

## **VII. Course Curriculum Detailing (Semester- IV)**

- A) Course Code : 2020471(020)  
 B) Course Title : SURVEYING II  
 C) Pre-requisite Course Code and Title : SURVEYING I  
 D) Rationale: Basic knowledge of Field survey is required for preparation of any engineering maps or drawings. Field survey can be professionally carried out only when various steps involved in the survey work are known with skills of operating theodolite, tachometer, curves and modern surveying instruments and tools. At diploma level, students are expected to study about these aspects so as to develop their understanding, performance oriented abilities in order to apply their knowledge in construction industry.

E) Course Outcomes :

- CO 1 Measure horizontal and vertical angles in the field using theodolite.  
 CO 2 Measure linear distances and angles in the field using tachometer.  
 CO 3 Set out horizontal and vertical curves in the field.  
 CO 4 Carry out field survey work using modern equipments like.  
 CO 5 Apply GIS & GPS for field survey.

F) Scheme of Studies:

Board of Study	Course Code	Course	Scheme of Studies (Hours/Week)			Credit L+ T+P/2
			L	T	P	
Civil Engineering	2020471(020)	Surveying II	2	-	4	4

L- Lecture, T- Tutorial, P- Practical,

Legend: Lecture (L)→CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture and others).

Practical (P)→LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies).

Tutorial (T)→ SL: Self Learning

G) Scheme of Assessment:

Board of Study	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
Civil Engineering	2020471(020)	Surveying II	70	20	30	30	50	200

ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment

Legend - PRA : Process Assessment, PDA : Product Assessment

Note: i) TA in Theory includes Sessional work (SW) and attendance (ATT) with weightage of 70% and 30% of total respectively.

ii) TA in practical includes performance of PRA, PDA and Viva-Voce with weightage of 50%, 40% and 10% respectively.

iii) 85% attendance is essential in theory and practical classes to appear in Examination

**H) Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

**CO-1 Measure horizontal and vertical angles in the field using theodolite.**

(Approx. Hrs: CI+LI = 7+16)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1 Explain the basic function of different parts of theodolite. SO 1.2 Operate theodolite and measure horizontal and vertical angle. SO 1.3 Perform traversing using theodolite.	LE 1.1 Study of parts of a theodolite and their uses. LE 1.2. Temporary adjustment of a theodolite. LE 1.3. Measurement of a horizontal angle by repetition method. LE 1.4. Measurement of a horizontal angle by reiteration method. LE 1.5. Measurement of a vertical angle	<b>Unit-1.0 Theodolite Survey</b> <b>1.1</b> Introduction to theodolite, Uses of theodolite , Sketch the parts of Transit Vernier theodolite, Reading of main and vernier scale on horizontal and vertical plate <b>1.2</b> Temporary adjustment of a theodolite <b>1.3</b> Fundamental axis of theodolite and their relationship <b>1.4</b> Definitions and various technical terms <b>1.5</b> Methods of measuring horizontal angles and vertical angles <b>1.6</b> Measuring direct and deflection angles, Errors in theodolite survey <b>1.7</b> Theodolite Traversing, Traverse computations, Closing errors, Balancing the traverse	SL 1.1 Computation of closing error.

**SW-1 Suggested Sessional Work (SW):****a. Assignments:**

- Sketch the parts of Transit Vernier Theodolite.
- (a) What are 'face left' and 'face right' observations? Why is it necessary to take both face observations? (b) Why both verniers are read?
- Explain temporary adjustment of a transit theodolite.
- State what errors are eliminated by repetition method.

**b. Mini Project**

- Take a simple closed traverse of 5-6 sides .Calculate included angles using theodolite, locate details and plot them on a drawing sheet.

**CO-2 Measure linear distances and angles in the field using tacheometer.****(Approx. Hrs: CI+LI = 7+8)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
SO 1. Explain the principles of tacheometry  SO 2. Understand the tacheometric constant of tacheometer.  SO 3. Calculate R.L. and horizontal distance between object and instruments.	LE2.1 Determine the tacheometric constant  LE2.2 Determine the distance and R.L. of a point when line of sight is horizontal.	<b>Unit-2 Tacheometry</b> 2.1 Introduction 2.2 Purpose and Principles of tacheometric surveying 2.3 Instruments used in Tacheometry 2.4 Methods of Tacheometry (Stadia & Tangential )  2.5 Principle of of Stadia Tacheometry 2.6 Methods of determining constants of a Tacheometer 2.7 Anallatic Lens, advantages & disadvantages. 2.8 Numerical examples on tacheometer constants 2.9 Method of Fixed Hair : - When line of sight is horizontal and staff held vertically 2.10 Advantages and disadvantages of Tangential method 2.11 Stadia field work – General arrangement of field work, Triangulation, Traversing, Operations in tacheometric observations, 2.12 Errors in Stadia Tacheometry	2.1 Anallatic Lens, advantages & disadvantages.  2.2 Advantages and disadvantages of Tangential method

**SW-2 Suggested Sessional Work (SW) :****a. Assignments:**

1. What are the different methods employed in tacheometric survey?
2. Explain how you would determine the constants of a tacheometer?
3. Sketch the different types of stadia diaphragm.
4. Explain how you would obtain constants of a tacheometer in the field?
5. Solve numerical problems in tacheometry.
6. Explain operations in tacheometric observations.

**b. Mini Project:**

Carry out the project for a 3 to 4 stations for closed traverse by tacheometry and prepare the drawing sheet.

