Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Civil Engineering / Civil & Rural Engineering / Construction Technology / Civil & Environmental Engineering**		
Programme Code	**: CE / CR / CS / LE**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Third** **NCrF Entry Level : 3.5**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											Total Marks
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																							
1	STRENGTH OF MATERIALS	SOM	DSC	313308	1	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
2	ADVANCED SURVEYING	ASU	SEC	313321	-	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	CONCRETE TECHNOLOGY	CTE	DSC	313322	1	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175
4	HIGHWAY ENGINEERING	HEN	DSC	313323	1	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
5	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	313002	-	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
6	BUILDING PLANNING & DRAWING WITH CAD	BDC	SEC	313009	1	2	-	4	2	8	4	-	-	-	-	-	50	20	50#	20	25	10	125
7	CONSTRUCTION MANAGEMENT	CMA	DSC	313010	-	1	-	2	1	4	2	-	-	-	-	-	25	10	-	-	25	10	50
Total					**4**	**17**	**0**	**16**	**7**		**20**		**120**	**280**	**400**		**175**		**100**		**175**		**850**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory			Based on LL & TL				Based on Self Learning		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	

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

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

Note :

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

Course Category : Discipline Specific Course Core (DSC) : 4, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, AbilityEnhancement Course (AEC) : 0, Skill Enhancement Course (SEC) : 2, GenericElective (GE) : 0

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Production Engineering/**
Programme Code	**: AE/ AL/ CE/ CR/ CS/ LE/ ME/ PG**
Semester	**: Third**
Course Title	**: STRENGTH OF MATERIALS**
Course Code	**: 313308**

I. RATIONALE

All civil & mechanical engineering components are subjected to different types of loads and behave in a specific way. Students can able to understand & analyze various types of loads, stresses & strains with regards to the structural behavior of components and materials. This course is a prerequisite for understanding elastic behavior of different engineering materials, structural analysis, machine design, principles and the strengths of various structural elements used in civil & mechanical industries.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Analyze the stresses & strains in the given structural elements using relevant methods.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Calculate the M.I. of the given object using relevant formulae & methods.
- CO2 - Analyze the structural behavior of the given structural components under various loading conditions.
- CO3 - Draw SFD and BMD for the given structural element under given loading conditions.
- CO4 - Determine the bending and shear stresses in beams under different loading conditions
- CO5 - Analyze the direct & bending stresses in the structural members under eccentric loading conditions.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				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	
313308	STRENGTH OF MATERIALS	SOM	DSC	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Calculate Centroid, Moment of Inertia of Plane lamina and radius of gyration of a given lamina. TLO 1.2 Explain Parallel and Perpendicular axes theorems. TLO 1.3 Calculate Moment of inertia of standard solid shapes and hollow shapes. TLO 1.4 Calculate Moment of inertia of composite plane figures such as I, C, T & L sections. TLO 1.5 Understand Moment of inertia for built-up section.	**Unit - I Moment of Inertia** 1.1 Concept of Moment of Inertia, M.I. of plane lamina and radius of gyration of a given lamina. 1.2 Parallel and perpendicular axes theorems (without derivation). 1.3 M.I. of standard basic figures like square, rectangle, triangle, circle, semi-circle, quarter-circle and Hollow Rectangular & Circular sections. (without derivation). 1.4 M.I. of Composite plane figures such as symmetrical and unsymmetrical I-section, channel section, T-section, angle section. Numerical on composite figure consisting of maximum 03 standard shapes. 1.5 Introduction to M.I. for built-up sections. (No numerical). (IKS* Concept of Centre of Gravity & M.I.used in ancient constructions like temples, forts etc.)	Chalk-Board Hands-on Collaborative learning Video Demonstrations Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Understand concept of stresses and strains in deformable bodies. TLO 2.2 Understand Hook's law, elastic limit, Linear and lateral strain, Poisson's ratio. TLO 2.3 Determine modulus of elasticity, modulus of rigidity and bulk modulus for given material. TLO 2.4 Articulate practical significance of stress- strain curve for given material under given loading conditions for their relevant use. TLO 2.5 Concept of single shear, double shear & punching shear. TLO 2.6 Compute the total deformation for given homogeneous (compound) sections under axial load. TLO 2.7 Determine the stresses in each material for given composite section. TLO 2.8 Compute strain along x, y and z-direction for a given bi-axial or tri-axial stress system. TLO 2.9 Determine volumetric strain & change in volume for given cube or cuboid.	**Unit - II Simple Stresses, Strains & Elastic Constants** 2.1 Concept of elastic body ,definition of stress, strain, Type of stresses & strains. 2.2 Hook's law, elastic limit, Linear and lateral strain, Poisson's ratio. 2.3 Young's Modulus, Shear Modulus, Bulk Modulus & Relation between these three moduli. 2.4 Standard stress strain curve for mild steel bar and Tor steel bar under tension test, Yield stress, proof stress, ultimate stress, breaking stress, and working stress, strain at various critical points, percentage elongation and Factor of safety. 2.5 Shear stress and shear strain, Single shear, Double shear, Punching shear. 2.6 Deformation of body subjected to axial force for uniformed and stepped sections .Deformation of uniform body subjected to forces at its intermediate sections. 2.7 Concept of composite section, stresses induced and load shared by each material under axial loading only.(No numerical on stepped sections). 2.8 Uni-axial, Bi-axial and Tri-axial stress systems. 2.9 Strain in each direction, volumetric strain, change in volume.	- Chalk-Board - Hands-on Collaborative learning - Video - Demonstrations - Presentations
3	TLO 3.1 Enlist Types of Supports & Types of Beams TLO 3.2 Enlist types of loads acting on a beam. TLO 3.3 Understand the relation between SF, BM and rate of loading. TLO 3.4 Draw SFD and BMD for Simply supported beams ,Cantilever beams & overhanging beams. TLO 3.5 Locate point of maximum BM and point of contra-flexure.	**Unit - III Shear Force & Bending Moment** 3.1 Types of Supports: Simple, Hinge, Roller & Fixed and Beams: Cantilever, Simply supported, Roller, Hinge & overhanging beams. 3.2 Types of loads: Concentrated or Point load, Inclined point load & Uniformly Distributed load. 3.3 Meaning of SF and BM, Relation between them, Sign conventions. 3.4 SFD & BMD for Simply Supported, Cantilever and overhanging beams subjected to Vertical point load & UDL only. 3.5 Drawing SFD and BMD, Location of Point of Contra-Shear, maximum BM, Location of Point of Contra-flexure.	Chalk-Board Hands-on Collaborative learning Video Demonstrations Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Understand concept of pure bending , Neutral Axis and radius of gyration of a given lamina and section modulus. TLO 4.2 Determine Moment of Resistance (M.R.) & section modulus (Z) using Flexural Formula. TLO 4.3 Determine the Bending stresses at given location in simply supported & cantilever beams subjected to standard loading cases (Point load & UDL only). TLO 4.4 Compute & draw maximum and average shear stress for rectangular and circular section. TLO 4.5 Draw shear stress distribution diagram for given section across its depth. TLO 4.6 Determine shear stresses in hollow rectangular section.	**Unit - IV Bending and Shear Stresses in beams** 4.1 Theory of pure bending, assumptions in pure bending, Concept of Neutral Axis and section modulus. 4.2 Flexural Equation (without derivation) with meaning of each term used in equation, bending stresses and their nature, bending stress distribution diagram. 4.3 Bending stress variation diagram across depth of given cross section for cantilever and simply supported beams for symmetrical sections only. 4.4 Shear stress equation (without derivation), meaning of each term used in equation, relation between maximum and average shear stress for square, rectangular and circular section (numerical), shear stress distribution diagram. 4.5 Shear stress distribution diagram for square, rectangular, circle, hollow square, hollow rectangular, hollow circle, T- section & symmetrical I- section only. (no numericals) 4.6 Use of shear stress equation for determination of shear stresses in hollow rectangular section.	Chalk-Board Hands-on Collaborative Learning Demonstration Video Presentations
5	TLO 5.1 Explain effect of direct and eccentric loads on columns. TLO 5.2 Draw resultant stress distribution diagram for a compression member subjected to eccentric load about one of its principal axis. TLO 5.3 Write No tension condition for columns, Core of the section for rectangular & circular column. TLO 5.4 Identify the terms radius of gyration, slenderness ratio & effective length for given column with different end conditions. TLO 5.5 Understand the concept of buckling load in columns using Euler's Formula & Rankine's Formula.	**Unit - V Direct and Bending Stresses** 5.1 Introduction to direct and eccentric loads, Eccentricity about one principal axis, nature of stresses. 5.2 Maximum and minimum stresses, resultant stress distribution diagram. Condition for 'No tension' condition(Problems on Column subjected to Eccentric load about one axis only.) 5.3 Limit of eccentricity, core of section for circular cross sections, middle third rule for rectangular section. 5.4 Introduction to compression members, effective length, radius of gyration, slenderness ratio, type of end conditions for columns. 5.5 Buckling (or Crippling) load for columns by Euler's Formula & Rankine's Formula with meaning of each term in it.(No numericals.)	Chalk-Board Collaborative learning Presentations Demonstration Videos

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different components of UTM .	1	*Conduct sample compressive and tensile tests on metal using Universal Testing Machine along with introduction to machine & other tests to be conducted on UTM.	2	CO2
LLO 2.1 Perform Tension test on mild steel as per IS:432(1) .	2	*Tension test on mild steel as per IS:432(1) .	2	CO2
LLO 3.1 Perform tension test on Tor steel as per IS:1608, IS:1139 .	3	Tension test on Tor steel as per IS:1608, IS:1139 .	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Conduct compression test on sample test piece using Compression Testing Machine .	4	*Compression test on any two metals like Mild Steel, Brass, Al etc. using Compression Testing Machine .	2	CO2
LLO 5.1 Conduct Izod Impact test on given metals as per IS:1598 .	5	*Izod Impact test on any two metals like mild steel/ brass/aluminum/ copper /cast iron etc. as per IS:1598 .	2	CO2
LLO 6.1 Conduct Charpy Impact test on given metals as per IS:1598 .	6	Charpy Impact test on two metals like mild steel/ brass/aluminum/ copper /cast iron etc. as per IS:1757 .	2	CO2
LLO 7.1 Determine Compressive strength of dry and wet bricks .	7	Compressive strength of dry and wet bricks as per IS:3495 (part I), IS:1077 .	2	CO2
LLO 8.1 Perform Single Shear and double shear test on given metals as per IS:5242 .	8	*Single Shear and double shear test on any two metals like Mild steel/ brass/ Al / copper / cast iron etc. as per IS:5242 .	2	CO2 CO4
LLO 9.1 Conduct Compression test on timber section along the grain and across the grain .	9	Compression test on timber section along the grain and across the grain as per IS:2408 .	2	CO1 CO2
LLO 10.1 Plot Shear force and Bending Moment diagrams of beams subjected to different types of loads.	10	*Shear force and Bending Moment diagrams of cantilever, simply supported and overhanging beams for different types of loading . (02 problems on each type of beam) .	4	CO3
LLO 11.1 Conduct Flexural test on timber beam on rectangular section.	11	*Flexural test on timber beam on rectangular section in both orientations as per IS:1708, IS:2408 .	2	CO1 CO4
LLO 12.1 Prepare PPT on Strain Energy. LLO 12.2 Prepare PPT on Thermal Stresses & Thermal Strains.	12	a) Prepare PPT of minimum 05 slides on the concept of Strain Energy & instantaneous stress induced in a material due to gradual, Sudden & impact load. b) Prepare PPT of minimum 04 slides on Thermal Stresses & Thermal Strains.	2	CO2
LLO 13.1 Conduct Flexure test on floor tiles/roofing tiles.	13	Flexure test on floor tiles IS:1237, IS:13630 or roofing tiles as per IS:654, IS:2690 .	2	CO4
LLO 14.1 Determine hardness no. for given metal using Rockwell Hardness Tester.	14	Rockwell Hardness Test on any two Metals like Mild Steel, Brass Copper, Aluminum etc.	2	CO2
LLO 15.1 Determine hardness no for given metals using Brinell Hardness Tester.	15	Brinell hardens test on any two metals like Mild Steel, Brass Copper, Aluminum etc.	2	CO2

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.

