify columns as per slenderness ratio and explain with neat sketches of their nature of failure. TLO 2.2 Decide minimum M.I. TLO 2.3 Determine Euler's buckling load for long columns TLO 2.4 Determine Rankine's buckling load for intermediate columns.	2.1 Definition, types and classification of columns-long, intermediate & short. 2.2 Concept of buckling, different end conditions, effective length, radius of gyration, slenderness ratio. 2.3 Analysis of columns by Euler's theory, assumptions, buckling load, a factor of safety. Safe load, Columns of various sections & built-up sections to be covered. 2.4 Analysis of columns by Rankine's formula, for calculating buckling and safe load for various sections & built-up sections. (No derivation of formulae in theory examination).	Chalk & Board	CO2
	UNIT III: Fixed Beams (CL Hrs-10, Marks - 14)			
3	TLO 3.1 Differentiate statically indeterminate beams and explain the effect of fixity on the beams. TLO 3.2 Analyse fixed beams carrying point loads and u.d.l. TLO 3.3. Plot SFD and BMD using the principle of superposition.	3.1 Types of beams, statically indeterminate beams, analysis of statically determinate beams. Concept of fixity, the effect of fixity, advantages and disadvantages, fixed end moments, principle of superposition. Advantages and Disadvantages. 3.2 Analysis of fixed beams subjected to concentrated loads and uniformly distributed loads over the entire span. 3.3 To plot SFD and BMD for these beams using standard formulae.	Chalk & Board	CO3

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT IV : Continuous Beams (CL Hrs-12, Marks – 16,)			
4	TLO 4.1 Enlist effects of continuity on beam TLO 4.2 Analyze two-span continuous beams with equal EI subjected to point loads and u.d.l. TLO 4.3 Plot SFD and BMD for these beams using the principle of superposition.	4.1 Definition, effect of continuity, nature of moments induced due to continuity, deflected shape. 4.2 Analysis of continuous beams by Clapeyron's three moments theorem up to two spans only, overhanging end cases to be covered supports at the same level, equal flexural rigidity EI, subjected to concentrated and uniformly distributed loads over the entire span. 4.3 Drawing shear force and bending moment diagrams. The beams with overhanging ends are also to be covered	Chalk & Board	CO3
	UNIT V: Slope and Deflection (CL Hrs-08, Marks- 12)			
5	TLO 5.1 State the importance of minimizing deflection for the beams. TLO 5.2 Determine the maximum slope and maximum deflection using standard formulae. TLO 5.3 Determine slope and deflection of simply supported beams using Macaulay's Method.	5.1 Concept of slope and deflection, stiffness of beams, flexural rigidity of beams. Relation between slope, deflection and radius of curvature, differential equation (No derivation to be asked in examination.) 5.2 Maximum Slope &maximum deflection of cantilever and simply supported beams carrying point loads and u.d.l. by standard formulae. Analysis of propped cantilever beams, plotting SFD and BMD for these. 5.3 Calculation of slope & deflection of simply supported beams subjected to concentrated loads by Macaulay's Method.	Chalk & Board	CO4

V. LABORATORY LEARNING OUTCOME AND PEDAGOGICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/LaboratoryLearningOutcome (LLO)	Laboratory Experiment / Practical Titles /TutorialTitles	Number of hrs.	Relevant COs
1	LLO1.1	To solve and practice problems based on the topic of Direct and Bending stresses.	2	1
2	LLO2.1	To solve and practice problems based on the topic Columns	2	2
3	LLO3.1	To solve and practice problems based on the topic of Fixed Beams	2	3
4	LLO4.1	To solve and practice problems based on the topic of Continuous beams	2	3
5	LLO5.1	To solve and practice problems based on topicSlope and Deflection.	2	4
6	LLO6.1	Complete a micro project based on guidelines provided in Sr. No. 11	4	ALL

VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES OR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Microproject:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. (Affective Domain Outcomes). Each student will have to maintain an activity chart consisting of individual contributions to the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a model to demonstrate the effect of eccentricity.

b. Prepare a chart showing values of maximum slope and deflection in a fixed beam and simply supported beam, under various loading conditions.

c. Collect photographs of fixed beams from the actual site.

d. Collect information on continuous beams on actual sites and study the reinforcement provided.

e. Collect information and photographs of simple trusses, their span and type. Prepare a chart based on the information.

f. Prepare models of different trusses

Assignment: -

Students should conduct the following activities in groups and prepare reports of about five pages for each activity, also collect/record physical evidence for their (student's) portfolio, which will be helpful in their placement interviews:

a. Prepare journals based on practicals performed in a laboratory.

b. Prepare charts of maximum bending moment and shear force values in standard beams.

c. Collect information and standard values of important mechanical properties for five standard materials used in the mechanical field.

d. Present a seminar on different testing methods used in the industry.

e. Collect information comprising different machine components subjected to bending stresses.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	**Freeware** for SF and BM diagrams	LLO 4.1, LLO 5.1

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS &ASSESSMENT PURPOSE

(SpecificationTable)

Sr.No	Unit	UnitTitle	Aligned COs	LearningHours	R-Level	U-Level	A-Level	Total Marks
1	I	Direct and Bending Stresses	CO1	12	4	4	6	14
2	II	Columns	CO2	08	4	10	-	14
3	IV	Fixed Beams	CO3	10	2	4	6	14
4	V	Continuous Beams	CO3	10	4	6	6	16
5	VI	Slope and Deflection	CO4	08	2	4	6	12
Grand Total				48	16	28	24	70

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two unit tests of 30 marks and an average of two unit tests.	End semester assessment of 70 marks theory examination

X. CO-PO MAPPING

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	3	3	2	1	1	3	1	2	NA
CO2	3	3	3	2	1	1	3	1	1	NA
CO3	3	3	3	2	1	1	3	1	1	NA
CO4	3	3	3	2	1	1	3	1	1	NA
CO5	3	3	3	2	1	1	3	1	1	NA

Legends:-High:03, Medium:02, Low:01, NoMapping:-
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	S. Ramamrutham	Theory of Structures	Dhanpatrai & Sons, Delhi. ISBN : 978-93-84378-10-3
2	R.S. Khurmi	Theory of Structures	S.Chandand Co., NewDelhi ISBN:978-81-21905-20-6
3	Junnarkar, S.B.	Mechanics of structures, Volume-I and II	CharotarPublishing House, Anand ISBN:978-93-80358-99-4
4	Bhavikatti S.S	Structural Analysis Vol-1	VikasPublishingHousePvt Ltd.NewDelhi; ISBN:978-81-25927-90-7

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	nptel.ac.in/courses/112107146/lects%20&%20picts/.../lecture30%20and%2031.html	NPTEL lectures
2.	www.nptel.ac.in/courses/1 05101085/downloads/l ec-32.pdf	NPTEL lectures
3.	www.facweb.iitkgp.ernet.in/~baidurya/CE21004/onlinelecture notes/m2112.pdf	TOS lecture notes
4.	https://en.wikipedia.org /wiki/Theorem of three moments	Theorem of three moments
5.	https://en.wikipedia.org/wiki/Moment distribution method	Moment distribution method
6.	www.facweb.iitkgp.ernet.in/~baidurya/CE21004/online_lecture_notes/m3119.pdf	TOS lecture notes
7	www.bgstructuralengineering.com/BGSMA/ContBeams/BGSMA CB_0201.html	Beams
8	www.civilprojectsonline.com > Building Construction	Building Construction projects
9	www.mathalino.com/reviewer/engineering.../method-sections-analysis-simple-trusses	Simple trusses

Name & Signature:

24/07/24

Dr.K.B.Kale
HoD Applied Mechanics

Shri.S.V.Khadake
Lecturer in Applied Mechanics

(Course Experts)

Name & Signature:

V G Tambe
(Civil Programme Head)

V B Kondawar
(Head II Shift)

Name & Signature:

Shri.S.B.Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120-NEP' SCHEME

PROGRAMME	DIPLOMA IN CIVIL ENGINEERING
PROGRAMME CODE	01
COURSE TITLE	HYDRAULICS
COURSE CODE	CE31205
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING AND ASSESSMENT SCHEME:

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week						Paper Duration (hrs.)	Theory				Based on LL& TL				Based on Self Learning		Total Marks
														Practical						
			CL	TL	LL	SLH	NLH			FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
	HYDRAULICS	DSC	3	0	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs. for Term: 0Hrs

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:@InternalAssessment,#ExternalAssessment,*#OnLineExamination,@SInternalOnlineExamination.

Note:

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

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 course.
2. 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 re submit SLA work.
3. Notional Learning hours for the semester are (**CL+LL+TL+SL**)hrs.*15Weeks
4. 1credit equivalent to **30 Notional hrs.**
5. *Self learning hours shall not be reflected in the Time Table.
6. *Self learning includes micro project/assignment /other activities.

II. RATIONALE:

The course Hydraulics gives the conceptual ideas / theoretical background in the construction of Civil engineering structures in the field of Water Resources, Irrigation, and Environmental Engineering. The course is concerned with behaviour of flow at rest or in motion and conveyance of water in different water carriage systems like open channel, pipe flow.

III. COURSE LEVEL LEARNING OUTCOMES (CO's)

CO1: Calculate Pressure, Pressure intensity using Pressure measuring devices.

CO2: Calculate Total Pressure, Centre of Pressure acting on surface.

CO3: Calculate Discharge, Velocity, Total Head and Direction of flow.

CO4: Calculate Loss of head due to major and minor losses of flow in the design of pipes in parallel and in series.

CO5: Design the Open Channel section from the given data.

CO6: Suggest the type of pump in a given situation

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's	Suggested Learning Pedagogies	Relevant Cos
UNIT 1 PRESSURE MEASUREMENT (CL Hrs-06, Marks -08)				
1	TLO1.1 Find the area of application of hydraulics in the fields of civil engineering. TLO1.2 Calculate properties of given fluid. TLO1.3 Calculate gauge pressure, absolute pressure. TLO1.4 Convert pressure head of a liquid in terms of other liquid. TLO1.5 Calculate pressure at a point and pressure difference between two points by using pressure measuring instruments.	1.1 Introduction - Definition, Hydraulics, Hydrostatics, and Hydro-dynamics, Ideal and Real Fluid, Application of Hydraulics in Civil Engineering Field. 1.2 Properties of fluid – Density, Unit weight Specific Gravity-Cohesion, Adhesion, Surface Tension, Capillarity, Viscosity, Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure, Concept of Pressure Head and its unit, Pascal's law of fluid pressure and its uses. 1.3 Conversion of pressure head of one liquid in terms of other liquid. 1.4 Pressure measuring instruments - Piezometer, Simple U tube manometer, differential U tube manometers and inverted U tube manometer Bourdon pressure Gauge.	Assignment, Video Demonstrations, Chalk-Board	CO1
UNIT 2: HYDROSTATICS (CL Hrs-08, Marks - 12)				
2	TLO2.1 Determine total pressure acting on the immersed surface and its position that is center of pressure TLO2.2 Determine total pressure acting on the side and bottom of tank and its position. TLO2.3 Determine Resultant total pressure acting on partition wall with the same or different liquids on either side of the wall and its position. TLO2.4 Determine total pressure and its position acting on surfaces with Pressure Diagram concept.	2.1 Total hydrostatic pressure and Center of Pressure- Definition, variation of pressure with depth, Pressure diagrams. Determination of Total Pressure and Center of Pressure on vertical, inclined and horizontal immersed surfaces, side and bottom of tanks, partition walls. 2.2 Determination of Total Pressure and Center of Pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical surface in contact with liquid on either side. 2.3 Determination of Total Pressure and Center of Pressure using Pressure Diagram.	Chalk-Board Lab work	CO2