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

Micro project

- Collect the information of Indian Knowledge System (IKS) given in different units.
- Prepare charts of maximum bending moment and shear force values in standard beams.
- Two Numericals on Chimneys (of rectangular and circular cross section) subjected to wind pressure & also draw stress distribution diagram at base of it.

- Draw & identify difference between Bending stress distribution & Shear stress distribution diagrams for square, rectangular, circle, hollow square, rectangular, circle, T- section, & symmetrical I- section.

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Extensometer with least count 0.01mm, maximum extension 25 mm with dial gauge/ digital display suitable for various gauge length.	1,2,3
2	Accessories: Vernier caliper, meter scale, weighing balance, weights, punch, file, hammer, screw driver, pliers, etc.	1,2,3,4,5,6,7,8,9,11,13
3	Universal Testing Machine of capacity 1000kN, 600 kN / 400 kN, analog type/digital type with all attachments and accessories.	1,2,3,8,11,13
4	Tile flexural testing machine confirming to IS:654, capacity 200 Kg with uniform loading rate of 45 to 55 Kg/minute provided with lead shots .	13
5	Brinell and Rockwell Hardness Test machine .	14,15
6	Compression Testing Machine of capacity 2000 kN / 1000 kN, analog / digital type with all attachments and accessories.	4,7,9
7	Izod/Charpy impact testing machine confirming to IS: 1757.	5,6
8	Hot Air Oven with thermostatic control having temp. range 100 to 105 degree celsius .	7

IX. SUGGESTED 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	Moment of Inertia	CO1	10	2	4	6	12
2	II	Simple Stresses, Strains & Elastic Constants	CO2	16	6	8	4	18
3	III	Shear Force & Bending Moment	CO3	14	2	4	10	16
4	IV	Bending and Shear Stresses in beams	CO4	10	2	4	6	12
5	V	Direct and Bending Stresses	CO5	10	2	4	6	12
Grand Total				**60**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests of 30 marks each will be conducted and average of two-unit tests considered. • For formative assessment of laboratory learning 25 marks • Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test)

XI. 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	3	2	2	1	--	2			
CO2	3	3	3	3	1	--	3			
CO3	3	3	2	1	1	--	2			
CO4	3	3	2	1	1	---	2			
CO5	3	3	2	1	1	--	2			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Khurmi R.S., Khurmi N.	A Textbook of Strength of Materials	S. Chand and Co. Ltd. New Delhi, 2019, ISBN 9789352833979
2	Ramamrutham S.	Strength of Materials	Dhanpat Rai and sons, New Delhi, 2015, ISBN 9788187433545
3	Punmia B. C., Ashok Kumar Jain , Arun Kumar Jain .	Mechanics of Materials	Laxmi Publications (p) Ltd. New Delhi, 2017, ISBN-13: 978-8131806463
4	Rattan S.S.	Strength of Materials	McGraw Hill Education; New Delhi 2017, ISBN-13: 978-9385965517
5	Rajput R. K .	A Textbook of Strength of Materials	S. Chand Publishing 9789352533695, 9352533690

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/DzyIEz3dKXQ?si=beGDRqJ1olZ70LUe	Concept of Stress and Strain .
2	https://youtu.be/RSlmDKHDMUY?si=FHCxXE1QSaa0FqBn	Standard stress-strain curve for mild steel bar and Tor steel bar .
3	https://www.youtube.com/watch?v=MFZ18Ed4HI8	Field Test on TMT .
4	https://www.youtube.com/watch?v=C-FEVzI8oe8	Concept of SFD and BMD .
5	https://www.youtube.com/watch?v=yvbA4mk36Kk	Practical examples of SFD and BMD.
6	https://www.youtube.com/watch?v=f2eGwNUopws	Concept & Numerical on Point of Contraflexure .
7	https://www.youtube.com/watch?v=f08Y39UiC-o	Bending Stresses & Shear Stresses in Beams .
8	https://skyciv.com/structural-software/beam-analysis-softwar e	Calculation & Drawing of SFD & BMD freeware Software .

Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/**
Programme Code	**: CE/ CR/ CS/ LE**
Semester	**: Third**
Course Title	**: ADVANCED SURVEYING**
Course Code	**: 313321**

I. RATIONALE

The technology has brought the significant advancements in field of surveying. This will help civil engineers for accurate measurements of physical features of various construction projects and land with utmost accuracy, speed and easy operation of these surveying equipment's. The data obtained by various advanced surveying equipment's includes information of topography, grading, elevation, distances etc. Such data obtained helps civil engineers for future project planning and effective execution. The advanced surveying also helps in identifying potential risks associated with construction projects. This course will help students to acquire skills associated with surveying of land and buildings.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use the relevant instrument to undertake the survey of the given area.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use the Tacheometer to obtain relevant details of the terrain in given situation.
- CO2 - Set out a Simple Circular curve to finalize the alignment of the given element.
- CO3 - Prepare layout plans using relevant surveying instruments.
- CO4 - Locate the co-ordinates of a given stations using the relevant technology.
- CO5 - Interpret the images of given terrain using Photogrammetry Techniques.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313321	ADVANCED SURVEYING	ASU	SEC	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the principles of Tacheometric surveying. TLO 1.2 Use the tacheometer to determine Reduced level, horizontal and vertical distance in the given situation. TLO 1.3 Select the relevant method of Tacheometric surveying in the given situation. TLO 1.4 Calculate constants of a Tacheometer from the given data. TLO 1.5 Specify the Limitations of tacheometry with examples.	**Unit - I Tacheometric Surveying** 1.1 Principle of tacheometry, Use of Tacheometry 1.2 Tacheometer and its component parts, Analytic lens, Tacheometric formula for horizontal distance with telescope horizontal and staff vertical. 1.3 Methods of Tacheometry: Stadia and fixed hair method 1.4 Field method for determining constants of tacheometer 1.5 Limitations of tacheometry.	Video Demonstrations Presentations Collaborative learning Hands-on Model Demonstration Lecture Using Chalk-Board Demonstration
2	TLO 2.1 Classify the curves used in surveying to fix the alignment. TLO 2.2 Draw the labelled diagram of simple circular curve. TLO 2.3 Derive the relationship between Radius and Degree of curve TLO 2.4 Set a simple circular curve using the relevant method of curve setting in the given situation.	**Unit - II Curves setting** 2.1 Curve: Definition, Necessity of Curves, Types of curves used in roads and railway alignments. 2.2 Elements of simple circular curve, Designation of the curve by Radius and Degree of curve. 2.3 Radius and Degree of curve. 2.4 Setting out a simple circular curve by offsets from long chord and Rankine's method of deflection angles.	Presentations Lecture Using Chalk-Board Collaborative learning Video Demonstrations Demonstration Model Demonstration Hands-on

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Use the EDM to measure the distance between two given stations. TLO 3.2 Use Electronic Digital Theodolite to measure the required angle. TLO 3.3 Explain the procedure to measure the angle between the given lines using Total Station instrument. TLO 3.4 Undertake the site layout operation for the given building structure using Total Station instrument.	**Unit - III Advanced Surveying Equipment's** 3.1 Electronic Distance Meter (EDM): Principle of Electronic Distance Meter (EDM), component parts and their Functions, use of EDM. 3.2 Electronic Digital Theodolite: Construction and Features of Electronic Digital Theodolite, procedure of angle measurement. 3.3 Total Station: Introduction, component parts with their functions, and Applications of Total Station, Temporary adjustments, sources of errors in Total Station, Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station. Traversing, Profile Survey and Contouring with Total Station. 3.4 Building Site layout using Total Station: Procedure.	Model Demonstration Video Demonstrations Hands-on Presentations Lecture Using Chalk-Board Collaborative learning Demonstration Site/Industry Visit
4	TLO 4.1 Propose the relevant system of remote sensing to be used for the given situation. TLO 4.2 Describe the procedure to find out the coordinates of the given station using GPS. TLO 4.3 Use the GIS technology to solve the given civil engineering problem.	**Unit - IV Remote sensing, GPS and GIS** 4.1 Remote Sensing : Definition, Electro-Magnetic Energy, Active and Passive system, Applications of remote sensing in Mining, land use / Land cover, mapping, disaster management and Environment. 4.2 Global Positioning System: Introduction, Construction and use of Global Positioning System (G.P.S.) 4.3 Geographic Information System (GIS): Overview, Component, Sources of errors, applications, Software's in GIS.	Presentations Video Demonstrations Collaborative learning Lecture Using Chalk-Board Demonstration Site/Industry Visit Case Study Hands-on
5	TLO 5.1 Suggest the relevant method of aerial surveying for the given situation. TLO 5.2 Classify the type of drones as per DGCA TLO 5.3 Explain the principles of photogrammetry TLO 5.4 Explain the type of Photogrammetry. TLO 5.5 Specify the Merits and Demerits of Photogrammetry surveying. TLO 5.6 Use the photogrammetry techniques to solve civil engineering problems.	**Unit - V Aerial Surveying and Photogrammetry** 5.1 Aerial surveying: Definition, principle, uses, methods 5.2 DGCA Classification of Drones, Silent features of Drone Rules, 2021 as per DGCA. 5.3 Definition of photogrammetry, Basic Principles of Photogrammetry. Types of Photogrammetry: Terrestrial and Aerial Photogrammetry 5.4 Types of Photographs, Terminology in aerial surveying. 5.5 Merits and Demerits of Photogrammetry surveying 5.6 Applications of Photogrammetry in civil engineering.	Case Study Video Demonstrations Demonstration Hands-on Collaborative learning Lecture Using Chalk-Board Presentations Site/Industry Visit