	UNIT 3: HYDRO KINEMATICS AND HYDRO-DYNAMICS (Hrs-10, Marks -16)			
3	TLO3.1 Identify the type of flow using Reynolds's number. TLO3.2 Calculate Discharge and velocity in the given situation using continuity equation. TLO3.3 Use Bernoulli's theorem to find the missing parameters of Bernoulli's equation and direction of flow. TLO3.4Identify components of Venturimeter and calculate discharge and coefficient of discharge.	3.1 Classification of flow - Steady and unsteady, uniform and non - uniform, laminar and turbulent based on Reynolds's number, compressible and incompressible flow. 3.2 Discharge –definition, unit, continuity equation. 3.3 Energies associated with fluid flow-Potential, Kinetic, Pressure Energy. 3.4 Bernoulli's Theorem-- Statement, Equation, Modified Bernoulli's equation. 3.5 Application of Bernoulli's Theorem-Venturimeter. 3.6 Concept of Total Energy Gradient Line(TEL), Hydraulic Gradient Line(HGL)	Chalk-Board, Lab work	CO3
	UNIT 4 FLOW THROUGH PIPES (Hrs-08, Marks -12)			
4	TLO4.1 List the reasons for loss of energy of fluid flow. TLO4.2 Using Darcy's Weishbach equation calculate frictional loss. TLO4.3 Calculate minor losses. TLO4.4 Calculate total loss of head if flow is through pipes arranged in series or in parallel. TLO4.5 Draw EGL and HGL for the given sstem of pipe flow. TLO4.6 Find diameter and length of Equivalent pipe using Dupit's equation.	4.1 Loss of head –major and minor losses. 4.2 Flow through pipes in series and parallel. 4.3 Equivalent pipe- definition, Dupit's equation 4.4 Water hammer-causes, effects and remedial measures. 4.5 Moody diagram- use, Nomogram - use.	Chalk-Board, Lab work	CO4

UNIT 5: FLOW THROUGH OPEN CHANEL (Hrs-10, Marks -14)				
5	TLO5.1 Identify the technical terms of a given channel section. TLO5.2 Determine discharge of a channel section. TLO5.3 Design the Most Economical Section of Channel. TLO5.4 Determine discharge through measuring device triangular and rectangular notch. TLO5.5 Describe the procedure to measure the velocity of flow using velocity measuring devices in given situation. TLO5.6 List the uses of hydraulic jump, and identify the situations where it is formed.	5.1 Geometrical properties of open channel section: Depth of flow, Top width of flow, Wetted area, Wetted perimeter, Hydraulic Radius for rectangular and trapezoidal channel section. 5.2 Chezy's equation and Manning's equation of velocity. 5.3 Conditions for most economical rectangular and trapezoidal channel section. 5.4 Discharge measuring devices: Triangular and rectangular Notches, end contractions,Velocity of approach Francis formula. 5.5 Velocity measuring devices: Current Meter, Floats and Pitot Tube 5.6 Specific Energy Diagram, Froude's Number, and Hydraulic Jump.	Chalk-Board, Lab work	CO5
UNIT 6 HYDRAULIC PUMPS (CL Hrs- 06, Marks - 08)				
	TLO6.1 Differentiate centrifugal pump and reciprocating pump. TLO6.2 Identify the pump and its components, heads associated with each type of pump. TLO6.3 Describe the working of centrifugal pump and reciprocating pump. TLO6.4 Calculate power required by the pump in given situation. TLO6.5 List the factors affecting the selection of pump.	6.1 Pump- Definition, Purpose, Factors affecting selection of pump. 6.2 Type of Pumps- Centrifugal, Reciprocating, Submersible Pump. 6.3 Centrifugal Pump- Components, Working, Priming of pump, Suction Head, Delivery Head, Static Head, Manometric Head, Efficiency and Power of pump. 6.4 Reciprocating Pump- Components, Working of Single Acting Reciprocating Pump.	Chalk-Board, Lab work, Model	CO6

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Sr. No.	Practical/Tutorial/ Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles / Tutorial Titles	No. Of Hrs.	Relevant Cos
1	LLO1- Determine the physical properties of given water sample.	Compute the physical properties of given tap water and muddy water.	02*	CO1
2	LLO2- Read pressure head and find intensity of pressure.	Use the Piezometer to measure the pressure at a given point.	02	CO1
3	LLO3- Read pressure head and find difference of pressure.	Use the U tube differential manometer to measure the pressure difference between two given points.	02	CO1
4	LLO4- Plot pressure diagram.	Find the resultant pressure and its position for given situation of liquid in a tank.	02*	CO2
5	LLO5- Take measurements to find discharge.	Measure actual Discharge through pipe.	02	CO2
6	LLO6- Determine velocity of flow and Reynold's number to identify flow type.	Use the Reynolds's apparatus to interpret type of flow	02	CO3
7	LLO7- Detemine total loss of head and plot HGL and TEL.	Use the Bernoulli's apparatus to apply Bernoulli's theorem to get the total energy line for a flow in a closed conduit of varying cross sections.	02*	CO3
8	LLO8- Determine friction factor using provided pipe material.	Use the Friction factor Apparatus to determine friction factor for the given pipe.	02*	CO4
09	LLO 9 -Use the pipe system to determine minor losses.	Determine the minor losses in pipe fittings due to sudden contraction and sudden enlargement, Bend and Elbow	02*	CO4
10	LLO 10- Determine Cd of venturimeter	Determine Coefficient of Discharge of Venturimeter fixed in a pipe.	02*	CO3
11	LLO12- Determine Cd of notch	Use the Triangular OR Rectangular notch to measure the discharge through open channel.	02*	CO5
12	LLO13- Carry out survey and collect information and pamphlets	Study of centrifugal pump and Visit nearby hardware shop and collect the information of different types of centrifugal pumps and prepare a report.	04*	CO6
13	LLO14- Carry out a Micro project on suggested or any relevant topic	Prepare a report on a relevant micro project topic in consultation with subject teacher	04*	CO1 to CO6

* Compulsory. Minimum 10 experiments should be conducted other than micro-project.

VI. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELFLEARNING)

The micro projects could be industry application based, internet based, workshop based, laboratory based or field based. Each micro project should encompass two or more COs. A suggestive list of micro projects is given below. Similar micro projects could be added by the concerned faculty.

a. Collect the information of different types of pumps for selection of type of pump.
b. Compare the suitability, working conditions to select a type of pump.
c. Work out and recommend a suitable power of centrifugal pump to a farmer based on site conditions.
d. Suggest the relevant type of pump for typical bungalow / single story building for the given data.
e. Design a channel for a given specific discharge.
f. Determine the total head loss for a multistoried building and suggest measures to reduce losses.
g. Measure the discharge of the channel by using triangular notches of different angle.
h. Measure Velocity of flow of a nearby canal by suitable method.
i. Collect information on pressure measuring devices used in industry/WTP/STPs.
j. Design water pipelines for a small house/apartment.
k. Design roadside gutters/drain to carry storm water/sewage of your campus.
l. Design a ground storage tank and/or overhead tank for a small house/apartment.

Assignment:

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should conduct following activities in group and prepare reports of about 5 pages for each activity, collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed in laboratory.
b. Follow the safety precautions.
c. Library / Internet survey of hydraulic structures.
d. Prepare power point presentation or animation for understanding different principles of hydraulics.
e. Visit nearby natural channel/canal to prepare report on flow data, cross sections, hydraulic data etc.
f. Interpretation and relevance of Moody's chart and Nomogram.
g. Collect data from YouTube/Videos showing various concepts and technologies related to the subject.
h. Solve numerical and assignments.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with broad specifications	Relevant LLO
1	Measuring cylinder, Weighing balance	1
2	Piezometer	2
3	U tube differential manometer, Mercury	3
4	Reynolds's apparatus, color dye, Stop watch	6
5	Bernoulli's apparatus, Stop watch, measuring tank	4,5,7
6	Friction factor Apparatus, Stop watch	8
7	Apparatus for finding minor losses in the pipe, Stop watch	9
8	Pipe set up fitted with Venturimeter, U tube differential manometer, Stop watch	10
9	Channel set up with different notches	11
10	Centrifugal pump set up - cut model	12

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Unit	Unit Title	Aligned COs	Learning Hours	R Level	U Level	A Level	Total marks
I	PRESSURE MEASUREMENT	CO1	06	2	2	4	08
II	HYDROSTATICS	CO2	08	2	2	8	12
III	HYDRO KINEMATICS AND HYDRO DYNAMICS	CO3	10	4	4	8	16
IV	FLOW THROUGH PIPES	CO4	08	2	2	8	12
V	FLOW THROUGH OPEN CHANNEL	CO5	10	2	4	8	14
VI	PUMPS	CO6	06	2	2	4	08
		Total	48	12	18	40	70

IX. ASSESSMENT METHODOLOGIES / TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two unit tests of 30 marks and an average of two unit tests. For laboratory learning 25 marks.	End semester assessment of 25 marks for internal assessment. End semester assessment of 70 marks theory examination.

X. SUGGESTED COS-POs–PSOs MATRIX FORM

CourseOutcomes(COs)	ProgrammeOutcomes(POs)							ProgrammeSpecific Outcomes*(PSOs)		
	PO-1 BasicandDiscipline-SpecificKnowledge	PO-2 ProblemAnalysis	PO-3 Design/ DevelopmentofSolutions	PO-4 Engineer-ing Tools	PO-5 EngineeringPractices, forSociety,Sustainability and Environment	PO-6ProjectManagement	PO-7 LifeLong Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	2	3	1	2	--	1	--
CO2	3	2	2	2	2	1	2	--	2	1
CO3	3	2	2	2	2	1	2	--	1	1
CO4	3	2	2	2	2	1	2	--	2	1
CO5	3	2	2	2	2	1	2	--	2	1
CO6	2	3	3	2	3	1	3	--	--	3

Legends:-High:03,Medium:02,Low:01,NoMapping:-
*PSOsaretobeformulatedattheinstitutelevel

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Modi,P. N.and Seth, S.M.	Hydraulics and Fluid Mechanics	Standard book house, Delhi ISBN:13: 978-8189401269;

2	Ramamrutham, and Narayan, R.	Hydraulics, Fluid Mechanics and Fluid Machines	Dhanpat Rai Publishing Company, New Delhi, ISBN:8187433841
3	Khurmi,R S	Hydraulics, Fluid Mechanics, Hydraulic machines	S Chand Publishers, New Delhi ISBN: 9788121901628
4	Rajput, R K	Fluid Mechanics	S Chand, New DelhiISBN: 9788121916677
5	Ojha, C S P, and Berndtsson, R	Fluid Mechanics and Machinery	Oxford University Press, New Delhi, ISBN: 9780195699630

XII. LEARNING WEBSITES & PORTALS

Apartment from inputs imparted by course teacher, students are encouraged to explore following video lectures on NPTEL platform and virtual laboratories;

Sr. No.	Link / Portal	Description
1	www.nptel.com	
2	https://nptel.ac.in/courses/105103096	Introduction to hydraulics
3	https://nptel.ac.in/courses/105105203	Basics of Fluid mechanics

J N Thorat
Lecturer in Civil Dept
(Course Experts)

S V Kolhe
Lecturer in Civil Dept
(Course Experts)

Name & Signature:

V G Tambe
(Programme Head)

V B Kondawar
(Head II Shift)

Name & Signature:

S B Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE
'120-NEP' SCHEME

PROGRAMME	DIPLOMA IN CE
PROGRAMME CODE	01
COURSE TITLE	CIVIL ENGINEERING CAD
COURSE CODE	CE41202
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING AND ASSESSMENT SCHEME:

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
CE41202	CIVIL ENGINEERING CAD	SEC	0	0	4	2	6	3	0	0	0	0	0	50	20	50@	20	25	10	125

Total IKS Hrs. for Term: 0

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:@InternalAssessment,#ExternalAssessment,*#OnLineExamination,@SInternalOnlineExamination.