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use theodolite as a Tacheometer to determine the Tacheometric Constant	1	*Determine the Tacheometric Constant	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Use theodolite as a Tacheometer to compute reduced levels and horizontal distances	2	*Determine reduced levels of given stations and horizontal distances by Tacheometric Method (Part I)	2	CO1
LLO 3.1 Use theodolite as a Tacheometer to compute reduced levels and horizontal distances	3	*Determine reduced levels of given stations and horizontal distances by Tacheometric Method (Part II)	2	CO1
LLO 4.1 Use the offsets from Long Chord Method to Set out a circular curve	4	*Setting out of a circular curve by offsets from Long Chord Method.	2	CO2
LLO 5.1 Apply the technique of Rankine's Method of Deflection Angles to Set out a circular curve	5	*Setting out a circular curve by Rankine's Method of Deflection Angles. **(Project)** (Part I). Plot the curve details on A1 size imperial drawing sheet.	2	CO2
LLO 6.1 Apply the technique of Rankine's Method of Deflection Angles to Set out a circular curve	6	*Setting out a circular curve by Rankine's Method of Deflection Angles. **(Project)** (Part II). Plot the curve details on A1 size imperial drawing sheet.	2	CO2
LLO 7.1 Use EDM to measure horizontal and vertical distance	7	*Determine horizontal and vertical distance by using EDM.	2	CO3
LLO 8.1 Use Electronic Digital Theodolite to determine Horizontal and vertical angles	8	*Determine Horizontal and vertical angles using Electronic Digital Theodolite	2	CO3
LLO 9.1 Set up the Total Station instrument.	9	Setting up the Total Station instrument on site for surveying.	2	CO3
LLO 10.1 Use Total station instrument to measure horizontal, vertical and slope distances	10	*Determine horizontal, vertical and slope distances using Total station equipment (Part I)	2	CO3
LLO 11.1 Use Total station instrument to measure horizontal, vertical and slope distances	11	*Determine horizontal, vertical and slope distances using Total station equipment. (Part II)	2	CO3
LLO 12.1 Use Total station instrument to measure the given horizontal and vertical angles	12	*Determine horizontal and vertical angles using Total Station. (Part I)	2	CO3
LLO 13.1 Use Total station instrument to measure the given horizontal and vertical angles	13	*Determine horizontal and vertical angles using Total Station. (Part II)	2	CO3
LLO 14.1 Use Total station to determine Reduce Levels	14	*Determine the Reduced Levels of given stations (Minimum 10 station) (Part I)	2	CO3
LLO 15.1 Use Total station to determine Reduce Levels	15	*Determine the Reduced Levels of given stations (Minimum 10 station) (Part II)	2	CO3
LLO 16.1 Use Total Station to stack out station points on ground.	16	Stack out (transferring the data on ground) using Total Station (Part I)	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 17.1 Use Total Station to stack out station points on ground.	17	Stack out (transferring the data on ground) using Total Station (Part II)	2	CO3
LLO 18.1 Use Total station instrument to measure Reduced Level for given road profile project	18	Road profile of 100m length using Total Station instrument (Part I)	2	CO3
LLO 19.1 Use Total station instrument to measure Reduced Level for given road profile project	19	Road profile of 100m length using Total Station instrument (Part II)	2	CO3
LLO 20.1 Use Total station instrument to prepare contour plans	20	Contouring using Total Station instruments for the area of size 50 X 50 m	2	CO3
LLO 21.1 Use Total Station to prepare Building site layout	21	*Prepare Building site layout by using Total Station **(Project)** (Part I). Plot the project details on A1 size imperial drawing sheet.	2	CO3
LLO 22.1 Use Total Station to prepare Building site layout	22	*Prepare Building site layout by using Total Station **(Project)** (Part II). Plot the project details on A1 size imperial drawing sheet.	2	CO3
LLO 23.1 Use Total station to carry out five-sided closed traverse Surveying Project	23	*Carry out 5-Sided closed traverse Surveying project by using Total Station.**(Project)** Part I). Plot the traverse details on A1 size imperial drawing sheet.	2	CO3
LLO 24.1 Use Total station to carry out five-sided closed traverse Surveying Project	24	*Carry out 5-Sided closed traverse Surveying project by using Total Station. **(Project)** Part II). Plot the traverse details on A1 size imperial drawing sheet.	2	CO3
LLO 25.1 Use GPS technology to locate the coordinates of a station.	25	*Locate the coordinates of a station with the help of GPS.	2	CO4
LLO 26.1 Develop the contour maps using photogrammetry images	26	Create the images of contouring map with given data (Photogrammetry images, etc) using the freeware/open source software (Part I)	2	CO5
LLO 27.1 Develop the contour maps using photogrammetry images	27	Create the images of contouring map with given data (Photogrammetry images, etc) using the freeware/open source software (Part II)	2	CO5
LLO 28.1 Develop the Road Profile plan using photogrammetry images	28	Create the images of Road Profile plan with given data (Photogrammetry images, etc) using the freeware/open source software (Part I)	2	CO5
LLO 29.1 Develop the Road Profile plan using photogrammetry images	29	Create the images of Road Profile plan with given data (Photogrammetry images, etc) using the freeware/open source software (Part II)	2	CO5
LLO 30.1 Use relevant software for preparation of contour maps using given image data	30	*Write a brief report on the visit to nearby surveying software laboratory for visualization of image creation of contouring map of given area using data collected by drone technology / Arrange Expert Lecture / Show study videos of Photogrammetry surveying.	2	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.

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

Assignment

- Measure the height of the flag post in your institute using Theodolite as tacheometer.
- Measure the height of the slab bottom of second floor of your institute building using Theodolite as tacheometer.
- Set the alignment of proposed road using Theodolite as tacheometer.
- Use freeware or open source software for image processing using photogrammetry principles
- Plot the contours using Total station by direct method.
- Mark building layout using Total station.
- Measure distance between two distant(>500m) points using EDM
- Locate the coordinates of the campus using GPS
- Search and download the freeware/open source software and prepare a report stating the applications.

Micro project

- Carry out comparative study of following survey instruments of different make and brands: Total station/ EDM/GPS/Digital theodolite.
- Collect the relevant technical and commercial information of minimum five advanced survey instruments available in the market with specifications.
- Determine the RLs of the existing structures like lintels, chajja, slab, and beam using Tacheometer and Total station in a multistoried building and compare the results.
- Download specifications for Total Station/ EDM/GPS and make a chart.
- Set the profiles of curves at the changes in alignment of road in the premises of the institute (minimum two).
- Study the specifications of Mobile devices used for distance measurement.
- Collect the information on 360-degree laser
- Collect information of software required for mapping of images for photogrammetry.
- Collect the Information about Drone survey.
- Collect the information on Rover survey for land measurement

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Twenty Second Transit theodolite with accessories.	1,2,3,4,5,6
2	GPS instrument	25
3	Surveying Drone - About 1 to 1.5 Sq. Km. area can be easily captured by one PPK Survey grade Drone flying with an altitude of about 80 to 100m above average ground level)	27,26,28,29,30
4	Electronic Distance meter (+or- 2mm accuracy) with accessories.	7
5	Electronic Digital Theodolite with accessories.	8
6	Total Station (+ or - 2mm accuracy) instrument with accessories	9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24

IX. SUGGESTED 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	Tacheometric Surveying	CO1	10	2	8	6	16
2	II	Curves setting	CO2	8	2	4	6	12
3	III	Advanced Surveying Equipment's	CO3	10	2	8	6	16
4	IV	Remote sensing, GPS and GIS	CO4	9	4	4	6	14
5	V	Aerial Surveying and Photogrammetry	CO5	8	4	4	4	12
Grand Total				**45**	**14**	**28**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Termwork, Assignment, Microproject (60% Weightage to process and 40% weitage to product), Question and Answer

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test), Practical Exam

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Kanetkar T. P.; Kulkarni S. V.	Surveying and Levelling volume I & II	Pune Vidyarthi Gruh Prakashan, Pune; ISBN:978-81-858-2511-3
2	Basak N. N.	Surveying and Levelling	McGraw Hill Education, New Delhi ISBN 93-3290-153-8
3	S. K. Duggal	Surveying I & II	McGraw Hill Education, New Delhi, ISBN: 978-00-701-5137-6
4	Punmia B.C, Ashok Kumar Jain, Arun Kumar	Surveying I & II	Laxmi Publications., New Delhi. ISBN: 8- 17-008853-4

Sr.No	Author	Title	Publisher with ISBN Number
5	Shivam Pandey	Basic Concept of Remote Sensing, GPS, and GIS	Sankalp Publication, Gaurav Path, Bilaspur Chhathisgarh-4955001 ISBN: 978-81-94-77801-1

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/content/storage2/courses/105107122/modules/module7/html/100.htm	Tacheometry Surveying
2	https://www.youtube.com/watch?v=7UhaCqea7IY	Curve Setting
3	https://archive.nptel.ac.in/content/storage2/courses/105107122/modules/module11/index.htm	Curve Setting
4	https://nptel.ac.in/courses/105104100	Lecture on Total Station
5	https://www.youtube.com/watch?v=bbs5AEPstl4	Total Station
6	https://www.youtube.com/watch?v=1KCqxx8r5Y4	Electronic Digital Theodolite
7	https://www.youtube.com/watch?v=QLgwwVdMaWU	Remote sensing GIS and GPS
8	https://archive.nptel.ac.in/courses/105/103/105103193/	Remote Sensing and GIS
9	https://onlinecourses.nptel.ac.in/noc22_ce84/preview	Remote Sensing and GIS
10	https://archive.nptel.ac.in/courses/105/104/105104101/	Aerial Surveying and Photogrammetry
11	https://nptel.ac.in/courses/105104100	Aerial Surveying and Photogrammetry

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/**
Programme Code	**: CE/ CR/ CS/ LE**
Semester	**: Third**
Course Title	**: CONCRETE TECHNOLOGY**
Course Code	**: 313322**

I. RATIONALE

Concrete is the most common construction material on earth and it directly determines the construction quality of the concrete structure and plays a very important role in the stability of the building structure. A diploma civil engineering students are required to develop the basic competency in dealing with concrete as a construction material ,so that they should have the basic knowledge of cement chemistry, concrete batching, placement, compaction and curing and testing of concrete. This course will be helpful for students to build their theoretical and practical knowledge in civil and structural engineering.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Design the concrete mix as per the given specifications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Suggest relevant types of cement to be used in the given site conditions.
- CO2 - Classify the given aggregates based on its shape and size with the importance of their properties.
- CO3 - Prepare concrete of required specifications in the given situation.
- CO4 - Undertake the necessary procedures to maintain the quality of given type of concrete.
- CO5 - Suggest relevant type of admixtures to be used in the given situation.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				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	
313322	CONCRETE TECHNOLOGY	CTE	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the chemical constituents of the given type of cement TLO 1.2 Describe the relevant physical properties of the given type of cement in the given situation. TLO 1.3 Carry out the relevant test on the given sample of cement for the given purpose. TLO 1.4 Propose the relevant type of cement to be used in the given situation.	**Unit - I Cement** 1.1 Chemical Constituents of OPC (Ordinary Portland Cement) and their effects on properties of OPC, Bogue's compounds and their properties, hydration of cement. Physical properties of OPC: fineness, specific gravity, standard consistency, setting time, soundness, compressive strength 1.2 Different grades of OPC 33, 43, and 53 with its uses and specifications of physical properties as per relevant IS codes for OPC. 1.3 Testing of OPC: Field tests and laboratory tests-fineness test, standard consistency test, setting time test, soundness test, and compressive strength test, Storage of cement and effect of storage on properties of cement. 1.4 Field applications of different types of cements: Rapid hardening cement, Low heat cement, Portland pozzolana cement, sulphate resisting cement, blast furnace slag cement, High alumina cement, White cement.	Lecture Using Chalk-Board Hands-on Site/Industry Visit Collaborative learning Video Demonstrations Case Study
2	TLO 2.1 Identify the type of given aggregate samples based on source, shape and size. TLO 2.2 Explain the methodology to suggest suitability of given fine aggregate. TLO 2.3 Explain the methodology to suggest suitability of given coarse aggregate.	**Unit - II Aggregates** 2.1 Aggregates: Requirement of good aggregates, Classification according to source, size and shape. 2.2 Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand by sieve analysis, silt content in sand and their specification as per IS 383, bulking of sand. Concept of crushed Sand. 2.3 Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity, bulk density, fineness modulus of coarse aggregate by sieve analysis, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specification.	Lecture Using Chalk-Board Hands-on Video Demonstrations Site/Industry Visit Collaborative learning Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Justify use of different grades of concrete and their properties for given applications, TLO 3.2 Select w/c ratio for a given grade of concrete, with justification TLO 3.3 Interpret the given data obtained from test on given type of concrete sample. TLO 3.4 Describe the factors affecting overall durability of given type of concrete. TLO 3.5 Explain the given method of concrete mix design for the given situation. TLO 3.6 Describe the need of NDT for the given field situation	**Unit - III Concrete and its testing.** 3.1 Concrete: Necessity of supervision for concreting operation, different grades of concrete (ordinary Concrete, standard concrete and high strength concrete) as per provisions of IS 456. 3.2 Water cement ratio, Duff Abraham w/c law, significance of w/c ratio, selection of w/c ratio for different grades of concrete and different exposure conditions. 3.3 Properties of fresh concrete: Workability, Factors affecting workability of Concrete. Determination of workability of concrete by slump cone test and compaction factor test. Range values of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures. 3.4 Properties of Hardened concrete: compressive strength, durability, impermeability and dimensional changes of concrete, creep and shrinkage. 3.5 Concrete Mix Design objectives, methods of mix design, study of mix design procedure by I.S. method as per I.S. 10262-(Only procedural steps) 3.6 Testing of concrete: Significance of testing, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results. Non- destructive testing of concrete: Importance of NDT, methods of NDT(only List of methods)	Lecture Using Chalk-Board Video Demonstrations Hands-on Site/Industry Visit Collaborative learning Case Study
4	TLO 4.1 Explain the sequential operations of concreting in given situation. TLO 4.2 Explain the given type of form works and stripping time. TLO 4.3 Identify the type of construction joint to be used in given situations of concreting works, with justification.	**Unit - IV Quality Control of Concrete** 4.1 Concrete operations: Batching – Definition and types of Batching, Mixing – Types of Mixing and Mixers, Transportation- Modes of Transportation of concrete, precautions to be taken during transportation, Placing- placing of concrete in form work, precautions to be taken while placing of concrete, Compaction of concrete-methods of compaction, care to be taken during compaction, Finishing of concrete-purpose of finishing, types of Finishing, Curing of concrete-definition of curing, necessity of curing, different methods of curing and their application 4.2 Formwork for concreting: Different types of formworks for beams, slabs, columns. Materials used for form work. Requirement of good form work. Stripping time for removal of formworks per IS 456-2000 provision for different structural members. 4.3 Joints in concrete construction: Types of joints, joining old and new concrete, methods of joining, materials used for filling joints.	Lecture Using Chalk-Board Video Demonstrations Hands-on Site/Industry Visit Collaborative learning Cooperative Learning