Note:

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

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 course.

2.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 re submit SLA work.

3.Notional Learning hours for the semester are **(CL+LL+TL+SL)**hrs.*15Weeks

4.1creditis equivalent to **30 Notional hrs.**

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

6.*Self learning includes micro project/assignment /other activities.

II.RATIONALE:

An essential required skill of a civil engineering diploma holder is to use Computer Aided Drawing as a drafting tool to draw, read and interpret the civil engineering drawings. The use of CAD improves speed, accuracy and avoids repetitive work which is not possible in traditional pencil-paper drawing method. The course will develop professional presentation skills in students while working in future.

III.COURSE LEVEL LEARNING OUTCOMES (COS)

CO1: Read, and Interpret the given 2-D civil engineering drawing.

CO2: Use computer aided drawing software to draw and edit the given 2D drawing.

CO3: Mark/Locate/show the dimensions in drawing.

CO4: Draw the relevant type of plan/drawings for the given type of building.

CO5: Draw the Isometric and 3- Dimensional drawings of the given component of the structure.

IV.THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

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

Sr. No.	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's	Suggested Learning Pedagogies	Relevant Cos
UNIT 1: Fundamentals of Computer Aided Drawing(CL Hrs.- Nil ,Marks- Nil)				
1	TLO1.1 Explain the importance of Computer Aided Drawing in Civil Engineering applications. TLO 1.2 Recognize the features of computer aided drawing screen. TLO 1.3 Perform the initial setting using format menu.	1.1 CAD software –meaning, uses of CAD in civil engineering and other programmes, various drafting software's for civil engineering applications. 1.2 System requirement for drawing software. 1.3 Advantages of computer aided drawing over traditional method of drawing. 1.4 Study the features of CAD screen. 1.5 Initial setting required to start new drawing 1.6 Save and plot/print command.	Assignment, Video Demonstrations, Presentations	CO1
UNIT 2: Computer Aided Draw and Editing commands(CL Hrs.- Nil ,Marks- Nil)				
2	TLO2.1 Use modify command to edit the given figure. TLO2.2 Use the enquiry command to find the parameters like distance, area, perimeter of a given figure. TLO 2. 3 Identify the different features of layer command and use in given situation.	2.1 Draw commands- line, poly line, construction line, rectangle, polygon, circle, ellipse, hatch, boundary, text, arc, point, make block. 2.2 Modify commands- erase, copy, mirror, offset, trim, move, extend, rotate, array, lengthen, scale, chamfer, fillet, explode, stretch, join, brake, divide. 2.3 Enquiry –list, area ,distance, mass property; 2.4 Changing properties of entity-line type, color, scale, font- size, color, style. 2.5 Layer command.	Collaborative learning, Video Demonstrations, Presentations	CO2/CO4
UNIT 3 : Computer Aided Commands-Dimensioning and Hatchings(CL Hrs.- Nil ,Marks- Nil)				
3	TLO 3.1 Explain the necessity of dimensioning the figure. TLO 3.2 Use the different dimension command as per requirement to mark the dimensions of the given drawing.	3.1 Use the dimension style as required. 3.2 Type of dimensions- quick dimension, linear dimension, and continuous dimension, align dimension, angle dimension and radius, diameter.	Hands-on Collaborative learning, Video Demonstrations, Presentations.	CO3/CO4

	TLO 3 3 Modify the existing dimension style.	3.3 Modify dimension style.		
UNIT 4: Introduction to Isometric and 3-D Drawing(CL Hrs.- Nil ,Marks- Nil)				
4	TLO 4.1. Justify the need of isometric drawing and 3-Dimensional view. TLO 4.2 Sketch isometric drawing of simple given objects. TLO 4.3Sketch 3- dimensional drawing of simple given Object.	4.1 Necessity of 3 dimensional view 4.2 Isometric drawing- meaning and necessity, use of isometric snap, isometric axes, iso circle, iso text 4.3 Three Dimensional drawing –use of extrude, press full command	Video Demonstrations, Hands-on Collaborative learning, Presentations.	CO5

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Sr. No.	Practical/Tutorial/ Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles / Tutorial Titles	No. Of Hrs.	Relevant Cos
1	LLO1.1 Introduction to AutoCAD.	Identify the components of CAD screen and apply the processes of Initial setting.	02	CO1
2	LLO1.2 Use " Draw and modify command"	*Use " Draw, modify and dimension commands" to draw the given shapes also including commands like -hatch,to find area,perimeter of given figure,edit polyline.	06	CO2
3	LLO 1.3 Prepare Line Plans of the Public buildings from given line plan.	*Prepare Line plan of Public Building with staircase(minimum Two).	02	CO2
4	LLO 1.4 Prepare Developed Plan of the load bearing structure from given line plan.	*Draw submission drawing to suitable scale of a single storey load bearing residential building (2BHK) with staircase-Part I	04	CO2/CO4
5	LLO1.5 Prepare Sectional elevation of the load bearing structure.	*Draw submission drawing to suitable scale of a single storey load bearing residential building (2BHK) Section passing through Staircase, W.C. and Bathroom and foundation plan,site plan,area statement and construction notes-Part II.	08	CO2/CO4
6	LLO 1.6 Prepare Developed Plan of the framed structure from given line plan.	*Draw submission drawing to suitable scale of (G+1) Framed Structure Residential Building (2BHK) with staircase-Part I.	04	CO4
7	LLO 1.7 Prepare Sectional elevation of the framed structure.	*Draw submission drawing to suitable scale of (G+1) Framed Structure Residential Building (2BHK) section passing through Staircase, W.C. and Bathroom and foundation plan,site	08	CO4

		plan,area statement and construction notes-Part II.		
8	LLO 1.8 Prepare Sectional elevation and plan of RCC Beam, Lintel and Chajja of framed structure.	*Draw Detailed enlarge section of RCC building components- Beam, column, footing, Lintel, slab, Chajja and doglegged staircase.	08	CO4
9	LLO 1.9 Prepare drawing of K.T.Weir.	Draw plan and cross section of K.T.Weir from given drawing.	04	CO4
10	LLO 1.10 Prepare drawing of Road section.	Draw road section in cutting and in embankment of NH/SH/DR/VR.	04	CO3/CO4
11	LLO 1.11 Prepare drawing of Septic tank.	Draw plan and cross section of Septic tank and community well.	02	CO3/CO4
12	LLO 1.12 Prepare Isometric drawings of given object.	*Draw isometric drawing of simple objects.(minimum 04 objects).	04	CO5
13	LLO 1.13 Prepare 3-D view of given object.	*Draw 3-D view of simple object. (any five).	04	CO5
Note : Out of above suggestive LLOs -'*' Marked Practicals (LLOs) Are mandatory. Minimum 80% of above list of lab experiment are to be performed. Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VI. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF LEARNING)

The micro projects could be industry application based, internet based, workshop based, laboratory based or field based. Each micro project should encompass two or more COs. A suggestive list of micro projects is given below. Similar micro projects could be added by the concerned faculty.

a.Prepare Developed Plan and Elevation for any one Public Building.
b.Draw plan, elevation and section of given framed structure.
c.Draw plan, elevation and section of given load bearing structure.
d.Prepare construction notes, site plan, schedule of openings from drawings of framed structure made available from builder/engineer/civil engineering service provider.
e.Prepare construction notes, site plan, schedule of openings from drawings of load bearing structure made available from builder/engineer/civil engineering service provider.
f.Learn latest software of civil engineering drawing.
g.Prepare Three dimensional view of a single room with door, window openings, chajja projection.

Note :

Above is just a suggestive list of microprojects; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student inacquiring the desired skills.
If a microproject 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.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with broad specifications	Relevant LLO
1	CAD software available in computer laboratory (if possible with latest configuration).	All
2	Printer preferably for the output of A-3 size, paper	All
3	LCD projector.	All

VI. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Unit	Unit Title	Aligned COs	Learning Hours	R Level	U Level	A Level	Total marks
I	Fundamentals of Computer Aided Drawing	CO1	08	--	--	--	--
II	Computer Aided Draw and Editing commands	CO2/CO4	32	--	--	--	--
III	Computer Aided Commands-Dimensioning and Hatchings	CO3/CO4	12	--	--	--	--
IV	Introduction to Isometric and 3-D Drawing	CO5	08	--	--	--	--
	Total		60	--	--	--	--

IX. ASSESSMENT METHODOLOGIES / TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
End semester assessment of 50 marks for practical assessment.	End semester assessment of 50 marks for practical examination.

X. SUGGESTED COS-POs–PSOs MATRIX FORM

Course Outcomes (COs)	ProgrammeOutcomes(POs)							ProgrammeSpecific Outcomes*(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineer-ing 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	-	-
CO2	3	3	1	2	1	1	3	2	-	2
CO3	3	3	2	3	1	2	3	-	-	-
CO4	3	3	2	3	1	2	3	2	-	-
CO5	3	3	2	3	2	2	3	2	-	-

Legends:-High:03,**Medium:**02,**Low:**01,**NoMapping:**-
*PSOs are to be formulated at the institute level

XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No.	AUTHOR	TITLE	ISBN Number
1	Ajit singh, Tata Mcgraw Hill Publishing Co Ltd, Edition 2002	Working with Auto CAD 2000	0070435960 9780070435964
2	N.D.Bhatt,Charote Publications, Anand, 53rd Edition,2016	Engineering drawing	978-93-80358-83-3 978-93-80358-96-
3	ShyamTickoo CADCIM Technologies, 22nd Edition , August 2015	AutoCAD 2016: A Problem-Solving Approach, Basic and Intermediate	10: 1942689004
4	NighatYasmin, SDC Publication, 2011	Introduction to Auto CAD 2012 for Civil Engineering Applications	978-1-58503-642-4

XII. LEARNING WEBSITES & PORTALS

Apartment from inputs imparted by course teacher, students are encouraged to explore following video lectures on NPTEL platform and virtual laboratories;

Sr. No.	Link / Portal	Description
1	http://www.autodesk.com/education/freesoftware/autocad	Autocad education
2	https://www.autodesk.in/products/autocad/free-trial	Demonstration video

Name &Signature: A. Shinde Lecturer in Civil Dept (Course Experts)	
Name & Signature: **V G Tambe** (Programme Head) **V B kondawar** (Head II Shift)	Name & Signature: **S B Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC PUNE
TECHNICAL EDUCATION FOR SELF RELIANCE

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	Diploma in Civil Engineering
PROGRAMME CODE	01
COURSE TITLE	WATER AND WASTE WATER ENGINEERING
COURSE CODE	CE41204
PREREQUISITE COURSE CODE & TITLE	-------

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory				Based on LL &TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	WATER AND WASTE WATER ENGINEERING	DSC	4	00	02	0	6	3	3	30	70	100	40	25	10	25#	10	0	0	150

Total IKS Hrs for Term: 00 Hrs

Abbreviations: **CL**-Classroom 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, *# - Online Examination, **@S** - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**.
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Water and waste water Engineering plays important role in solving the problems related with environment having adverse effect on health, well-being of society and the environment. The knowledge of Water and waste water engineering earned by the civil engineers will be used to develop technologies to treat water and wastewater and protect the quality of environment. The students will be able to develop technologies for sustainable environment.

III. COURSE LEVEL LEARNING OUT COMES(CO'S).

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

CO1: Identify the sources and characteristics of water.
CO2: Apply the water purification processes.
CO3: Select the distribution system and pipe network for water supply.
CO4: Interpret the Building Sanitation and plumbing system.
CO5: Interpret the Systems of Sewerage and sewer appurtenances.
CO6: Apply the wastewater treatment processes.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		SECTION I		
		UNIT-I Sources, Quantity and Quality of Water (CL Hrs-10, Marks-10)		
1.	TLO 1.1 Classify the sources with intake structures of water on the basis of given criteria. TLO 1.2 Determine future population by using relevant forecasting methods. TLO 1.3 Undertake the testing of given water sample using relevant method as per IS code.	1.1 Sources of water: Surface and Subsurface sources of water, Intake Structure: Definition, types and factors governing the location of intake structure. 1.2 Demand of water: Need to protect water supplies, Demand of water: Definition, Types, Factors affecting rate and variations in water demand, Forecasting of population: Introduction and Methods (Numerical based on Arithmetical Increase, geometrical increase and Incremental increase only). Design period, estimating of demand of water supply required for city or town. 1.3 Quality of water: Need for analysis of water, Physical, Chemical and Biological properties of water. Testing of water for Total Solids, hardness, chlorides, Dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN, Sampling of water, Water Quality standards as per IS:10500, 2012.	Video Simulation Chalk-Board And power point Lecture Presentations	CO1
		UNIT-II Purification of Water (CL Hrs -12, Marks-15)		
2	TLO 2.1 Draw the labeled flow diagram of water treatment plant with enough description. TLO 2.2 Justify the process of filtration of water. TLO 2.3 Justify the process of disinfection of water. TLO 2.4 Apply the relevant technique of water softening for the given sample of water.	2.1 Purification of Water: Flow diagram of water supply scheme, functions of units of water supply scheme, Screening, Aeration, Plain Sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, process of coagulation. 2.2 Clariflocculator, Filtration: theory of filtration, classification of filters, slow sand filters, rapid sand filter. 2.3 Disinfection: Objects, methods of disinfection. Chlorination: Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, orthotolidine test. 2.4 Water Softening Methods: Need and necessity of water softening, Lime soda process and zeolite process.	Video Simulation Chalk-Board And power point Lecture Presentations	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-III Conveyance and distribution of water (CL Hrs-10, Marks-10)			
3	TLO 3.1Select the relevant mode of conveyance system in the given situation. TLO 3.2. Suggest the water distribution system for the given situation. TLO 3.3 Use the relevant pipe layout distribution system for water distribution in the given situation.	3.1 Conveyance Pipes: Types, Choice of materials, Joints and Valves-Types, location and functions. 3.2 Distribution System: Gravity System, Pumping System, Dual System. 3.3 Layout of distribution System: Dead End System, Grid Iron System, Circular System, Radial System.	Video Simulation Chalk-Board And power point Lecture Presentations	CO3
	SECTION II			
	UNIT- IV Building Sanitation and Sanitary fittings (CL Hrs-10, Marks-10)			
4	TLO 4.1. Justify the necessity of Sanitation for the given Building. TLO 4.2 Describe the various types of traps for the given situation with sketches. TLO 4.3 Describe relevant system of plumbing in the given situation. TLO 4.4 Draw layout plan of drainage system for the given building.	4.1 Building Sanitation: Necessity of sanitation, Necessity to treat domestic sewage. Definitions: sewage, sullage. Types of sewage, Definitions of the terms related to Building Sanitation: Water pipe, Rain water pipe, Soil pipe, Sullage pipe, Vent pipe. 4.2 Building Sanitary fittings: Water closet —Indian and European type, flushing cistern. Wash basin, sinks, Urinals. Traps- types, qualities of good trap. 4.3 Systems of plumbing - one pipe, two pipe, single stack, choice of system. 4.4 Principles regarding design of building drainage, layout plan for building sanitary fittings (drainage plan), inspection and junction chambers, their necessity, location, size and shape, Maintenance of sanitary units.	Video Simulation Chalk-Board And power point Lecture Presentations	CO4
	UNIT –V Systems of Sewerage and Sewer Appurtenances (CL Hrs-08, Marks-10)			
5	TLO 5.1 Describe the testing procedure for the given sewers. TLO 5.2. Explain the necessity of manhole and drop manhole in the given sewerage system.	5.1 Systems of Sewerage and Sewer Appurtenances: Types of Sewers. Systems of sewerage, Design of sewers, Self cleansing velocity and non-scouring velocity. 5.2 Laying, Testing and maintenance of sewers 5.3Manholes and Drop Manhole-component parts, location, spacing, construction details, Sewer Inlets, Street Inlets.	Video Simulation Chalk-Board And power point Lecture Presentations	CO5

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		UNIT –VI Waste Water Treatment (CL Hrs-14, Marks-15)		
6	TLO 6.1 Evaluate the characteristics of given sewage sample. TLO 6.2 Explain the terms, "BOD treatment of and COD" for the given sample of sewage. TLO 6.3 Examine the quality of treated sewage as per given norms of MPCB. TLO 6.4 Draw flow diagram for sewage treatment plant for the given data. TLO 6.5 State Characteristics of industrial waste water from following industry- Sugar, Dairy, Textile, Paper and pulp.	6.1 Analysis of sewage: Characteristics of sewage 6.2 B.O.D., C.O.D. and its significance. Aerobic and anaerobic process 6.3 Maharashtra Pollution Control Board Norms for the discharge of treated sewage, objects of sewage treatment and its flow diagram. 6.4 Treatment of Sewage: Screening, Grit removal, Skimming, Sedimentation of sewage, Sludge digestion, Trickling filter, Activated sludge, Septic tank, sustainable domestic waste water treatment processes. 6.5 Industrial waste water, study of characteristics of industrial waste water from following industry- Sugar, Dairy, Textile, Paper and pulp.	Video Simulation Chalk-Board And power point Lecture Presentations	CO6

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/ Tutorial/ Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant Cos
1	LLO 1.1. Determine pH value of the given sample of water	Determination of pH value of water sample	2	CO1
2	LLO 2.1 Determine the turbidity of the given sample of water.	Determination of turbidity of the water sample.	2*	CO1
3	LLO 3.1 Use the Whatman filter paper to determine the suspended solids, dissolved solids and total solids of given sample of water.	Determination of suspended solids, dissolved solids and total solids of a given water sample.	2	CO1
4	LLO 4.1Use digital DO meter to find the dissolved oxygen content present in a given sample of water.	Determination of the dissolved oxygen in a given sample of water.	2*	CO2
5	LLO 5.1 Undertake the test to detect the presence of residual chlorine in a given sample of water using Ortho tolidine testing kit.	Determination of residual chlorine in a given sample of water.	2*	CO2
6	LLO 6.1 Undertake a field visit to water treatment plant.	Preparation of report on field visit to the nearby water treatment plant.	2*	

Sr. No	Practical/ Tutorial/ Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant Cos
7	LLO 7.1 Deploy the jar test method to find the optimum dose of coagulant in the given raw water sample.	Determination of the optimum dose of coagulant in the given raw water sample by jar test.	2*	CO2
8	LLO 8.1 Draw sketches of various joints used in the water supply pipeline.	Illustration of various joints used in water supply pipeline through sketches	2	CO3
9	LLO 9.1 Draw a labeled sketch of the one pipe, two pipe system and layout plan for drainage for a residential building.	Preparation of a sketch of one pipe, two pipe system and layout plan for drainage or a residential building.	4	CO4
10	LLO 10.1 Explain process of Laying and Testing of sewers.	Study of process of Laying and Testing of sewers.	2	CO5
11	LLO 11.1 Determine pH value of the given sample of waste water	Determination of pH value of waste water sample	2	CO6
12	LLO 12.1 Calculate BOD of a given sample of wastewater	Determination of BOD of a given sample of wastewater.	2	CO6
13	LLO 13.1 Calculate the dissolved oxygen content in the given sample of wastewater.	Determination of the dissolved oxygen in the given sample of wastewater.	2*	CO6
14	LLO 14.1 Calculate COD of a given sample of wastewater.	Determination of the COD of a given sample of wastewater.	2	CO6
15	LLO 15.1. Write a report on wastewater treatment plant.	Preparation of a report on a field visit to the wastewater treatment plant.	2*	CO6

Note : Out of above suggestive LLOs -

1. '*' Marked Practicals (LLOs) are mandatory.
2. Minimum 80% of above list of lab experiment are to be performed.
3. Judicial mix of LLOs is to be performed to achieve desired outcomes.

VI. SUGGESTED MICROPROJECT /ASSIGNMENT /ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT(SELF-LEARNING)

Microproject:

- Present the test results of minimum three water samples obtained from a locally available area to ascertain its characteristics. (pH, Turbidity, D. O., Residual chlorine, Temperature, etc.)
- Conduct an internet surfing survey/visit to local statutory water bodies for the quality of water, prepare a report on it and write your comment.
- Present the test results of minimum three wastewater samples obtained from a locally available area to ascertain its characteristics.
- Suggest minimum ten remedial measures for the control of pollution of local water sources by conducting relevant studies and tests.
- Visit the site where recycling and utilization of treated wastewater is being implemented and prepare a detailed report on it.
- Suggest minimum three social and eco-friendly methods to treat sullage water.

- Suggest minimum five relevant methods/strategies to save water.
- Suggest a treatment given to bore water to make it fit for drinking.
- List a minimum of six building sanitary appurtenances used in current practice.Prepare a presentation with minimum ten slides on the treatment of wastewater.
- Applications of SCADA in water treatment and waste water treatment plant operation.

Assignment: -

- Collect information regarding minimum ten norms for water and wastewater treatment of statutory water bodies.
- Prepare a presentation with minimum ten slides on conventional or advanced wastewater treatment processes.
- Draw minimum four sketches of valves used in the water supply pipeline.
- Study the related free open software for the design of the water supply distribution network.
- Prepare a report of minimum five pages on the plumbing system for an existing building (G+1 or above) in the nearby area.

VII. LABORATORY EQUIPMENT /INSTRUMENTS /TOOLS /SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital pH meter (4 Digit Display (LED), 0 to 1000 mV, Resolution: 0.01 pH, Manual Temperature, Compensation: 0-to-80-degree C.)	1, 11
2	BOD incubator with BOD bottles (Rated Voltage: AC 220V±10% 50Hz, Power: 2800W, Temperature Controlling Mode: Digital Display, Temperature Controlling Point: 24 degree, 93.5 degree C, Temperature Controlling Precision: ±0.1 degree C)	12
3	Digital COD digester (Glassware: 15 Reaction Vessels & Air Condensers, Temperature: 150± 1% degree C, Capacity: 15 Samples at a time, Sample Size: 20 ml, Range: 0 to 500 ppm without dilution, Timer: 2 hours timer with Buzzer, Power Requirement: 230V 1000W	14
4	Digital Turbidity Meter. (Range 0 to 200 NTU, Resolution 1NTU, Accuracy: ± 3% FS, ± 1Digit, Display 3½ Digit 7-Segment LED Light Source 6V, 0.3 Amp Tungsten Lamp, Detector: Photodiode, Sample System: 30 mm Clear Glass Test Tubes, Power 230 V ± 10%AC, 50 Hz, Accessories Test tube Set of 5, Operation Manual, Dust Cover.	2
5	Electric Oven with digital control (Temperature: 300 degree C, 25 kg capacity)	3
6	Digital DO meter (Range: 0 to 20 ppm, Resolution: 0.1 ppm, Temperature compensation: 0to 50 degree C).	4, 13
7	Orthotolidine test kit (free and total chlorine testing for EPA reporting over the range of 0-4mg/L.)	5
8	Jar Test Apparatus (Digital timer: 1 to 99 minutes, material: Stainless steel, Power: Electric supply, Range: 25 to 250 rpm, with 6 glass jars of 1000 mL)	7

VIII. SUGGESTED FORWEIGHTAGETO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Sources, Quantity and Quality of water	CO1	10	02	04	04	10
2	II	Purification of water	CO2	12	02	04	09	15
3	III	Conveyance and Distribution of water	CO3	10	02	04	04	10
4	IV	Building Sanitation and Sanitary fittings	CO4	10	02	04	04	10