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Justify the need of given admixtures in concrete mix. TLO 5.2 Describe the characteristics and uses of given type of Mineral admixtures in concrete. . TLO 5.3 Select the type of Special Concrete in the given situation with justification.	**Unit - V Admixture in concrete and Special Concrete** 5.1 Admixture in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixture, air entraining admixture, plasticizers and super plasticizers, (IKS*: Paste of Vegetable Extract and Jaggery used as a admixture in the construction of Vadakumnathan temple, Tirussur, Kerala, India .) 5.2 Cementitious (Mineral) Admixtures: Fly ash, Silica Flume, Blast furnace slag, its use, properties and effects 5.3 Special Concrete: Properties, advantages and limitation of the following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete and self-compacting concrete, light weight concrete.	Lecture Using Chalk-Board Video Demonstrations Case Study Site/Industry Visit Collaborative learning Presentations

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Check suitability of cement based on its fineness.	1	Determine fineness of cement by Blaine's air permeability apparatus or by sieving.	2	CO1
LLO 2.1 Propose the water cement ratio for the given type of cement.	2	*Determine standard consistency, initial and final setting times of OPC.	2	CO1
LLO 3.1 Undertake the testing on the given type of cement to determine its compressive strength.	3	*Determine compressive strength of ordinary Portland cement.	2	CO1
LLO 4.1 Measure the volumetric changes in the given sample of cement.	4	Determine the soundness of ordinary Portland cement (OPC)	2	CO1
LLO 5.1 verify the suitability of given sample of sand to prepare concrete	5	Determine silt content of given sample of sand by volume.	2	CO2
LLO 6.1 Undertake the required test to estimate the quantity of sand for preparing concrete	6	Determine bulking of the given sample of sand.	2	CO2
LLO 7.1 Use relevant aggregate for concrete mix design.	7	Determine bulk density of fine and coarse aggregates.	2	CO2
LLO 8.1 Decide percentage of absorbed water in aggregate and able to decide Water cement ratio.	8	Determine water absorption of fine and coarse aggregates.	2	CO2
LLO 9.1 Decide Grading of fine aggregates for quality of concrete Mix.	9	*Determine Fineness modulus of fine aggregate by sieve analysis.	2	CO2
LLO 10.1 Decide Grading of coarse aggregates for quality of concrete Mix.	10	*Determine Fineness modulus of coarse aggregate by sieve analysis.	2	CO2
LLO 11.1 Decide the suitability of coarse aggregate for wearing or non-wearing surfaces.	11	*Determine aggregate impact value or Crushing Value or Abrasion value	2	CO2
LLO 12.1 Decide the suitability of coarse aggregate for concrete work based on its size and shape.	12	*Determine aggregate elongation index and flakiness index.	2	CO2
LLO 13.1 Decide suitability of concrete according its workability in different situations.	13	*Determine workability of concrete by slump cone test or Compaction factor test.	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Measure the ability of concrete to resist the compressive loads.	14	*Determine compressive strength of concrete for 7 days	2	CO3
LLO 15.1 know the components parts of RMC and its functioning.	15	*Field Visit/video demonstration on RMC plant to understand the components and its functioning.	2	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.

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

specific learning / Skills Development (Self Learning)

- Prepare a list of IS codes with their Specifications required for Cement, Aggregate and concrete (Any three codes for each).
- Study of Sieve Analysis for WMM (Wet Mix Macadam) and GSB(Granular sub base) courses.
- Study of water quality parameters used in concrete as per IS 456.
- Study of various methods of NDT such as Rebound Hammer method and Ultrasonic pulse velocity test.
- Prepare a study report on hot & cold weather concrete.

Micro project

- Market survey to select type of cement for various types of construction works.
- Visit to site under construction to observe concreting operations.
- Visit to site under construction to observe the quality of fresh concrete.
- Visit to site under construction to observe form work, scaffolding used and joints in concrete.
- Search the software/freeware for the course content and prepare report stating their applications.
- Visit to site under construction to collect detail information about the ingredients of concrete mix.
- Market survey to select types of admixture for relevant construction work.
- Prepare mix design for the grade given by course teacher.
- Visit to stone crusher to observe its manufacturing.

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Blaine's air permeability apparatus as per IS: 4031 (part 1)-1999, and sieve no. IS 90 micron - IS Brass Sieve (200 mm dia), 90 Micron size.	1
2	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,90 µ and pan) , sieve shaker with adaptors	1,9,10,11
3	Aggregate impact testing apparatus with mould,	11

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
4	Aggregate crushing mould	11
5	Los Angeles abrasion testing machine	11
6	Elongation gauge and thickness gauge.	12
7	Slump cone(top dia.100mm, bottom dia.200mm, Height 300mm)	13
8	Compaction factor test apparatus	13
9	Table vibrator, moulds(150mm x150mmx 150mm)	14
10	Vicats apparatus- VICAT mould of dia. 80 mm & 40 mm high glass base plate, initial needle, final needle. Consistency plunger M.S. base plate (non porous) of weight 300 gm. Vicat mould split type with camping ring.	2
11	Measuring Cylinder 1000 ml capacity	2,3,5,6
12	Measuring Cylinder of 100 ml capacity	2,3,5,6
13	Compression testing machine-2000 kN capacity, Cement mortar cube vibrator-, moulds size 50 cm2 (7.07 cm x 7.07 cm)	3,14
14	Curing Tank	3,14
15	Le chatelier apparatus	4
16	Hot Air Oven	5,6,7,8,9,10,11,12
17	Density basket as per IS specification	7
18	Weighing Balance	All

IX. SUGGESTED 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	Cement	CO1	6	2	4	4	10
2	II	Aggregates	CO2	8	2	4	6	12
3	III	Concrete and its testing.	CO3	16	4	8	12	24
4	IV	Quality Control of Concrete	CO4	8	2	4	6	12
5	V	Admixture in concrete and Special Concrete	CO5	7	4	8	0	12
Grand Total				**45**	**14**	**28**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work, Assignment, Micro project, SLH (60% Weightage to process and 40% weightage to product), Question and Answer

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test), Practical Exam,

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Gambhir, M.L.	Concrete Technology	Tata McGraw Hill Publishing Co. Ltd., New Delhi, ISBN-13: 978-1-259-06255-1
2	Shetty, M.S	Concrete Technology	S. Chand and Co. Pvt. Ltd., Ram Nagar, New Delhi-110055 ISBN, : 978-8-121-90003-4
3	Santhakumar ,A. R	Concrete Technology	Oxford University Press, New Delhi ISBN-13: 978-0-195-67153-7
4	Neville, A. M. and Brooks, J.J.	Concrete Technology	Pearson Education Pvt. Ltd., New Delhi ISBN 978-0-273-73219–8
5	Job Thomas	Concrete Technology	CENAGE Publication ISBN-13:978-81-315-2668-2

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/105/102/105102012/	NPTEL Concrete Technology course by Dr. B. Bhattacharjee, Department of Civil Engineering, IIT Delhi
2	https://youtu.be/sl0smPfvVAo?list=PLkyVnO47pDX9YJglk1o2iYzWgABo5I_xA	Testing of Cement by NITTTR Chandigarh
3	https://www.nitttrchd.ac.in/sitenew1/nctel/civil.php	Practical's on Cement/Concrete/Aggregate by NITTTR Chandigarh
4	https://www.youtube.com/watch?v=yzpWGrh9j6Y	Workability of Concrete – Slump Cone Test. By Ultra tech cement.
5	https://www.youtube.com/watch?v=M9hkvS_OLmk	Ultrasonic Pulse Velocity Test on Concrete.
6	https://youtu.be/6iThtydES5c?si=OAOv5EW3lukFiFBD	Fineness of Cement as per IS 4031-Part1 by Sieving method
7	https://cs-iitd.vlabs.ac.in/List%20of%20experiments.html	Virtual laboratory practical on concrete technology
8	https://www.researchgate.net/publication/283109018	Research Article on Knowing from the past – Ingredients and technology of ancient mortar used in Vadakumnathan temple, Tirussur, Kerala, India (for IKS) in Journal of Building Engineering, ELSEVIER Publication

Sr.No	Link / Portal	Description
9	https://youtu.be/83AcFYK-Eno?si=5HUfRSWIQOLftjvc	Rebound Hammer Test
10	https://youtu.be/KHDdhYVP_GI?si=p3ADC6IkclMTKnai	Visit to Ready mix concrete (RMC) batching plant | How RMC plant works?
11	https://youtu.be/SR_Eq9Z7tbM?si=FQlrkUkEBx5zidt8	Visit to RMC Concrete Batching Plant Animation video
12	https://youtu.be/rdtDV-bE0wo	The Overview of the Stages involved in Manufacture of Concrete

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/**
Programme Code	**: CE/ CR/ CS/ LE**
Semester	**: Third**
Course Title	**: HIGHWAY ENGINEERING**
Course Code	**: 313323**

I. RATIONALE

Efficient network of road is the life line of any nation. Highway engineering is one of the most favored-effective and economical modes of land transportation. It is instrumental in determining the economic development of the country. Highway and Transport facilities are an important part of urban infrastructure. Highway engineering is one of the branches of Civil engineering which deals with the process of design, construction, and maintenance of different types of roads. The basic requirements of efficient transportation are speed, safety, and comfort. It provides door to door service and connects to inaccessible parts of the country. Hence it is essential for Civil engineering student to acquire the knowledge of this course.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Undertake the construction of the given type of pavements including its maintenance (Roads).