5	V	Systems of Sewerage and Sewer Appurtenances	CO5	08	02	04	04	10
6	VI	Waste water Treatment	CO6	14	04	04	07	15
Grand Total				**64**	**14**	**24**	**32**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Term work, Assignment, Microproject (60% Weightage to process and 40% weightage to product), Question and Answer	Pen and Paper Test (Written Test), Practical Exam

X. 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	1	-	-	1	-	1	-	-	-
CO2	3	1	-	-	1	-	1	1	2	3
CO3	3	2	1	1	1	1	1	1	2	3
CO4	2	3	2	2	1	1	1	1	1	2
CO5	2	2	1	1	2	1	2	1	1	1
CO6	3	3	2	2	3	1	2	2	2	3

Legends: -High:03, Medium:02, Low:01, No Mapping: -
*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No.	Author	Title	Publisher with ISBN Number
1	Garg S.K.	Environmental Engineering Vol I and Vol II	Khanna Publishers, New Delhi, 2017, ISBN: 978-81-7409-120-8, ISBN: 978-81-7409-230-4
2	G.S. Birdie J.S. Birdie	Water Supply and Sanitary Engineering	Dhanpati Rai Publishing Company (P) Ltd. New Delhi, ISBN :978-93-84559-577-3
3	C. S. Rao	Environmental Pollution Control Engineering	New Age International Publishers, New Delhi, 2016, ISBN: 81-224-1835-X
4	Howard S. Peavy, Donald R. Rowe, George Tchobanoglous	Environmental Engineering	McGraw Hill Education., New Delhi, 2013, ISBN-10. 9351340260 · ISBN-13. 978-9351340263

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	https://iitb.vlabs.co.in/discipline.html?discipline=Civil_Engineering	Experiments for drinking Water and wastewater.
2	https://ee1-nitk.vlabs.ac.in/	Experiments for drinking water and wastewater.
3	https://www.vlab.co.in/participating-institute-nitk-surathkal	Experiments for drinking Water and wastewater.
4	https://www.vlab.co.in/ba-nptel-labs-civil-engineering	Experiments for drinking Water and wastewater.
5	https://iitb.vlabs.co.in/discipline.html?discipline=Civil_Engineering.	Experiments for drinking water and wastewater.
6	https://nitsri.ac.in/Department/Library/List_VLabs	Experiments for drinking water and wastewater.
7	https://www.youtube.com/watch?v=V_bd-Ijo7Ic	Determination of pH.
8	https://www.youtube.com/watch?v=4AWR_xfwfi4	Turbidity Determination
9	https://www.youtube.com/watch?v=fHRxhuMQQnE&list=PLbRMhDVUMngdeOSgQOe399aBKqdxkxNCp	Working of wastewater treatment Plant.
10	https://www.youtube.com/watch?v=4-SRMmqH2s4&list=PLLy_2iUCG87AZvtaiuD3r4HATrBKhb90P	Working of wastewater treatment Plant.
11	https://www.mpcb.gov.in./water-quality/standards-	Standard Norms as per MPCB
12	https://cpcb.nic.in/who-guidelines-for-drinking-water-quality/	Standard Norms as per MPCB
13	chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://cpcb.nic.in/wqm/BIS_Drinking_Water_Specification.pdf	BIS: Drinking Water specifications (IS 10500:2012)
14	https://archive.nptel.ac.in/content/storage2/courses/105104102/Lecture%2014.htm	Water distribution systems

Name & Signature:

(Dr. R. M. Aghav)
Lecturer in Civil Engineering
(Course Experts)(Course Experts)

(Mrs. A. P. Shinde)
Lecturer in Civil Engineering

Name & Signature:		Name & Signature:
Shri V.S. Tambe (Programme Head)	Shri V.B. Kondawar (CE HOD II Shift)	**Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN CE/EE/ET/ME/MT/CM/IT**
PROGRAMME CODE	**01**
COURSE TITLE	**Railway & Tunnel Engineering**
COURSE CODE	**CE51201**
PREREQUISITE COURSE CODE & TITLE	**NA**

I. LEARNING&ASSESSMENTSCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL &TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
CE51201	Railway & Tunnel engineering	DSC	4	0	0	0	4	2	3	30	70	100	40	--	--	--	--	--	--	100

Total IKS Hrs for Term: 1 Hrs

Abbreviations: **CL**-Classroom 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,*# - Online Examination,@S - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Civil Engineering Diploma technicians have direct employment avenues in Indian Railways or construction companies executing works of Indian railways. They also have employment opportunities in state and central government departments or construction companies executing tunnel constructions and maintenance. This course is intended to inculcate the knowledge and practices involved in investigation surveys, alignment work, construction and maintenance of railway permanent way and tunnels. The course makes the student conversant with the principles and procedures involved in execution of railway and tunneling projects.

III. COURSE-LEVELLEARNINGOUTCOMES(CO'S)

Students will be able to achieve and demonstrate the following CO's oncompletion of course-based learning

CO1.Identify the components of Railway Track and Tunnel.

CO2.Understand the Geometric design of Railway Track and aspects of Tunneling.

CO3.Understand and analyze various surveys required for construction of Railway Track and Tunnel.

CO4.Supervise the execution and maintenance of railway and Tunnel projects.

CO5.Effectively communicate with the upper level and bottom level of technical hierarchy.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) alignedtoCO's.	Learningcontentmappedwith TLO's.	Suggested LearningPedagogies	Relevant COs
	UNIT 1. Permanent Way (CL Hrs- 10 Marks-16)			
1.	1a.Define permanent way. 1b. Enlist components of permanent way. 1c. Draw labeled sketch with dimensions of the cross section of permanent way for different gauges and different site conditions. 1d. State the requirements for ideal components of permanent way. 1e. Classify the components of permanent way. 1f. State the advantages and disadvantages of different types of components of the permanent way. 1g. Suggest selection of the type of component for different site and traffic conditions	1.1 Definition, requirements of an ideal permanent way. 1.2 Different components of permanent way 1.3Cross-section of Broad Gauge and Meter Gauge single and double line in cutting and embankment. 1.4 Rails- Types, functions, 1.5 Types of rail joints, ideal joint. 1.6 Welding of rails – purpose & advantages of welding of rails. 1.7.Sleeper- Functions and requirements. Types of sleepers – wooden, Metal, cast iron,Steel trough and prestressedconcrete sleepers. 1.8 Gauges – Types of Gauges – Broad Gauge, Meter Gauge, Narrow Gauge, their gauge width,circumstances under which they are used ,Necessity and importance of uniform gauge 1.9 Rail fixtures and fastenings -Fixtures and fastenings between railand sleepers.Bearing plates, keys, bolts, elastic fastenings. 1.10 Ballast- Functions and requirements. Different types of ballast and their properties.	Assignment, Video Demonstrations, Chalk-Board	CO1
	UNIT 2 Geometric Design & Turnout (CL Hrs- 10, Marks-14)			
2.	2a.Define the terms -coning of wheels, tilting of wheels, super-elevation on track, cant deficiency, grade compensation and creep. 2b. State the reasons for the provision of coning of wheels, tilting of wheels, super-elevation on track, cant deficiency, grade compensation and occurrence of creep on railway track. 2c.Describe the procedure for the provision of super- elevation along railway track. 2d. State the reasons for	2.1 Coning of wheels & tilting of rails. 2.2Super - elevation on curves.2.3Cant deficiency and grade compensation. 2.4 Creep of rails- Definition, causes, effects & prevention of creep 2.5 Turn-outs - components of Turn-out and their functions 2.6 Simple split switch turnout consisting of points and crossings. 2.7 Line sketches of diamond crossing, crossovers and theirsalient features.	Chalk-Board ,ppt	**CO2**

	occurrence of creep and its effect on the railway track. 2e. State the procedures for prevention and correction of creep on railway track. 2f. Define Points and crossings on railway track. 2g. Draw labeled sketch of simple switch turnouts on railway track 2h. Draw line sketches of complicated turnouts, diamond crossings and crossovers on railway track. 2i. State the functions of the components of turnouts.			
UNIT 3 Station and Yards (CL Hrs- 10, Marks- 10)				
3.	3a. State the factors influencing selection of site for railway station. 3b. Classify the railway stations. 3c. Sate the requirements of ideal railway station complex. 3d. State the different yards in railway stations and enlist the amenities to be provided in those yards. 3e. Draw sketches of the different types of stations and different station yards. 3f.State the needfor maintenance of railway track. 3g.State the types of maintenance of railway track. 3h.Describe the organization structure for railway maintenance work. 3i.State the duties and responsibilities of the personnel in the organization structure for the maintenance work of railway track	3.1Functions, factors affecting selection of station, Types of stations. 3.2 Study of layout and functions of different types of yards- Passenger, goods. Marshalling and locomotive yards. 3.3 Introduction, Importance of Maintenance. 3.4 Types of maintenance- Daily maintenance, periodical maintenance. 3.5 Inspection of track, working and responsibility of different personnel in track maintenance	Video Demonstrations Presentations Chalk-Board	**CO3**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT 4 Primary Aspects of Tunneling (CL Hrs- 14, Marks-14)				

4.	4.a State the situations necessitating tunneling. 4.b Classify tunnels based on shapes and purpose. 4.c State the advantages and disadvantages of tunneling. 4.d Describe the economics of tunneling. 4.e Describe the various surveys involved in tunneling. 4.f Explain the procedure for setting out the tunnel alignment on ground and inside tunnel. 4.g Describe with a sketch, the procedure for transferring alignment through shafts	4.1.Introduction to tunnelling 4.2.Necessity of tunnelling 4.3.Types of tunnels 4.4.Shapes of tunnels 4.5.Advantages of tunnelling 4.6.Economics of tunnelling 4.7.Initial surveys, geology, topography, 4.8 Setting out of the tunnel centre line on the surface, setting out tunnel centre line inside tunnel. 4.9 Transferring of alignment through shafts. 4.10 Ventilation of tunnel. 4.11 Lighting of tunnels. 4.12 Drainage of tunnel.	Video Demonstrations Presentations Chalk-Board	CO4
Unit 5: Methods of tunneling in soft strata & hard strata (CL Hrs- 16, Marks- 18)				
5.	5.a List the operations involved in tunneling through soft ground. 5.b Describe the methods of tunneling in soft ground. 5.c Describe the roof supporting methods during tunneling in soft strata. 5.d Write the sequence of operations involved in tunneling through hard rock along with the time estimates for the same. 5.e Describe the methods of tunneling in hard rock.	5.1 Operations involved in tunnelling in soft ground. 5.2 Tunnelling in soft ground- Needle beam method, multiple drift method, Shield method of tunnelling. Method of supporting roof- *Advanced method of supporting roof by shot creeting including use of wire mesh, steel fibres and different types of rock bolt sand sides in multiple drift method. 5.3 Sequence of operation for construction of tunnel in rocky strata. Drilling, Blasting,*Use of electric delay detonators, its advantages and various drilling patterns,Inspection and handling misfire, mucking, *Mucking Using Different Types Of Dumpers, Time distribution for various operations. 5.4 Tunnelling in rock – Full face method, Heading and bench method.*Modern methods of Tunnelling -New Austrian tunnelling method (NATM), Use of Tunnel boring machine (TBM), Micro Tunnelling 5.5 Tunnel Maintenance- Purpose & measures to be taken for proper maintenance	Video Demonstrations Presentations Chalk-Board	CO5

V. LABORATORYLEARNINGOUTCOMEANDALIGNEDPRACTICAL/TUTORIALEXPERIENCES.

NA

VI. SUGGESTEDMICROPROJECT/ASSIGNMENT/ACTIVITIESFORSPECIFICLEARNING/SKILLS DEVELOPMENT(SELF-LEARNING)

NA

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

NA

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (SpecificationTable)

Sr.No	Unit	UnitTitle	AlignedCOs	LearningHours	R-Level	U-Level	A-Level	TotalMarks
1	I	Permanent Way	CO1	10	06	06	04	16
2	II	Geometric Design & Turnout	CO2	10	06	06	02	14
3	III	Station and yards	CO3	10	02	04	04	10
4	IV	Primary aspects of Tunneling.	CO4	14	04	08	02	14
5	V	Method of tunneling in soft strata & hard strata	CO5	16	02	06	08	16
GrandTotal				60	20	30	20	70

IX.ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessmentfor Learning)	Summative Assessment (Assessmentof Learning)
Two unit tests of 30 marks and an average of two unit tests.	End semester assessment of 70 marks theory examination.

X. SUGGESTED COS- POS MATRIX FORM

CourseOutcomes(COs)	ProgrammeOutcomes(POs)							ProgrammeSpecificOutcomes*(PSOs)		
	PO-1 BasicandDiscipline-SpecificKnowledge	PO-2 ProblemAnalysis	PO-3 Design/ DevelopmentofSolutions	PO-4 EngineeringTools	PO-5 EngineeringPracticesforSociety, Sustainabilityand Environment	PO-6 ProjectManagement	PO-7 LifeLong Learning	PSO-1	PSO-2	PSO-3
CO1	1	1	1	2	2	2	2	2	2	2
CO2	3	2	3	3	2	2	2	2	3	3
CO3	1	1	3	3	2	1	2	3	3	2
CO4	1	1	2	2	1	1	2	1	2	2
CO5	1	1	2	2	2	1	2	2	2	2

Legends:-High:03,Medium:02,Low:01,NoMapping:-*PSOs are to be formulated at the institute level.

XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	B L Gupta &Amit Gupta	Roads,Railways,Bridges,Tunnels& Harbour Dock Engineering	Standard Publishers and Distributors 7th Edition 2011

2	Satish Chandra& M MAgarwal	Railway Engineering	Oxford University Press First Edition 2007
3	BIS	National Building Code	Bureau of Indian Standard
4	BIS	BIS 962 – 1989 Code Of Architectural and Building Drawing.	Bureau of Indian Standard
5	BIS	BIS 1038 – 1983 Steel Doors, Windows and Venitilators	Bureau of Indian Standard

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	www.nptel.com	NPTEL LECTURES
2	NPTEL Lecture series on Railway Engineering & Tunnel Engineering	Geometric design
3	YouTube Videos covering Railway Engineering and Tunnel Engineering	Permanent way

Name & Signature:

Shri. D K Bhandare
Lecturer in Civil Dept
(Course Experts)

Name & Signature:	Name & Signature:
V G Tambe (Programme Head) **V B Kondawar** (Head II Shift)	**Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE
PROGRAMME CODE	01
COURSE TITLE	EMERGING TRENDS IN CIVIL ENGINEERING
COURSE CODE	CE51202
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION COURSE	NO

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory Practical				Based on LL & TSL Practical				Based on SL		Total Marks
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
	EMERGING TRENDS IN CIVIL ENGINEERING	DSC	3	--	--	1	4	2	1	15	35*#	50	20	--	--	--	--	25	10	75

Total IKS Hrs. for Term: 0 Hrs.

Abbreviations: **CL**-Classroom 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, *# - Online Examination, @$ - Internal Online Examination

Note:

1. **FA-TH** represents an average of two class tests of 15 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that course.
3. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
1. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Civil engineering sector is continuously extending in each phase of construction activities. It has been noticed that the effective resource management and its utilization is the requirement of civil projects. Recent advancements are available in planning, execution and maintenance works. Many companies are using innovative techniques for effective planning, eco-friendly construction materials, highly efficient machineries in projects. This subject gives overall scenario of such new trends in the field of civil industry. The introduction of new inventions available worldwide will help to incorporate it in upcoming projects gradually.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's):

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Choose different applications of software's for planning, designing and execution of projects.
CO2: Select suitable advance materials for given civil engineering work.
CO3: Recommend suitable tools and equipment's for the given work situation.

CO4: Adopt the advanced resource management techniques for the given project.
CO5: Use feasible advance techniques for various civil engineering projects.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I Software's in Civil Engineering (CL Hrs-08, Marks-08)				
1.	**TLO 1.1** Describe merits and demerits of soft computing techniques. **TLO1.2** Understand the applications of software's used in Civil Engineering **TLO 1.3** Suggest the suitable software/s for the given construction activity.	1.1 Merits and Demerits of soft computing technique 1.2 Applications of software's - Build-Master, HEC-RAS, STRAP, WaterGEMS, ArcGIS, STAAD-Pro, RISA-Connection, MIDAS, Building Information Modeling (BIM), Procore, Primavera Pro, Virtual Reality Software-VR, MX Road Software, Building Planning & Management System (BPMS), Plaxis 3D,Autodesk Construction Cloud, Powerplay, Geo5,Revit	Chalk-Board Video Demonstrations Presentations Demonstration Hands-on Case Study	**CO1**
UNIT - II Recent Construction Materials (CL Hrs-10, Marks-12)				
2	**TLO 2.1.** Select the advanced construction material for given construction activity. **TLO 2.2** Enumerate the applications of given form of material/s in civil engineering. **TLO 2.3** Justify the use of given material for given site condition.	2.1 **Applications of Building materials:** Pollution absorbing bricks, Cooling bricks, 3D printed bricks, interlocking bricks translucent wood. 2.2 **Applications of Road materials:** Recycled asphalt shingles, Self-healing asphalt, Precast Pre-stressed Concrete Panels (PPCP) 2.3 **Applications of Concrete materials:** Synthetic concrete, new admixtures-Masterglanium, Polycarboxylic Ether, Nano concrete, Light transmitting concrete, Foam concrete, Bendable concrete or Engineered Cementitious Composite (ECC), Hydrophobic concrete, green concrete, Timbercrete, Ferrock	Chalk-Board Video Demonstrations Presentations Demonstration Hands-on Case Study	**CO2**
UNIT- III LATEST Tools and Equipment's (CL Hrs-09, Marks-10)				
3	**TLO3.1** Identify the correct use/s of given advanced tool/equipment.	3.1 **Survey equipment's:** LiDAR, Direct Reading Grade Rods, 3D Laser scanning, Robotic Mark out,	Chalk-Board Video Demonstrations Presentations	**CO3**

	TLO3.2 Select the appropriate instrument required for the given construction activity. **TLO3.3** Identify the situation for the use of given advance equipment/instrument.	Use of Robots in plastering, painting, brick laying. Google Earth. **3.2 Construction equipment's:** Advanced plastering machine, Bridge girder launcher. **3.3 Material handling equipment's:** Forklifts, paver, road header	Demonstration Hands-on Case Study	
UNIT-IV Sustainable Resource Management (CL Hrs-08, Marks-08)				
4	**TLO 4.1** Justify/Demonstrate the necessity of energy audit. **TLO 4.2** Suggest the appropriate safety technique for given site condition. **TLO 4.3**. Describe the concept of financial planning.	**4.1 Energy Audit-** Necessity and methods, Utilization of natural energy resources. **4.2 Site Safety-** Necessity, principles, tools, techniques, laws, rules and regulations. **4.3 Construction Financial Planning-** Introduction, importance, resources for construction projects, Effective cash flow management	Chalk-Board Video Demonstrations Presentations Demonstration Hands-on Case Study	**CO4**
UNIT-V Advance Construction Techniques (CL Hrs-10, Marks-12)				
	TLO 5.1 Select the appropriate advanced techniques for the given construction project. **TLO 5.2** Identify the application of given construction technique. **TLO 5.3** Justify the use of construction technique for the relevant work.	**5.1 Building construction techniques:** Pre-engineered building using Mivan technology, Fire protection in buildings, 3D printing, Sound Proofing walls. **5.2 Road construction techniques:** Road Printer, smart roads, Anti-icing roads, Piezoelectric roads, Hyperloop construction. **5.3 Ground improvement techniques:** Advanced piling techniques – Mono piling, Micro Piles, Soil Nailing, Sand Drains, Pre-Fabricated Vertical Drains, Thermal Methods-soil heating and soil freezing.	Chalk-Board Video Demonstrations Presentations Demonstration Hands-on Case Study	**CO5**

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES.

Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	No. Of Hrs.	Relevant COs
Not Applicable				

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Assignment

Student should maintain a separate full-size book to solve the assignment given by course teacher. Course teacher can assign following type of assignments to students. Assignments should be solved by individual students and corrective actions should be given by course teacher.

Microproject:

Student should prepare 10-15 pages microproject on any topic in a group of 4 students only. Course teacher can allot following topics to microproject group. Microproject report should be prepared with new information other than classroom teaching. The necessary guidance for the microproject work should be provided by course teacher.

1. Prepare the chart showing software and their applications.
2. Visit to robotics lab to understand uses of robots in civil industry and prepare a report of it.
3. Prepare a model of any one construction material or machinery used in recent days.
4. Prepare a report on advanced machinery and materials.
5. Elaborate the process of mass housing, pre-engineered buildings etc.
6. Make posters showing site safety and its awareness.
7. Prepare the charts showing different types of safety rules and regulations of site.
8. Prepare a report on Zero Energy Building and Green Building stating its case study mentioning material required advantages and disadvantages and applications etc.
9. Prepare a report on Techniques of Earthquake Resistant Structures mentioning methods, merits, practical difficulties, applications etc.

LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with broad specifications	Relevant LLO
1	Computer system (Any computer system with basic configuration)	All
2	LCD Projector with accessories	All

VII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

VII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Software's in Civil Engineering	CO1	08	02	02	04	08
2	II	Recent Construction Materials	CO2	10	02	06	04	12
3	III	Latest Tools and Equipments	CO3	09	04	02	04	10
4	IV	Sustainable Resource Management	CO4	08	02	02	04	08
5	V	Advance Construction Techniques	CO5	10	04	04	04	12
Grand Total				45	**14**	**16**	**20**	**50**

VIII. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Self-Learning (Assignment) Question and Answers in class room, quiz and group discussion.	End Semester Assessment of 50 marks.