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify the roads based on recommendations of IRC.
- CO2 - Implement geometrical features of different Highways.
- CO3 - Observe the various road construction activities.
- CO4 - Suggest the traffic control devices and intersections based on traffic flow survey data.
- CO5 - Suggest the relevant precautionary measures to control the drainage based on inspection to maintain the given section of roads.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				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		
313323	HIGHWAY ENGINEERING	HEN	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150	

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the relevant modes of transportation with its importance. TLO 1.2 Explain Role of IRC, NHAI in the development of roads in India. TLO 1.3 Classify the Roads TLO 1.4 Decide the relevant factors influencing the ideal alignment of road pavement.	**Unit - I Introduction to Highway Engineering** 1.1 Different modes of transportation and importance of road transportation. 1.2 History of the Road development in India and the agencies involved in this work. (*IKS- Ancient Roads) 1.3 General classification of Roads. 1.4 Alignment: Definition, Requirements, importance etc. of an ideal road alignment and the factors affecting road alignment.	Video Demonstrations Lecture Using Chalk-Board Site/Industry Visit Presentations Cooperative Learning
2	TLO 2.1 Illustrate various functional terms related to geometrics of the given type of highway with sketches. TLO 2.2 Sketch /Draw the cross sections of roads in embankment and cutting for the given site condition.	**Unit - II Geometric Elements of Highway** 2.1 Definition, purpose, types, and its IRC recommendation of Various geometric elements /Technical terms of road pavement :Permanent way/right of way, road formation, Carriageway width, Road margin, side slopes, side gutter, Camber, Gradient, Super elevation, Curves, Road Widening, Sight distance, Design speed and factors affecting design speed 2.2 Standards cross-sections of EXPRESSWAY, NH, SH, MDR, ODR and VR in embankment and cutting.	Video Demonstrations Presentations Lecture Using Chalk-Board Site/Industry Visit Collaborative learning Case Study

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Undertake the specific test on given sample of bitumen to check its suitability in road construction. TLO 3.2 Differentiate between the flexible and rigid pavement. TLO 3.3 Explain the importance of each layer in given type of road. TLO 3.4 Explain the construction of the given pavement including joints and sealers. TLO 3.5 Describe the components of the hill road in given situation. TLO 3.6 Suggest relevant measures to control the landslide in the given situation.	**Unit - III Construction of Road Pavements** 3.1 Overview of highway construction materials: Aggregate, Cement, Sand, Water, Soil, Bitumen: Ductility, Flash and Fire Point Test, Softening Point Test, Extraction Test, Grade of Bitumen, Emulsion, Cutback, Tar. 3.2 Definition, Types, Structural Components of pavement and their functions. 3.3 Construction of WBM road, Flexible pavement / Bituminous Road. 3.4 Construction of Rigid Pavement (Cement Concrete): methods of construction, Alternate and Continuous Bay Method, Construction joints, filler and sealers. 3.5 Components, functions of Hill roads. 3.6 Landslides: define, Causes, Types, Prevention of landslides.	Video Demonstrations Presentations Lecture Using Chalk-Board Hands-on Site/Industry Visit Case Study
4	TLO 4.1 Conduct traffic volume survey at the given road intersection. TLO 4.2 Justify the importance of PCU in traffic volume study to suggest the solution to the given problem. TLO 4.3 Justify the importance of traffic control devices. TLO 4.4 Justify the Intersections in the given situation.	**Unit - IV Traffic Engineering** 4.1 Traffic Volume Study (TVS): Definition, Purpose of TVS, method of TVS. 4.2 Passenger Car Unit (PCU) and factors affecting it. 4.3 Traffic control devices and its types: road signs, marking, Signals, Traffic Island. 4.4 Road Intersections: Cloverleaf, Diamond and Trumpet Interchange	Model Demonstration Video Demonstrations Lecture Using Chalk-Board Hands-on Cooperative Learning Case Study
5	TLO 5.1 Describe with sketches the relevant method of providing drainage in the given type of Road. TLO 5.2 Identify the causes of failure based on inspection of given type of pavement. TLO 5.3 Suggest the maintenance and repair works required for given type of defective road.	**Unit - V Road Drainage and maintenance** 5.1 Drainage-Definition, necessity, types and sketch of drainage system. 5.2 Failure of flexible and Rigid pavement and Its Causes and preventive measures. 5.3 Necessity of Maintenance of Road & its Classification.	Video Demonstrations Presentations Lecture Using Chalk-Board Site/Industry Visit Cooperative Learning Case Study

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Draw the sketches showing standard cross sections of NH, SH, MDR, ODR, VR.	1	*Draw the sketches showing standard cross sections of NH, SH, MDR, ODR, VR in embankment and cutting on A3 size sketch book.	2	CO1 CO2
LLO 2.1 Identify components of Road.	2	*Visit the existing road to identify the component parts of road and prepare photographic report.	2	CO1 CO2
LLO 3.1 Interpret the result of Softening point test on bitumen.	3	*Conduct Softening point test on bitumen.	2	CO3
LLO 4.1 Interpret the result of Penetration test on bitumen.	4	*Conduct Penetration test on bitumen.	2	CO3
LLO 5.1 Interpret the result of Flash and Fire Point on bitumen.	5	Conduct Flash and Fire Point test on bitumen.	2	CO3
LLO 6.1 Interpret the result of Ductility test on bitumen.	6	Conduct Ductility test on Bitumen.	2	CO3
LLO 7.1 Interpret the result of Bitumen Extraction Test on bitumen.	7	*Conduct Bitumen Extraction Test.	2	CO3
LLO 8.1 Write the function of each layer of Pavement. LLO 8.2 Observe the working of Highway Construction machineries. LLO 8.3 Onsite testing of Material and sequential method of Construction.	8	*Visit the road under construction to identify layers in the flexible pavement/Rigid Pavement. prepare photographic report consisting of Materials, Machineries used, Method of Construction and on-site testing of Materials.	2	CO1 CO2 CO3
LLO 9.1 Identify the components of Hill Roads.	9	Visit the hill road to study its components, geometrics and prepare the photographic report containing details.	2	CO1 CO2 CO3
LLO 10.1 Perform traffic volume survey for a road intersection.	10	*Carry out Traffic Volume Study (minimum two hours of peak period) for an important road intersection or roadway in your city/ town/ village.	2	CO4
LLO 11.1 Analysis traffic volume data and Interpret data.	11	Analysis traffic volume data obtained from above experiment.	2	CO4
LLO 12.1 Examine and relate the meaning of the traffic signs, road markings, islands in your city.	12	*Draw and identify the traffic signs, road markings, islands, intersections in your city/ town/ village and prepare the photographic report.	2	CO4
LLO 13.1 Inspect the existing road drainage system in your area and identify its type.	13	Visit the road of any one type flexible or rigid to know the road drainage system.	2	CO1 CO2 CO5
LLO 14.1 Identify the defects in road.	14	*Visit the road to identify the defects in road and suggest the possible remedial measures for it and prepare photographic report.	2	CO1 CO2 CO5
LLO 15.1 Suggest possible repairs and maintenance of the road.	15	*Suggest possible repairs and maintenance of the road visited in your city/ town/ village.	2	CO2 CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

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.

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

Micro project

- Develop Highway Intersection Model for smooth traffic flow.
- Differentiate geometric terms of different roads (NH, SH, MDR, ODR, VR) passing through your area.
- Advance Techniques of repairs like CBTR, White topping, Preventive maintenance, etc.
- Identify mode of transportation other than land transportation.
- List the National Highways/State Highways passing through Maharashtra.
- Collect the information relevant to transportation engineering about ongoing and completed road projects (Samrudhi-Mahamarg, Golden Quadrilateral, etc.).
- Role of MSRDC, NHAI and IRC in development and construction of roads.
- Asian Highways (AH) analysis.

Assignment

- IS Codes used for Planning, designing, construction and maintenance of roads.
- Illustrate the terms 1) Granular Sub Base-GSB 2) Wet Mix Macadam- WMM.
- New techniques and machineries used for rapid Highway Maintenance around the world.
- Evaluate the camber and gradient of any one road of each type of pavement in your area of college.
- Develop the photographic model of typical pavement structure for actual visited site.
- Make a list of Mega Highway Projects around the world and advanced techniques/machineries used in it.
- Participate in RTO Safety week and Study its activities.
- Observe construction techniques of WBM/Flexible/ Rigid Road.

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Ring and Ball test apparatus (Hot plate 160mm dia. with magnetic stirrer, brass ring, steel ball and glass vessel 600ml and glass thermometer +800c.	3
2	Digital Analytical Weighing Scale, Accuracy: 1 Mg capacity : 30 g to 300 g	3,4,5,6,7
3	1) Lab Safety products (Heat Resistant Gloves, PPE Kit for Laboratory work, etc.) 2) Laboratory items-Lab Utensils and Hand Tools and Sample Containers and Bags	3,4,5,6,7
4	Standard Penetrometer with penetration needle 100gm weight, container 55mm dia. and 53mm ht. as per IS:1203.	4

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
5	Pensky Marten's Flash and Fire Point test apparatus 100x200x240mm with measurement range 0-95 as per IS:1209-1953	5
6	Ductility Testing Machine with ductility mould and base plate	6
7	Bitumen Extraction Test Apparatus: - Centrifuge Extractor, Electrical Operation, Capacity 1500g, with a Dimmer stat for speed control from 2,400 to 3,600 rpm. Suitable for operation on 230 V, 50 Hz, Single Phase, A.C. supply.	7

IX. SUGGESTED 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	Introduction to Highway Engineering	CO1	3	2	4	0	6
2	II	Geometric Elements of Highway	CO2	15	6	8	8	22
3	III	Construction of Road Pavements	CO3	15	6	8	8	22
4	IV	Traffic Engineering	CO4	6	2	4	4	10
5	V	Road Drainage and maintenance	CO5	6	2	4	4	10
Grand Total				**45**	**18**	**28**	**24**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Termwork, Assignment, Microproject (60% Weightage to process and 40% weightage to product), Question and Answer.

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test)

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number

Sr.No	Author	Title	Publisher with ISBN Number
1	Khanna S.K., Justo, C E G and Veeraragavan, A.	Highway Engineering	New Chand and Brothers, Rookie, 2010, ISBN 978-8185240800
2	Kadiyali, L.R.	Traffic Engineering and Transport Planning	Khanna Publishers, New Delhi, 2008, ISBN: 978-8174092205
3	Duggal, Ajay K. and Puri, V. P.	Laboratory Manual in Highway Engineering	New Age International (P) Limited, Publishers, New Delhi, 2010, ISBN: 9788122403107
4	Raji A. K. and K. K. Babu	Transportation engineering theory and practice)	AICTE New Delhi ISBN 978-81-960576-1-9
5	N L Arora	Transportation engineering	New India Publishing House, New Delhi ...

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://iksindia.org/index.php	Indian Knowledge Systems (IKS)
2	https://www.youtube.com/watch?v=acfJIG9o8iw	Flakiness and Elongation Index of Aggregate
3	https://www.youtube.com/watch?v=TE8zYxUJHt0 https://ts-nitk.vlabs.ac.in/exp/ductility-test/	Ductility test on Bitumen.
4	https://www.youtube.com/watch?v=-yBXl4z70mI https://ts-nitk.vlabs.ac.in/exp/softening-point-test/	Softening point test on bitumen.
5	https://www.youtube.com/watch?v=9HZE6DNfF5U https://ts-nitk.vlabs.ac.in/exp/penetration-test/	Penetration test on bitumen.
6	https://www.youtube.com/watch?v=PR7q4-ilENA	Flash and Fire Point test on bitumen.
7	https://www.youtube.com/watch?v=JEySduXuxCc&t=563s https://www.youtube.com/watch?v=d48qDaiDyVI	Bitumen Extraction Test
8	https://www.youtube.com/watch?v=2VehMMP70HE&list=PLLy_2iUCG87C7nApYQjgkDA0p67fMaXnE	Geometric Design of Highways By Prof. Rajat Rastogi IIT Roorkee
9	https://www.youtube.com/watch?v=5zKC_aq4ypM&list=PLE88643285BC70E0F	Transportation Engineering and Road development Process by IIT Kharagpur
10	https://crridom.gov.in/	CSIR-Central Road Research Institute
11	https://www.irc.nic.in/	Indian Roads Congress (IRC)
12	https://nhai.gov.in/#/	National Highway Authority of India (NHAI)
13	https://msrdc.in/1307/Home	Maharashtra State Road Development Corporation Ltd.