IX. 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	1	1	1	2	1	2	1	2	3	2
CO2	2	2	1	2	2	1	1	2	3	2
CO3	2	2	1	2	1	2	1	2	3	2
CO4	2	2	2	2	2	2	1	1	3	1
CO5	2	2	1	2	1	2	1	2	2	2

Legends: - High:03, **Medium:**02, **Low:**01, **No Mapping: -**
*PSOs are to be formulated at the institute level

X. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Emerging Materials for Civil Infrastructure: State of the Art	Roberto Lopez-Anido, Tarun Naik	American Society of Civil Engineers (31 July 2000), ISBN-13: 978-0784405383
2	Sustainable Construction Materials	Ravindra K. Dhir OBE Jorge de Brito Rui Silva Chao Qun Lye	Woodhead Publishing, 9th January 2019, eBook ISBN: 9780081009918 Hardcover ISBN: 9780081009857

3	Learning Manual on "Emerging Trends in Civil Engineering-Second Edition"	MSBTE, Mumbai.	--
4	Advanced Construction Techniques and Equipment	Dr. Manoranjan Samal	S.K. Kataria & Sons, 2022, ISBN: 978-93-5014-751-1
5	Advanced Construction and Equipment	Dr. R. P. Rethaliya	Atul Prakashan, Ahmedabad, 1 January 2019, ISBN: 978-93-81518.94-6
6	Advanced Construction Technology	Dr. R. Vigneswaran	Magnus Publication, ISBN: 978-81-964838-0-7
7	Emerging Trends in Civil Engineering Select Proceedings of ICETCE 2018	K. Ganesh Babu, H. Sudarsana Rao, Y. Amarnath	Springer Publication, 12 January 2020 ISBN:978-9811514036
8	Emerging Trends in Engineering and Technology (Volume - 5)	Mohit Bajpai Dr. A.V. Sudhakara Reddy and Dr. V. Lakshmi Devi	Integrated Publicaions, New Delhi, ISBN:978-93-93502-97-1

XI. LEARNING WEBSITES & PORTALS

Sr. No.	Link/Software	Description
1	https://www.engineeringcivil.com/softwares.	Softwares used in Civil Engineering
2	https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html	Building materials, new construction materials
3	https://geniebelt.com/blog/10-innovative-construction-materials	Innovative construction materials
4	https://www.viatechnik.com/blog/modern-construction-machines-theyre-used/	Modern construction machines
5	https://www.academia.edu/28172313/ADVANCED_BUILDING_CONSTRUCTION_EQUIPMENT	Advanced Building Construction Equipment
6	https://theconstructor.org/construction/sustainability-construction-civil-engineering/9492/	Sustainability in Construction
7	https://www.designingbuildings.co.uk/wiki/Advanced_construction_technology	Advanced Construction Technology
8	https://www.constructionjunkie.com/blog/2018/1/7/the-16-most-interesting-advances-in-construction-technology-of-2017	Emerging Trends in Civil Engineering
9	https://mysubs.in/buy/recent-trends-in-civil-engineering-and-technology-journal-subscription?gclid=Cj0KCQjw6IfoBRCiARIsAF6q06scZ5teDlexIYz_j85yv2ZH_v1kiQcytNvYf3AeIfE3LcZndTbhrQwaAqv2EALw_wcB.	Recent Trends In Civil Engineering-And Technology
10	https://www.flatworldsolutions.com/engineering/articles/6-latest-trends-in-civil-engineering.php.	Latest Trends In Civil Engineering.

Name & Signature: **Miss.B.N. Makam** Lecturer in Civil Engineering **(Course Experts)**	**Mrs.S.R Panapalli** Lecturer in Civil Engineering **(Course Experts)**
Name & Signature: **Shri V.B. Kondawar** **(CE HOD II Shift)** **Shri V.G Tambe** **(Programme Head)**	Name & Signature: **Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM
PROGRAMME CODE	01/02/03/04/05/06/07/08
COURSE TITLE	SOCIAL AND LIFE SKILLS
COURSE CODE	HU21204
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SLA		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR				
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
	SOCIAL AND LIFE SKILLS	VEC	1	--	2	1	4	2	--	--	--	--	--	25	10	--	--	25	10	50

Total IKS Hrs for Term: 0 Hrs

Abbreviations: **CL**-Classroom 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,*# - Online Examination,@$ - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that course.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
1. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
3. **1 credit** is equivalent to **30 Notional hours.**
4. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

The introduction of a social and life skills course for diploma engineers is indeed a significant step forward in shaping well-rounded professionals. By integrating soft skills training with technical education, this curriculum addresses the growing need for engineers who are not only experts in their field but also adept in interpersonal communication, collaboration, and leadership. Such skills are crucial for success in the modern workforce, where the ability to navigate complex social dynamics can be just as important as technical know-how. Moreover, the emphasis on ethical decision-making prepares engineers to approach their work with integrity and responsibility. As these professionals progress in their careers, the benefits of this comprehensive education will manifest in their ability to innovate, lead, and contribute positively to their communities and the broader society. This forward-thinking approach ensures that the engineers of tomorrow are equipped not just with the tools to excel in their careers, but also with the vision to drive societal progress.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Achieve shared goals through effective teamwork in executing sustainable community development projects.
CO2: Improve cooperation and understanding through refined communication skills.
CO3: Encourage ethical choices and compassionate behaviour by nurturing moral values.
CO4: Foster ethical judgment, honesty, and societal accountability to shape principled and conscientious professionals.
CO5: Equip students with practical financial literacy skills for efficient financial management.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	TheoryLearning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
UNIT-I ENGAGEMENTS WITHIN UNNAT MAHARASHTRA ABHIYAN (UMA) (CL Hrs-03, Marks-NIL)				
1.	**TLOI.I:** Recognize the importance of addressing societal needs and involving relevant stakeholders in problem-solving efforts. **TLO1.2:** Integrate academia, society, and technology to devise comprehensive solutions for complex societal issues. **TLO1.3:**Enhance communication and negotiation skills to effectively engage stakeholders, ensuring diverse perspectives and productive collaboration in problem-solving. **TLO1.4:** Utilize critical data sources such as economic surveys, and environmental data to guide decision-making and solution development in problem-solving endeavours. **TLO1.5:** Identify key stakeholders and delineate their roles and interests in addressing societal challenges. **TLO1.6:** Identify	**1.1 Identifying Regional Societal Challenges:** Recognizing Community Needs Requiring Engineering Solutions. **1.2Integrating Multidisciplinary Approaches:** Linking Academia, Society, and Technology **1.3 Involving Diverse Stakeholders:** Engaging Various Actors in the Problem-Solving Process **1.4Accessing Secondary Data Sources:** Utilizing Resources like Census and Economic Surveys **1.5Mapping Problems and Stakeholders:** Understanding Activities' Relevance to System Components and Key Stakeholders **1.6Defining Measurement Metrics:** Identifying Essential Attributes for Evaluation **1.7 Employing Data Collection Tools:** Exploring Surveys and Measurement Equipment **1.8Establishing Measurement Standards:** Developing Survey Forms and Piloting Processes **1.9Conducting Field Surveys:** Quantifying Local Systems such as Agriculture and Transportation **1.10Analyzing Data and Creating**	Considering the unit design, it's vital to consider the following factors during the implementation of the unit: i) Organize students into smaller groups of 5-6 members to carry out fieldwork within the larger cohort. ii) Allocate multiple student groups evenly among all faculty members involved in the course. iii) A team of course faculty will visit local governing bodies like Municipal Corporations, Villages, Panchayats, Zilla Parishads, and Panchayat Samitis to assess small-scale technological or engineering needs within their jurisdiction. iv) The team of course instructors will conduct initial field visits to explore various scenarios and options	CO1

	essential attributes for measurement in the problem-solving process. **TLO1.7:** Explore diverse tools and templates for data collection, including surveys and measurement equipment. **TLO1.8:** Establish a structured framework for measuring identified attributes, including the development of survey forms and piloting the measurement process. **TLO1.9:** Gain practical experience in conducting fieldwork to gather primary data, such as agricultural output, rainfall, and transportation networks. **TLO1.10:** Develop proficiency in data analysis to draw meaningful conclusions, informing decision-making and solution development processes.	**Reports:** Summarizing Data and Reflections in Reports, Utilizing Various Formats like Tables and Graphs	for student-led fieldwork to assess and quantify different parameters and characteristics. **a) Session I** will introduce the development approach, fieldwork methodology, and the utilization of case studies as instructional tools. **b) Sessions II - VII** will cover topics such as societal dynamics, stakeholder engagement, value creation, establishing metrics, basic analysis, and preliminary reporting. **c) Session VIII** will wrap up the program with feedback collection and assessment. **d) Field Work:** **1. Pilot Visit** - Testing the survey instrument **2. Survey Visit 1** - Gathering data/information Survey. **3. Visit 2-** Further data collection. **4.SummaryVisit-** Concluding activities post-analysis.	
UNIT - II NATIONAL SERVICE SCHEME (NSS) (CL Hrs-03, Marks- NIL)				
2	**TLO2.1:** Enhance communication and leadership abilities to effectively interact with local leaders. **TLO2.2:** Develop proficiency in conducting socio-economic surveys using appropriate data collection techniques and analysis methods to understand community needs. **TLO2.3:** Identify suitable villages and	2.1 Engaging with Village/Area 2.2 Conducting initial socio-economic surveys in nearby villages. 2.3 Selecting villages for adoption and initiating project activities. 2.4 Conducting thorough socio-economic surveys in the adopted village or area. 2.5 Identifying key issues and challenges within the community. 2.6 Raising awareness about advancements in agriculture, watershed management, wasteland reclamation, renewable energy, affordable housing, sanitation, nutrition, and personal hygiene. Also,	Considering the unit design, it's vital to consider the following factors during the implementation of the unit: i) Organize students into smaller groups of 5-6 members to carry out fieldwork within the larger cohort. ii) Allocate multiple student groups evenly among all faculty members involved in the course.	**CO2**

	devise activity plans based on community needs and available resources. **TLO2.4:** Analyze survey findings to discern socio-economic patterns, obstacles, and potential avenues for progress. **TLO2.5:** Prioritize community issues according to their significance and impact on community welfare. **TLO2.6:** Communicate information on agriculture, watershed management, renewable energy, housing, sanitation, nutrition, and hygiene effectively. **TLO2.7:** Cultivate networking and advocacy skills to foster collaboration among government agencies, development organizations, and the community.	informing about skill enhancement programs, income generation opportunities, government initiatives, legal aid, consumer rights, and related topics. 2.7 Facilitating collaboration between the government and development agencies to implement various schemes in the adopted village or slum.	iii) Before selecting a village or slum for NSS activities, it's advisable for teachers to conduct an initial visit. iv)The selected area should have a dense population. iv)Community members should exhibit a willingness to improve their living conditions and actively engage in projects initiated by the NSS for their benefit. vi) NSS units should avoid areas with a history of political conflicts. vii) The chosen area should be conveniently accessible for NSS volunteers to conduct regular visits to the slums.	
UNIT - III UNIVERSAL HUMAN VALUES (CL Hrs-03, Marks- NIL)				
3	**TL03.1:** Apply love and compassion to promote harmony and well-being. **TL03.2:** Demonstrate honesty and transparency to build trust and authenticity. **TL03.3:** Utilize non-violent approaches to resolve conflicts and enhance empathy. **TL03.4:** Align actions with moral principles to promote justice and fairness. **TL03.5:** Employ peace-building strategies for harmony and	**4.1 Exploring Love and Compassion (Prem and Karuna):** Learning about and embodying the principles of love and compassion in daily life. **4.2 Embracing Truth (Satya):** Understanding the significance of truthfulness and integrating it into one's actions and interactions. **4.3 Embracing Non-Violence (Ahimsa):** Understanding the importance of non-violence and applying it in personal and societal contexts. **4.4 Upholding Righteousness (Dharma):** Exploring the concept of righteousness and practising it through ethical conduct and moral	Proposed Learning Approaches for: i) Lecture Delivery ii) Demonstrations iii) Case Studies iv)Role-playing exercises v)Observational Learning vi)Portfolio Development vii) Simulations viii) Inspirational Talks from Industry Professionals ix) On-site Visits to sites or Industries	**CO3**

	reconciliation. **TL03.6:** Engage in acts of service to cultivate empathy and social responsibility. **TL03.7:** Prioritize others' needs to foster altruism and generosity. **TL03.8:** Exhibit behaviours that uphold gender equality and respect for diversity to create an inclusive	values. **4.5 Cultivating Peace (Shanti):** Reflecting on the essence of peace and cultivating inner tranquillity while promoting harmony in relationships and communities. **4.6 Embracing Service (Seva):** Understanding the value of selfless service and actively engaging in acts of kindness and support for others. **4.7 Embracing Renunciation (Sacrifice) Tyaga:** Understanding the concept of renunciation and willingly **letting go of self-interest for the greater good. and attitudes.** **4.8 Promoting Gender Equality and Sensitivity:** Recognizing the importance of gender equality and fostering an environment of inclusivity and respect for all genders through actions and attitudes.		
UNIT - IV VALUE EDUCATION (UNNATI FOUNDATION) (CL Hrs-03, Marks- NIL)				
4	**TLO4.1:** Display comprehension of one's own identity, values, and beliefs. **TLO4.2**: Recognize and express personal strengths and weaknesses effectively. **TLO4.3:** Demonstrate adeptness in active listening by providing feedback and demonstrating empathy. **TLO4.4:** Acquire strategies for handling conflicts constructively and respectfully. **TLO4.5:** Assess and reflect on moral values and principles that influence personal actions and choices. **TLO4.6:** Analyze and assess the moral values and principles guiding	**4.1. Self-awareness and Personal Development** Self-understanding, Identification of strengths and weaknesses, Setting goals and devising plans, Building self-esteem and confidence **4.2.Interpersonal Skills and Effective Communication** Engaging in active listening, Resolving conflicts, Cultivating healthy relationships **4.3. Ethics and Morality** Grasping ethical concepts, Upholding moral values and principles, Making ethical decisions, Demonstrating integrity and honesty **4.4. Social Values and Responsibility** Being punctual and initiating conversation, Managing emotions effectively, Introducing oneself and others, Maintaining a positive attitude Valuing family bonds, Creating favourable impressions, Communicating effectively,	i) Video Demonstrations ii)Flipped Learning Environment iii) Case Studies iv)Role-playing Activities v) Group-based Learning vi) Team-based Learning vii)Utilization of Chalkboard	**CO4**