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ TC/ TE/ TR/ TX**
Semester	**: Third**
Course Title	**: ESSENCE OF INDIAN CONSTITUTION**
Course Code	**: 313002**

I. RATIONALE

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome – Abide by the Constitution in their personal and professional life.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - List salient features and characteristics of the constitution of India.
- CO2 - Follow fundamental rights and duties as responsible citizen of the country.
- CO3 - Analyze major constitutional amendments in the constitution.
- CO4 - Follow procedure to cast vote using voter-id.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				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	
313002	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination

Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the meaning of preamble of the constitution. TLO 1.2 Explain the doctrine of basic structure of the constitution. TLO 1.3 List the salient features of constitution. TLO 1.4 List the characteristics of constitution.	**Unit - I Constitution and Preamble** 1.1 Meaning of the constitution of India. 1.2 Historical perspectives of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble of the Constitution of India.	Presentations Blogs Hand-outs Modules Flipped classrooms Case studies
2	TLO 2.1 Enlist the fundamental rights. TLO 2.2 . Identify fundamental duties in general and in particular with engineering field. TLO 2.3 Identify situations where directive principles prevail over fundamental rights.	**Unit - II Fundamental Rights and Directive Principles** 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance under part-IV-A. 2.3 Relevance of Directive Principles of State Policy under part-IV A.	Presentations Blogs Hand-outs Modules Case Study Flipped Classroom

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Enlist the constitutional amendments. TLO 3.2 Elaborate the elements of Centre-State Relationship TLO 3.3 Analyze the purposes of various amendments.	**Unit - III Governance and Amendments** 3.1 3.1 Amendment procedure of the Constitution and their types - simple and special procedures. 3.2 The Principle of Federalism and its contemporary significance along with special committees that were setup. 3.3 Major Constitutional Amendment procedure - 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd	Cases of Federal disputes with relevant Supreme court powers and Judgements Presentations Blogs Hand-outs Problem based learning
4	TLO 4.1 Explain the importance of electoral rights. TLO 4.2 Write the step by step procedure for process of registration TLO 4.3 Explain the significance of Ethical electoral participation TLO 4.4 Explain the steps to motivation and facilitation for electoral participation TLO 4.5 Enlist the features of the voter's guide TLO 4.6 Explain the role of empowered voter TLO 4.7 Write the steps of voting procedure TLO 4.8 Write steps to create voter awareness TLO 4.9 Fill the online voter registration form TLO TLO 4.10 Follow procedure to cast vote using voter-id.	**Unit - IV Electoral Literacy and Voter's Education** 4.1 Electoral rights , Electoral process of registration 4.2 Ethical electoral participation 4.3 Motivation and facilitation for electoral participation 4.4 Voter's guide 4.5 Prospective empowered voter 4.6 Voting procedure 4.7 Voter awareness 4.8 Voter online registration https:/ /www.ceodelhi.gov.in/ELCdetails.aspx	Presentations Hand-outs Modules Blogs Problem based Learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

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

Assignment

- Outline the procedure to submit application for Voter-id
- Assignments are to be provided by the course teacher in line with the targeted COs.

A1. Prepare an essay on Constitution of India .
A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA

- Assignments are to be provided by the course teacher in line with the targeted COs. A1. Prepare an essay on Constitution of India . A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies. LGBTQIA+

Micro project

- 1. Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country

2. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
3. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

- 1 Differences in the ideals of Social democracy and Political democracy.

2 Democracy and Women's Political Participation in India.
3 Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
4 Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

-
- Art 356 and its working in Post-Independent India.
- Women's Resrvation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model ?

Activity

- Arrange Mock Parliament debates.

Prepare collage/posters on current constitutional issues.
i. National (Art 352) & State Emergencies (Art 356) declared in India.
ii. Seven fundamental rights.
iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

Cases: Suggestive cases for usage in teaching:

- A.K. Gopalan Case (1950) :SC contented that there was no violation of Fundamental Rights enshrined in Articles 13, 19, 21 and 22 under the provisions of the Preventive Detention Act, if the detention was as per the procedure established by law. Here, the SC took a narrow view of Article 21.

Shankari Prasad Case (1951) : This case dealt with the amendability of Fundamental Rights (the First Amendment's validity was challenged). The SC contended that the Parliament's power to amend under Article 368 also includes the power to amend the Fundamental Rights guaranteed in Part III of the Constitution.
Minerva Mills case (1980) :This case again strengthens the Basic Structure doctrine. The judgement struck down 2 changes made to the Constitution by the 42nd Amendment Act 1976, declaring them to violate the basic structure. The judgement makes it clear that the Constitution, and not the Parliament is supreme.
Maneka Gandhi case (1978) :A main issue in this case was whether the right to go abroad is a part of the Right to Personal Liberty under Article 21. The SC held that it is included in the Right to Personal Liberty. The SC also ruled that the mere existence of an enabling law was not enough to restrain personal liberty. Such a law must also be "just, fair and reasonable."
Other cases:
1. Kesavananda Bharati Case (1973) : In this case the Hon. SC laid down a new doctrine of the 'basic structure' (or 'basic features') of the Constitution. It ruled that the constituent power of Parliament under Article 368 does not enable it to alter the 'basic structure' of the Constitution. This means that the Parliament cannot abridge or take away a Fundamental Right that forms a part of the 'basic structure' of the Constitution.
2. Mathura Rape Case(1979) : A tribal woman Mathura (aged 14 to 16 years) was raped in Police Custody. The case raised the questions on the idea of 'Modesty of Woman' and here it was was a tribal woman who succumbs to multiple pattiarchies. Custodial rape was made an offence and was culpable with the detainment of 7 years or more under Section 376 of Indian Penal Code. The weight of proofing the allegations moved from the victim to the offender, once sexual intercourse is established. The publication of the victim's identity was banned and it was also held that rape trials should be conducted under the cameras.
3. Puttswamy vs Union of India (2017) : In this landmark case which was finally pronounced by a 9-judge bench of the Supreme Court on 24th August 2017, upholding the fundamental right to privacy emanating from Article 21. The court stated that Right to Privacy is an inherent and integral part of Part III of the Constitution that guarantees

fundamental rights. The conflict in this area mainly arises between an individual's right to privacy and the legitimate aim of the government to implement its policies and a balance needs to be maintained while doing the same.
4. Navtej Singh Johar & Ors. v. Union of India (2018) : Hon. SC Decriminalised all consensual sex among adults, including homosexual sex by scrapping down section 377 of the Indian penal code (IPC). The court ruled that LGBTQ community are equal citizens and underlined that there cannot be discrimination in law based on sexual orientation and gender.
5. Anuradha Bhasin Judgement (2020) : The Supreme Court of India ruled that an indefinite suspension of internet services would be illegal under Indian law and that orders for internet shutdown must satisfy the tests of necessity and proportionality. The Court reiterated that freedom of expression online enjoyed Constitutional protection, but could be restricted in the name of national security. The Court held that though the Government was empowered to impose a complete internet shutdown, any order(s) imposing such restrictions had to be made public and was subject to judicial review.

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

IX. SUGGESTED 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	Constitution and Preamble	CO1	4	0	0	0	0
2	II	Fundamental Rights and Directive Principles	CO2	4	0	0	0	0
3	III	Governance and Amendments	CO3	4	0	0	0	0
4	IV	Electoral Literacy and Voter's Education	CO4	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment, Self-learning and Terms work Seminar/Presentation

Summative Assessment (Assessment of Learning)

XI. 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	-	-	-	2	-	-			
CO2	1	-	-	-	2	-	-			
CO3	1	2	-	-	2	-	1			
CO4	-	-	-	1	-	-	-			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P.M.Bakshi	The Constitution of India	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2	D.D.Basu	Introduction to Indian Constitution	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3	B. K. Sharma	Introduction to Constitution of India	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197
4	MORE READS :	Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal.	Extra Read
5	B.L. Fadia	The Constitution of India	Sahitya Bhawan,Agra, 2017, ISBN:8193413768

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.legislative.gov.in/constitution-of-india	Constitution overview
2	https://en.wikipedia.org/wiki/Constitution_of_India	Parts of constitution
3	https://www.india.gov.in/my-government/constitution-india	Constitution overview
4	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/	Fundamental rights and duties
5	https://main.sci.gov.in/constitution	Directive principles
6	https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf	Parts of constitution

Sr.No	Link / Portal	Description
7	https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-constitution	Parts of constitution

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/**
Programme Code	**: CE/ CR/ CS/ LE**
Semester	**: Third**
Course Title	**: BUILDING PLANNING & DRAWING WITH CAD**
Course Code	**: 313009**

I. RATIONALE

Building planning and drawing are critical components of the construction process, enabling stakeholders to visualize, communicate, problem-solve, comply with regulations, estimate costs, guide construction, and ensure quality throughout the project lifecycle. In today's era of globalization and technology revolutions, it is necessary to prepare the civil engineering drawings in such a way that it can be prepared with utmost precision and accuracy with ability to modify it as and when required. This is only possible if the said drawing is prepared using the CAD software. This course is therefore planned with the goal of developing such competency among the learners.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Prepare Drawings of the given building structure with required specifications using CAD Software.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Draw the line plans of given type of buildings considering the Principles of Planning.
- CO2 - Use CAD software for drafting and editing of the given type of drawing.
- CO3 - Draw the relevant type of plan/drawings for the given type of building.
- CO4 - Draw perspective drawing for the given type of objects.
- CO5 - Draw the Isometric and 3- Dimensional drawings of the given component of the structure.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				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	
313009	BUILDING PLANNING & DRAWING WITH CAD	BDC	SEC	2	-	4	2	8	4	-	-	-	-	-	50	20	50#	20	25	10	125

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the given basic principles of Planning of building (residential and public). TLO 1.2 Propose the relevant dimensions for the given component of building structures. TLO 1.3 Plan the dwelling unit as per the given requirement and specifications TLO 1.4 Plan the dwelling units/building in accordance with the provisions of governing authority in a given area TLO 1.5 Compute the required area of construction using the norms of the local authority. TLO 1.6 Draw line plans for the given residential buildings. TLO 1.7 Draw line plans for the given public buildings.	**Unit - I Principles of Planning** 1.1 Principles of planning of Residential and Public building: Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility, Roominess, Circulation, Furniture requirements, Sanitation, Economy. (IKS-Orientation of Indian Heritage Structures such as Mahalaxmi Temple, Kolhapur) 1.2 Space requirement and norms for minimum dimension of different components of building structure. 1.3 Planning of residential buildings as per the given requirement using IS 962-1989. 1.4 Rules and bye-laws of sanctioning authorities (local authority and town planning department) for construction work. 1.5 Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio) / FSI. 1.6 Line plans for residential building of minimum three rooms including w/c, bath and staircase as per principles of planning 1.7 Line plans for public building-primary health center, restaurant, bank, post office, hostel and Library.	Video Demonstrations Presentations Site/Industry Visit Case Study Lecture Using Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain the various software available with its importance for drawing through CAD to be used in the given situation. TLO 2.2 Undertake the required initial settings of the relevant software to draw the new drawing. TLO 2.3 Use the relevant command to draw the specific feature of the figure or plan in given situation. TLO 2.4 Modify the given drawing/figure using relevant command in given situation. TLO 2.5 Calculate the parameters like distance, area, perimeter of a given figure. TLO 2.6 Trace the anchor point on the given boundaries of the figure to get the relevant dimension of the figure. TLO 2.7 Use the concept of layer to visualize the specific component of the building/drawing. TLO 2.8 Apply the required dimension command to mark the dimensions in the given drawing. TLO 2.9 Use the output of the in the required format using specific command.	**Unit - II Computer aided drawing** 2.1 Fundamentals : various drafting software for civil engineering applications. System requirement for drawing software. Advantages of computer aided drawing over traditional method of drawing. 2.2 Initial setting required to start new drawing. 2.3 Draw commands: Line, poly line, construction line, rectangle, polygon, circle, ellipse, hatch, boundary, text, arc, point, make block. 2.4 Modify commands: Erase, copy, mirror, offset, trim, move, extend, rotate, array, lengthen, scale, chamfer, fillet, explode, stretch. 2.5 Compute area of the given drawing 2.6 Changing properties of entity: line type, color, scale, font- size, color, style. 2.7 Layer command: Create layers for given components of given drawing. 2.8 Dimension toolbar: Quick dimension, linear dimension, and continuous dimension; align dimension, angular dimensions, dimension style. 2.9 Use of plot/print command for the output of given drawing.	Video Demonstrations Presentations Hands-on Model Demonstration Lecture Using Chalk-Board
3	TLO 3.1 To prepare Submission Drawing of load bearing and Framed structure in accordance with the provisions of governing authority in a given area. TLO 3.2 Prepare working drawing of the given Load bearing and Framed structure TLO 3.3 Prepare foundation plan of the given Load bearing and Framed structure. TLO 3.4 Prepare structural drawings of given RCC Components of the building structure.	**Unit - III Planning of Buildings** 3.1 Data drawing (for Load bearing and framed structure): Developed plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement. Planning of staircase- Rise and Tread for residential building. 3.2 Working drawing: Developed plan, elevation, section passing through staircase or Sanitary Block. 3.3 Foundation plan of Load bearing and Framed structure. 3.4 Details of RCC Components: Footing, column, Beam, Chajjas, Lintel, Staircase and slab.	Video Demonstrations Demonstration Model Demonstration Site/Industry Visit Lecture Using Chalk-Board
4	TLO 4.1 Explain the principles of perspective drawings in the given situation TLO 4.2 Prepare perspective drawing of the given object using Two-point perspective method	**Unit - IV Perspective Drawing** 4.1 Definition, Types of perspective, terms and principles used in perspective drawing 4.2 Two Point Perspective of objects- steps, monuments, pedestals.	Video Demonstrations Hands-on Lecture Using Chalk-Board Model Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Justify the need of isometric drawing in civil engineering TLO 5.2 Prepare 3: dimensional drawing using the relevant 3 Dimensional Modify Commands.	**Unit - V Introduction to 3-Dimensional drawings** 5.1 Isometric drawing: meaning and necessity, use of isometric snap, isometric axes, isocircle, isotext 5.2 3-Dimensional drawing: Use of, Extrude, Press pull, Union, Subtraction command for preparing drawing of components-Beam, Columns etc.	Video Demonstrations Hands-on Lecture Using Chalk-Board Demonstration

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Represent the given door/window section using their standard signs and symbols.	1	* Draw various types of graphical symbols for materials, doors and windows as per IS 962:1989 **(Sketch book)**	2	CO1
LLO 2.1 Use the symbols to different water supply and Sanitary units of the building in the drawing	2	Draw various types of graphical symbols for sanitary, water supply as per IS 962:1989 **(Sketch book)**.	2	CO1
LLO 3.1 Use the symbols to different Electrical units of the building in the drawing.	3	Draw various types of graphical symbols for electrical installations and write abbreviations as per IS 962:1989 **(Sketch book)**	2	CO1
LLO 4.1 Illustrate different specifications of the given drawings.	4	Write summary of observations of all technical details from the given drawing (One/Two BHK) obtained from the professional architect or civil engineer **(Sketch book)**	2	CO1
LLO 5.1 Identify the different units of the building and prepare the plan as per the actual measurements.	5	*Measure the units of existing building (Load Bearing / Frame structure) & Draw line plan of measured existing building-(Part - I) **(Sketch book)**.	2	CO1
LLO 6.1 Identify the different units of the building and prepare the plan as per the actual measurements.	6	* Measure the units of existing building (Load Bearing / Frame structure) & Draw line plan of measured existing building-(Part -II) **(Sketch book) .**	2	CO1
LLO 7.1 Prepare Line Plans of the Residential building as per the requirement.	7	* Draw line plan to suitable scale (Minimum 1BHK, staircase, WC and Bathroom) for Residential Bungalows. (Minimum three) **(Sketch book)**	2	CO1
LLO 8.1 Prepare Line Plans of the Public building as per the requirement.	8	Draw line plans to suitable scale for Public Buildings - Primary Health Centre **(Sketch book)**	2	CO1
LLO 9.1 Prepare Line Plans of the Public building as per the requirement.	9	Draw line plans to suitable scale for Public Buildings – Hostel, Library. **(Sketch book)**	2	CO1
LLO 10.1 Prepare Line Plans of the Public building as per the requirement.	10	*Draw line plans on sketch book to suitable scale for Public Buildings- Bank, Post Office - **(Sketch book)**	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Prepare Developed Plan of the residential building as per the requirement.	11	Draw the Developed plan and Elevation for a Framed Structure (One/Two BHK)-Part I **(Sketch book)**	2	CO3
LLO 12.1 Prepare Section of the residential building as per the requirement.	12	Draw the Section through WC, Bath or Staircase for Plan in Practical No.11 for a Framed Structure (One/Two BHK) - Part II **(Sketch book)**	2	CO3
LLO 13.1 Prepare Site Plan and area statement of the residential building as per the requirement.	13	Draw the Site plan including area statement, schedule of opening and construction notes for a Framed Structure (One/Two BHK) - for Plan in Practical No.11 Part III **(Sketch book)**	2	CO3
LLO 14.1 Prepare Perspective view of the given object.	14	*Draw two-point perspective drawing of small objects - steps, monuments, pedestals (anyone) with suitable scale **(Sketch book)**	2	CO4
LLO 15.1 Prepare Line Plans of the Residential building as per the requirement.	15	Prepare Line plan of Residential Building with staircase (minimum two) using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 16.1 Prepare Line Plans of the Public building as per the requirement.	16	Prepare Line plan of Public Building with staircase (minimum Two) with using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 17.1 Prepare Plan and sectional elevation of the Staircase as per the requirement.	17	*Draw plan and Sectional Elevation of dog-legged staircase using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 18.1 Prepare Developed Plan of the load bearing structure as per the requirement.	18	*Draw submission drawing to suitable scale of a single storey load bearing residential building (2BHK) with flat Roof and staircase showing Developed plan and elevation using CAD Software.-Part I **(A-2 Size Half Imperial Sheet)**	2	CO3
LLO 19.1 Prepare Sectional elevation of the load bearing structure as per the requirement.	19	*Draw submission drawing to Suitable scale of a single Storey load bearing residential building (2BHK) with flat Roof and staircase showing - Section passing through Stair or W.C. and Bath using CAD Software - for Plan in Practical No.18 -Part II **(A-2 Size Half Imperial Sheet)**	2	CO3
LLO 20.1 Prepare Foundation Plan of the load bearing structure as per the requirement.	20	*Draw submission drawing to the suitable scale of a single Storey load bearing residential building (2BHK) with flat Roof and staircase showing - a) Foundation plan and schedule of openings. b) Site plan with suitable scale, area statement, construction notes for Plan in Practical No.18- using CAD Software -Part III- using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO3
LLO 21.1 Prepare Developed Plan of the Framed structure as per the requirement.	21	*Draw submission drawing, to the suitable scale of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing: a) Developed plan b) Elevation - **Part I Using** CAD Software **(A-2 Size Half Imperial Sheet)**	2	CO3
LLO 22.1 Prepare Sectional elevation of the framed structure as per the requirement.	22	*Draw submission drawing, to the suitable scale of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing. - Section passing through Stair, W.C. and Bath- For plan in Practical No.21 - Part II-using CAD Software **(A-2 Size Half Imperial Sheet)**	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 23.1 Prepare site plan and area statement of the framed structure as per the requirement.	23	*Draw submission drawing, to the suitable scale, of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing - a) Site plan and area statement b) Schedule of openings and construction notes - For plan in Practical No.21 - Part III using CAD Software **(A-2 Size Half Imperial Sheet)**	2	CO3
LLO 24.1 Prepare working drawing the framed structure as per the requirement.	24	Draw Foundation with suitable scale for Practical No.21 using CAD Software **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 25.1 Prepare Sectional elevation and plan of footing for framed structure as per the requirement.	25	Draw Detailed enlarge section of RCC column and footing with suitable scale using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 26.1 Prepare Sectional elevation and plan of RCC Beam, Lintel Beam and Chajja of framed structure as per the requirement.	26	*Draw Detailed enlarge section of RCC Beam, Lintel and Chajja with suitable scale using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 27.1 Prepare Sectional elevation and plan of Stair case as per the requirement.	27	Draw Detailed enlarge section of RCC staircase with suitable scale using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO2
LLO 28.1 Prepare Isometric drawings of given object.	28	*Draw isometric drawing of simple objects –Straight Lines and edges (minimum 02 objects) using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO5
LLO 29.1 Prepare Isometric drawings of given object.	29	Draw isometric drawing of simple objects-Curved Edges (minimum 02 objects) using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	CO5
LLO 30.1 Prepare 3-D view of given object.	30	*Draw 3-D view of simple object. (any one) - using CAD Software. **(A-2 Size Half Imperial Sheet)**	2	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.

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

Micro project

- Collect and study building Bye laws, rules and regulation for planning any two competent authority such as Gram-Panchayat/Municipal Corporation/Metro Cities/Town Planning Department.
- Prepare report on Provisions given in National Building Code 2005
- Prepare list of the documents required for obtaining permission for construction of residential building/apartment from competent authority and write report.
- Prepare a report on IS-962:1989 - Code of practice for architectural and building drawings
- Prepare Developed Plan and Elevation for a any one Public Building using CAD Software.

Self Learning

- List any five software's used for building planning and drawing and prepare one developed plan using any one Free opensource software.
- Prepare a model of a simple building using cardboard showing different components with suitable color.

- Prepare line plan as per given requirement Using CAD Software. (Any THREE -- other than mentioned in curriculum)
- Free Online Courses on Auto CAD by NPTEL /Coursera/IGNOU/SWAYAM

Assignment

- State and explain the classification of residential buildings with respect to Planning such as Row house/Apartments/detached /Semi-detached Buildings
- Explain the Role of Architect, Structural Engineer and Supervisor in Planning of Building.
- Prepare a report on BUILDING PLAN MANAGEMENT SYSTEM -By Urban Development Department Government of Maharashtra.
- Prepare a report on Building Plan Approval Process as per NBC -2005

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer with specification as 8GB RAM,Graphics Card 4 GB, HDD/SSD 500GB, LCD Monitor with relevant CAD software. (with latest configuration)	All
2	Printer preferably for the output of A-3 size, paper	All
3	LCD projector.	All

IX. SUGGESTED 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	Principles of Planning	CO1	6	0	0	0	0
2	II	Computer aided drawing	CO2	4	0	0	0	0
3	III	Planning of Buildings	CO3	12	0	0	0	0
4	IV	Perspective Drawing	CO4	4	0	0	0	0
5	V	Introduction to 3-Dimensional drawings	CO5	4	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work, Assignment, Microproject (60% Weightage to process and 40% weightage to product)

Summative Assessment (Assessment of Learning)

- Practical Exam, Oral Exam

XI. 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	02	01	02	01	02		02			
CO2	02	02	02	03	02	01	02			
CO3	02	02	02	02	02		02			
CO4	02	01	02	02	02		02			
CO5	02	01	01	03	02		01			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Shah. M.G., Kale C.M., Patki S.Y.	Building Drawing	Mcgraw Hill Publishing company Ltd. New Delhi 2002 ISBN: 9780074638767
2	Dr. Swamy Kumara N; Rao Kameshwara A .	Building Planning and Drawing	Charotar Publication, ANAND ISBN : 978-93-85039-12-6 (Ed.2015)
3	Mantri Sandip	A to Z Building Construction	Satya Prakashan; 2nd edition (2015), New Delhi, ISBN: 978-8176849692
4	Nighat Yasmin Ph.D.	Introduction to AutoCAD 2024 for Civil Engineering Applications	SDC Publications, ISBN: 978-1-63057-607-3
5	Malik R.S., Meo G.S.	Civil Engineering Drawing	Computech Publication Ltd New Asian Publishers, 2009, New Delhi ISBN:978-8173180026