	individual actions and decisions.	Emphasizing cleanliness, hygiene, and organization, Expressing preferences, Fostering confidence Enhancing listening skills, Demonstrating appropriate greetings, Promoting gender equality and sensitivity, Exercising responsibility, Integrating visual and verbal learning, Establishing and pursuing goals, Observing social media etiquette, Efficiently managing time and daily routines		
UNIT - V FINANCIAL LITERACY(CL Hrs-03, Marks- NIL)				
5	**TLO5.1:**Comprehending Savings and Investment Practices. **TLO5.2:**Cultivating Proficiency in Financial Planning. **TLO 5.3:**Developing Competence in Transaction Handling. **TLO5.4:**Achieving Proficiency in Income, Spending, and Budget Management. **TLO 5.5:**Attaining Understanding of Inflation Concepts. **TLO 5.6:** Fostering Competence in Loan Administration. **TLO5.7:** Acknowledging the Significance of Insurance understanding.	**5.1. Fundamentals of Finances:** Grasping concepts of income, expenses, and savings, Employing budgeting techniques, Understanding assets and liabilities, and Recognizing the significance of emergency funds. **5.2. Banking Essentials** Initiating and managing bank accounts, Familiarizing oneself with various account types (savings, checking, etc.), Comprehending interest rates, and Safely utilizing ATMs. **5.3. Management of Credit and Debt** Interpreting credit scores and reports, Identifying different credit types (credit cards, loans, etc.), Responsible debt management, and Preventing involvement in predatory lending. **5.4. Foundations of Investment** Understanding investment types (stocks, bonds, mutual funds, etc.), Assessing risk and return, Implementing diversification strategies, and Formulating investment approaches. **5.5. Financial Planning and Goal Establishment** Establishing financial objectives, Crafting a personalized financial blueprint, Continuously monitoring and adjusting financial goals, and Engaging in long-term financial strategizing. **5.6. Consumer Rights and Duties** Familiarizing oneself with consumer	i) Video Demonstrations ii) Presentations iii) Case Studies iv) Chalkboard Utilization v) Collaborative Learning	**CO5**

		entitlements, Safeguarding against financial scams and fraudulent activities Exercising responsible borrowing and spending practices, Upholding financial privacy and security measures. **5.7. Essentials of Insurance** Exploring different insurance categories (health, life, auto, home, etc.), Understanding insurance policy specifics, Recognizing the importance of insurance coverage, and Navigating the insurance claims process. **5.8. Economic Literacy** Grasping fundamental economic principles, Understanding the concepts of inflation and deflation, Analyzing market trends, and Interpreting economic indicators.		

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	**LLOI.I.1:** Communicating and interacting with residents or children with compassion and empathy, demonstrating an understanding of their needs and emotions.	1.1 Encouraging empathy and kindness through volunteer work at: i) a nearby nursing home ii)a care centre for children from disadvantaged families or similar types of facilities.	2	CO3
2	**LLO 2.1** Enhance goal-setting abilities by engaging in collaborative planning, analyzing obstacles, and reflecting on personal aspirations to align them with broader academic or career goals.	2.1 Pathway to Success: Goal-Setting Exercise	2	CO4
3	**LLO3.1:** Develop effective communication skills by demonstrating compassion, empathy, and understanding towards residents or children, while acknowledging and addressing their needs and emotions.	3.1 Exploring Your Inner World: Self-Reflection Activity	2	CO4
4	**LLO4.1:** Laboratory Learning Outcome: Cultivate structured self-reflection skills to assess personal strengths and weaknesses.	4.1 Strengths and Weaknesses Identification and Analysis Exercise	2	CO4
5	**LLO 5.1:** Display proficiency in time management through the creation and adherence to structured timelines for	5.1 Time Management Simulation for Coordinating Industrial Visits	2	CO4

	task coordination.			
6	**LLO 6.1**: Demonstrate competency in social media etiquette through engaging in activities and adhering to established norms and guidelines.	6.1 Activity on Social Media Etiquette	2	CO4
7	**LLO 7.1:** Develop skills in mapping and analyzing family income and expenses through structured exercises.	7.1. Exercise on Mapping and Analyzing Family Income and Expenses	2	CO5
8	**LLO 8.1**: Apply their knowledge of interest rate calculation to real-world financial situations, improving decision-making skills.	8.1 Exploring Simple and Compound Interest: A Hands-On Exercise on Interest Rate Calculation and Its Impact on Savings and Loans.	2	CO5
9	**LLO9.1:** Enhance comprehension of interest rates and their impact on financial dealings, encompassing savings accounts, Fixed Deposits (FDs), and loans.	9.1 Interest Rate Comparison Exercise: Analyzing Rates for Savings, Fixed Deposits, and Loans.	2	CO5
10	**LLO10.1:** Mastering and implementing safety protocols for ensuring secure ATM transactions.	10.1 Safety Precautions for ATM Usage: Exploring Tips for Secure Transactions	2	CO5

Note: Out of the above suggestive LLOs –

1. A judicial mix of LLOs is to be performed to achieve the desired outcomes

VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

SELF-LEARNING - MICRO PROJECT/ASSIGNMENT/ACTIVITIES (ANY ONE)

The following list provides examples of activities that can be pursued under the program. Each group has the flexibility to choose from these options or undertake any other activity deemed suitable based on local requirements. The group focuses on the holistic development of the selected area, whether it is a village or a slum.

a) Community clean-up drives

Group tasks for community clean-up drives are,

1. Site Survey and Planning: Identify areas needing attention and plan tasks.
2. Logistics Management: Coordinate supply distribution to volunteers.
3. Volunteer Coordination: Welcome, register, and assign tasks to volunteers.
4. Trash Collection and Segregation: Collect and sort waste into categories.
5. Street Sweeping and Cleaning: Sweep and clean streets, sidewalks, and public areas.
6. Beautification and Landscaping: Enhance aesthetics by planting and trimming.
7. Safety and First Aid: Ensure volunteer safety and manage emergencies.
8. Documentation and Reporting: Capture progress through photos and reports.
9. Community Engagement: Educate and raise awareness among residents.
10. Post-Clean-up Evaluation: Review success and plan future initiatives.

b) Tree plantation initiatives

Group tasks for Tree plantation initiatives,

1. Community Awareness: Workshops to educate on tree benefits.
2. Community Participation: Engage locals in all planting
3. Team Building: Group activities to strengthen community bonds.
4. Leadership Development: Empower individuals to lead initiatives.
5. Communication Workshops: Enhance effective messaging.
6. Problem-solving Discussions: Address planting challenges.
7. Environmental Responsibility: Foster care for green spaces.
8. Cultural Integration: Incorporate local traditions into initiatives.
9. Sustainability Education: Teach sustainable planting practices.
10. Monitoring and Evaluation: Assess impact and plan improvements.

c) Environmental conservation awareness

Group tasks for Environmental conservation awareness

1. Educational Workshops: Teach about conservation methods.
2. Art Competitions: Promote environmental themes through art.
3. Street Plays: Perform interactive skits in public spaces.
4. Awareness Walks: Organize marches with environmental messages.
5. Tree Plantation: Plant trees to enhance green spaces.
6. Clean-up Campaigns: Remove litter from local areas.
7. Guest Lectures: Invite experts to discuss environmental issues.
8. Film Screenings: Show documentaries on conservation topics.
9. Social Media Campaigns: Spread awareness through online platforms.
10. Community Workshops: Educate on waste management and sustainability.

d) Health and sanitation programs

1. Health Education Sessions: Conduct informative sessions on hygiene, disease prevention, and nutrition.
2. Sanitation Infrastructure Evaluation: Assess the effectiveness of existing sanitation facilities and propose improvements.
3. Community Clean-up Events: Organize collective efforts to clean and maintain public spaces for better health outcomes.
4. Distribution of Hygiene Kits: Provide essential hygiene items such as soap, toothpaste, and sanitary products to community members.
5. Vaccination Drives: Coordinate vaccination campaigns to protect against prevalent diseases and promote community health.
6. Water Quality Testing: Conduct regular testing of water sources to ensure safe drinking water for residents.
8. Personal Hygiene Workshops: Offer workshops focusing on personal grooming, handwashing techniques, and menstrual hygiene.
9. First Aid Training: Provide basic first aid training to community members to equip them with life-saving skills.
10. Community Health Surveys: Conduct surveys to assess health needs and gather feedback for future program planning.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications	Relevant LLO Number
1	Basic engineering measurement instruments, GPS data collection devices, and open-sour GIS software like Google Earth and QGIS, along with the Microsoft Office suite.	ALL

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

NOT APPLICABLE

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Formative assessment (Assessment for Learning) Report and presentation of fieldwork activities, Self- Learning (Assignment)	--

X. SUGGESTED COS- POS MATRIX FORM

NOT APPLICABLE

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Mark Stafford Smith and Pamela Matson	Sustainable Development: Principles, Frameworks, and Case Studies	Oxford University Press, ISBN: 9780199588952
2	Katar Singh	Rural Development: Principles, Policies and Management	SAGE Publications Pvt. Ltd, ISBN:978-9351502867.
3	Anand Kumar, Asim Kumar Mandal, and R. Venkata Rao	Maharashtra: Governance and Development"	Routledge India, ISBN: 978-0367709133
4	Dalai Lama and Howard C. Cutler	The Art of Happiness	Riverhead Books, and the ISBN: 978-1594488894.
5	Stephen R. Covey	The 7 Habits of Highly Effective People	Simon & Schuster, ISBN : 978-1982137274.
6	Local college students, UMA staff	Sample Case Studies on the UMA website	IITB-UMA team

XI. LEARNING WEBSITES & PORTALS

Sr.No.	Link/Portal	Description
1	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skills. Unit 4 i.e. Course 4 is to be referred
2	https://nss.gov.in/	The National Service Scheme (NSS) website provides information about the NSS program in India. It includes details about the objectives, history, and structure of NSS. Additionally, the website offers resources for NSS volunteers and coordinators, such as program guidelines, training materials, and reports.
3	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/20160113150152380 8.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
4	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/20160615145407370 8.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
5	https://www.humanvaluesfoundation.com/.	The Human Values Foundation website offers educators resources for teaching human values and social-emotional learning to children and youth. It provides curriculum-based programs, lesson plans, and activities to foster character development, resilience, and positive behaviour. Additionally, the website shares insights into the foundation's mission, values, and the global impact of its programs in schools.

Name & Signature:

Mr. S.B.Kulkarni
Lecturer in Mechanical Engineering
(Course Experts)

Name & Signature:	Name & Signature:
V G Tambe (Programme Head) **V B Kondawar** (Head II Shift)	**Shri. S.B. Kulkarni** (CDC In-charge)