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?app=desktop&v=E6TE9u1XgAg	2D Commands - NITTTR Chandigadh-NCTEL
2	https://www.youtube.com/watch?v=rX6XfCMRYU0	Demonstration video 2-Point Perspective View-Basics.
3	https://www.youtube.com/watch?app=desktop&v=N4FUbpGAWNA	3D Commands in Autocad - NITTTR Chandigadh -- NCTEL

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/**
Programme Code	**: CE/ CR/ CS/ LE**
Semester	**: Third**
Course Title	**: CONSTRUCTION MANAGEMENT**
Course Code	**: 313010**

I. RATIONALE

The construction industry is in continuous need of skilled professionals, capable of managing projects efficiently in the capacity of project engineers,construction managers, site supervisors, and project coordinators, among others. It is required for a civil engineer to plan, manage and execute Civil Engineering works with utmost precision within the time frame so as to optimize the resources.Therefore, it is necessary to develop a perfect blend of knowledge, skills, and attitudes in the form of the competencies among the learners to tackle with such engineering projects effectively and efficiently leading towards sustainable development.This course will help in developing these basic competencies among the students which will enable them to get an employment in the market.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Manage the given construction project using the relevant techniques of construction management.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Conduct the project feasibility analysis of the given project.
- CO2 - Apply the relevant scheduling technique in the given situation to decide the ethical element of the project.
- CO3 - Manage the inventory using relevant inventory control techniques.
- CO4 - Execute the project as per the prevailing safety practices

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				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	
313010	CONSTRUCTION MANAGEMENT	CMA	DSC	1	-	2	1	4	2	-	-	-	-	-	25	10	-	-	25	10	50

Total IKS Hrs for Sem. : 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, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the term, “Project Life Cycle” with its importance. TLO 1.2 Identify the characteristics of the given project with relevant constraints. TLO 1.3 Select the project from the available options based on feasibility analysis. TLO 1.4 Justify the importance of project management frameworks and standards. TLO 1.5 Select the relevant type of equipment for the given type of activity of project.	**Unit - I Project Initiation and its feasibility** 1.1 Project: Basic Definitions, management functions, ethics, project life cycle- Project Initiation, Project Planning, Project Executing, Project Monitoring and Controlling, Project Closing. 1.2 Project Characteristics and Constraints- Scope, time, cost, Quality; Stakeholder. 1.3 Project Feasibility Analysis- Market analysis, Financial analysis- Net Present Value(NPV), Payback Period, Examine the business problem/opportunity, Identify the requirements, undertake a feasibility study, Rank the feasibility results- Define the criteria, give ranking scores, Identify the feasibility outcome. 1.4 Project Management Frameworks and Standards, Project Management consultant (PMC)- roles & responsibilities. 1.5 Equipment used in executing the Civil Engineering projects- •Earth moving equipment (Tractor, Bulldozer, Scrapers, Excavators), • Hauling Equipment (Drum trucks, Front end loader, Conveyor belt), • Concreting Equipment (RMC mixer, Concrete pump), • Hoisting Equipment (Lifting & lowering equipments, Cranes).	Lecture Using Chalk-Board Presentations Site/Industry Visit Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Identify the broad activities involved in given construction project. TLO 2.2 Apply the relevant technique of analysis to get the required information about the given project. TLO 2.3 Explain the process of developing the critical path line in solving the given problem.	**Unit - II Project Management and Scheduling** 2.1 Broad activities in construction work – Earthwork, Foundation, RCC Work, Brick work, Scaffolding, Plastering, Painting etc & duration required for complete the activity 2.2 Methods of Scheduling-Gantt Chart, Bar chart, Development of Bar charts and Gantt chart, Merits & limitations of Bar chart & Gantt chart. 2.3 Concept of CPM & PERT: Introduction to Critical path method (CPM), Program evaluation & review techniques (PERT), Network Diagramming of Projects Activity-on-arrow (AOA) Diagrams- Concept of Activity and Event, Time-Analysis of Networks- Forward Pass, Backward Pass, Probabilistic Durations- Optimistic Time, Pessimistic Time, Most Likely Time, Project Scheduling- ES and LS Schedules as Limits, Resource Scheduling, Time/Cost Trade-off	Lecture Using Chalk-Board Video Demonstrations Hands-on Presentations
3	TLO 3.1 Apply the relevant material management techniques in the given construction project. TLO 3.2 Apply the material management technique for rebar in the given construction project..	**Unit - III Material Management** 3.1 Material Management-Introduction, Inventory and inventory control, EOQ (Economic order of quantity), ABC technique, V-E-D analysis, Just in Time Strategy (JIT), Store management & various records related to store management 3.2 Rebar Management: Wastage of steel on site, Preventive measures to avoid the wastage of steel. Rebar, Importance of rebar, Fabrication and transportation of Rebar. Understanding rebar drawings.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit
4	TLO 4.1 Explain the remedial measures with preventative strategies for the relevant identified cause of accidents on construction sites. TLO 4.2 Follow the relevant legal provisions related to labor laws in project execution.	**Unit - IV Safety and labour laws in construction** 4.1 Importance of Safety in construction work, causes of accidents on construction site & remedial measures, precautions to avoid accidents at site, safety policies. 4.2 Introduction to Labour laws related to construction-Workman Compensation Act, Minimum Wages Act, The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, Janshree Vima Yojna	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify the roles and responsibilities of manpower required for a construction project	1	*Draw the flow chart of manpower required for a given type of project	2	CO1
LLO 2.1 Select the relevant resources required for foundation or RCC or Brickwork for given construction project/data	2	*Draw the resource allocation plan for Foundation or RCC or Brickwork activity on construction site	2	CO1
LLO 3.1 Select the relevant resources required for Structural members of beam or column for given construction project/data	3	Draw resource allocation plan for Structural members for beam or column or slab for G+5 activity on site	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Select the relevant resources required for plastering or flooring for given construction project/data	4	Draw resource allocation plan for plastering or painting or flooring activity on site	2	CO1
LLO 5.1 Select different equipments used to carry out the construction of building	5	Write a brief report of site inspection with special reference to construction equipments used in the project with relevant photographs, video etc	2	CO1
LLO 6.1 Apply the concept of bar chart/Gantt chart to get the required information about the given project.	6	Draw the bar chart / Gantt chart for the activities of given construction project by using MS Excel/MS Project	2	CO2
LLO 7.1 Apply the concept of network diagram to get the required information about the given project.	7	Forecast the time duration required for various activities of the given construction project to represent them through a network diagram	2	CO2
LLO 8.1 Determine/Find the duration of the project and the sequence of critical activities.	8	*Solve the numerical on CPM for finding duration of project and Critical path of the any one problem for the given data	2	CO2
LLO 9.1 Apply the concept of PERT technique to get the required information about the given project.	9	*Solve the numerical on PERT to represent the sequence of activities and critical path of the any one problem for the given data.	2	CO2
LLO 10.1 Determine the Economic Order Quantity (EOQ) based on the given data	10	*Determination of EOQ (Economic order quantity) based on the given data. (Solve one Numerical)	2	CO3
LLO 11.1 Identify the most important product in given construction project/data	11	*Carry out the ABC analysis for the given problem/data (Solve one Numerical)	2	CO3
LLO 12.1 Apply the principles of management for rebar procurement on the given site.	12	Develop rebar procurement plan for the given construction site. (Manually or by using any open-source software)	2	CO3
LLO 13.1 Select the causes and remedial measures for given construction project/data	13	*Prepare a report on minimum five expected causes of accidents on construction sites with their remedial measures. (Visit any one Industrial/Residential/Public construction building)	2	CO4
LLO 14.1 Select the action plan measures for given construction project/data	14	*Prepare a brief report of the observation made on site with respect to safety on site (Visit any one Industrial/Residential/Public construction building)	2	CO4
LLO 15.1 Select various safety devices used at given construction site	15	Prepare the charts/report on various safety devices used at given construction site (Visit any one Industrial/Residential/Public construction building)	2	CO4

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.

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

Assignment

- Prepare a brief report on overview of Construction Professional Practice in India.
- Solve the numerical on bar chart, CPM and cost optimization for the given data.

- Collect and interpret various store forms from PWD, WRD, MJP.
- Download the labour laws documents from internet and wrote a brief summary on it.
- Learn material management module from SAP website
- Visit to a Site to study the construction technique and use of major construction equipment
- Student should watch any 3 learning website link given in XIII learning websites & portal and prepare a brief report on it
- Prepare a brief report on role of construction industry in national development.
- Compile minimum 10 safety slogans displayed at various sites with sources and write a brief summary on it.
- Prepare project cost analysis for small construction project.
- Collect & interpret bar chart/CPM network for existing construction project.

Micro project

- Prepare a report on different forms of inventory storage along with your interpretation.
- Collect the information about latest safety measures adopted at construction project.
- Collect information and prepare a report on any one top construction companies in India.
- Compare any 3 construction management software.
- Use any one free open ware software to collect information about modern techniques of material management like JIT/SAP/ERP/MSP/MSEXCEL/Primavera.
- Collect information and prepare a report on various construction equipments used in construction industry.
- Use any one free open ware software of Construction Management to prepare the scheduling of a project.
- Use any one free open ware software of Construction Management to determine the critical path for the given construction project.
- Interpret the network figures used in given civil engineering projects.

Note :

- Above is just a suggestive list of microprojects and assignments; 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 in acquiring 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Free Open ware software-1. Just-In-Time (JIT), 2. System Application & Product in data processing (SAP), 3. Microsoft Project (MSP)4. Microsoft Excel (MS Excel)5. Primavera6. Enterprise Resource Planning (ERP)	2,3

IX. SUGGESTED 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	Project Initiation and its feasibility	CO1	6	0	0	0	0
2	II	Project Management and Scheduling	CO2	5	0	0	0	0
3	III	Material Management	CO3	2	0	0	0	0
4	IV	Safety and labour laws in construction	CO4	2	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work, Self Learning Assessment (Assignment & Microproject). Note:Each Practical will be assessed considering-60% weightage to process related and 40 % weightage to product related

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	S.C. Sharma, S.V. Deodhar	Construction Engineering and Management	Khanna Book Publishing Co (P) Ltd. ISBN 9789386173980
2	IGNOU	Project Management	Indira Gandhi National Open University(eKumbh-AICTE)
3	K. K. Chitkara	Construction Project Management-Planning, Scheduling & Controlling	McGraw Hill Education ISBN-10 0070680752, ISBN-13 978-0070680753
4	L. S. Srinath	PERT And CPM Principles And Applications	East-West Press (Pvt.) Ltd. ISBN-10 8185336202 ISBN-13 978-8185336206
5	Jack Gido, Jim Clements, Rose Baker	Successful Project Management	Cengage Publication ISBN: 9781337363853

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/105/103/105103206/	Construction Method and Equipment Management
2	https://www.youtube.com/watch?v=Cx7i2wXB0kA&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=16	Project Scheduling
3	https://www.youtube.com/watch?v=j6VIllXT0Vs&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=22	Accidents in Construction Industry

Sr.No	Link / Portal	Description
4	https://www.youtube.com/watch?v=EVsi1QamfU0&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=26	Safety Organization and Safety Officer
5	https://www.youtube.com/watch?v=QoXvRBrFWyI&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=25	Implications of Construction Accidents
6	https://archive.nptel.ac.in/courses/105/104/105104161/	Introduction to planning and scheduling, resource levelling and allocation,crashing of networks
7	http://www.cidc.in/	Construction Industry Development Council (CIDC)
8	https://onlinecourses.nptel.ac.in/noc22_ce39/preview	Safety in Construction Industry
9	https://www.youtube.com/watch?v=Tm2HhqMu5Jg	PERT and CPM
10	https://www.youtube.com/watch?v=GAGoqqZSPh4&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=3	Overview of steps in execution of a project
11	https://www.youtube.com/watch?v=kuCHsNXeNMc&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=5	Resource Management in Construction Projects
12	https://www.youtube.com/watch?v=Bh_LYZh3KH4&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=21	Introduction to construction safety

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students