**CO- 3 Set out horizontal and vertical curves in the field.****(Approx. Hrs: CI+LI = 6+12)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
SO 3.1 Explain need of curve in field SO 3.2 Explain different elements of curves. SO 3.3 Compute necessary data required to setting out curve on field.	LE3.1. Determine the elements of simple circular curve.  LE 3.2. Determine the data for setting out curve from offset of long Chord.  LE 3.3. Determine the data for setting out curve By Rankine (one theodolite) method	<b>UNIT 3 Curves</b> 3.1 Introduction Types of circular curves, Definitions and notations, Designation of curve  3.2 Relation between Radius and degree of curve, Elements of simple circular curve. 3.3 Setting out simple circular curve- Linear Method and Angular Method of location of tangent, tangent point, peg interval. 3.4 Linear Methods – By ordinates from long chord, by successive bisection of arcs, by offsets from tangents, by offsets from chord produced. 3.5 Angular Method – Rankine’s method of tangential angle, 3.6 Introduction to Transition curves, Vertical curves and their purpose,	SL 3.1 Understanding components of transition curve. SL 3.2 Understanding components of compound curve.

**SW-3 Suggested Sessional Work (SW) :****a. Assignments:**

1. Define terms related to simple circular curves.
2. Solve numerical problems on setting out simple circular curves by different methods.
3. State purpose and requirement of transition curves.
4. Define Transition curve and vertical curve and state their purposes.

**b. Mini Project:**

1. Set out simple circular curve in the field.

**CO- 4 Carry out field survey work using modern equipments.****(Approx. Hrs: CI+LI = 6+20)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
SO4.1 Explain the principles of total station. SO4.2 Record data on total station as well as on computer. SO4.3 Retrieving the data and generate the drawings using application software.	LE 4.1 Identify the parts of the Total Station LE 4.2 Set out the total station on a station LE 4.3 Set out station by setting up a back sight LE 4.4 Measure the horizontal Angle LE 4.5 Measure the vertical angle LE 4.6 Measure the deflection angle	<b>Unit- 4 Modern Surveying Techniques</b> Introduction 4.1 Basics of Digital Theodolite 4.2 Introduction and Principles of E.D.M. 4.3 Introduction and Basics of Total station - Parts of Total station - uses of Total Station, Automatic Target Recognition ATR . 4.4 Surveying using Total Station, Fundamental Parameters of Total Station Precautions to be taken while using Total Station 4.5 Set up of Total Station Centering, Levelling, Orientation. 4.6 Field Procedure for Total Station , Initial Data Entry , Survey Station Descriptors , Survey Station entries , Sighted Point Entries, Occupied Point Entries , Procedure  4.7 Electronic data recording- Data loggers : Data recorders, Field computers, Memory cards, Internal Memory	SL4.1 Precautions to be taken while using Total Station

**SW-4 Suggested Sessional Work (SW) :****a. Assignments:**

- 1 How does the measurement of distance with an EDM instrument differ from the conventional methods? What are the advantages of EDM instruments?
2. Describe briefly important parts of total stations.
3. Explain briefly how we can perform topographic survey with a total station.

**b. Mini Project:**

Total Station survey: - To carry out the project for small traverse on a ground and prepare the drawing sheet

**CO- 5 Apply GIS & GPS for field survey.****(Approx. Hrs: CI+LI = 6+8)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
SO5.1 Explain GIS. SO5.2 Understand components of GIS SO5.3 Demonstrate application area of GIS in Civil Engineering. SO 5.4 Explain GPS. SO 5.5 Demonstrate working of GPS.	LI 5.1 Study about GIS components. LI 5.2 Study about various software available for GIS analysis. LI 5.3 Measurement of Latitude and Longitude of any place using GPS.	<b>GIS and GPS</b> 5.1 Introduction Definition of GIS 5.2 Objectives of GIS Subsystems of GIS 5.3 Tools of representation of features Point Data, Line Data, Areal Data. Data Structure for GIS : Vector and Raster data structure. 5.4 GIS SOFTWARE PACKAGES Application areas of GIS, Remote sensing and GIS, ArcGIS. 5.5 GPS Overview : Introduction and principle, Components of GPS 5.6 Introduction to GPS surveying techniques: Static and Dynamic, Uses and application of GPS.	SL 5.1 Understanding objective of GIS SL 5.2 GPS accuracy

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

**SW-5 Suggested Sessional Work (SW) :**

- a. Assignments:
  1. Explain different application area of GIS in Civil Engineering.
  2. Write short notes about GPS surveying techniques.
- b. Mini Project: Describe the types of vector overlays with neat sketches.

**Note:** Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

**I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):**

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
I	Theodolite Survey	4	6	4	14
II	Tacheometry	4	6	4	14
III	Curves	4	6	4	14
IV	Modern Surveying Techniques	4	6	4	14
V	GIS and GPS	4	6	4	14
Total		20	30	20	70

**Legend:** R: Remember, U: Understand, A: Apply and above

**J) Suggested Specification Table (For ESA of Laboratory Instruction\*):**

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
LI 1.1	Study of parts of a theodolite and their uses.	25	20	05
LI 1.2.	Temporary adjustment of a theodolite.			
LI 1.3.	Measurement of a horizontal angle by repetition method.			
LI 1.4.	Measurement of a horizontal angle by reiteration method.			
LI1.5.	Measurement of a vertical angle			
LI2.1	Determine the tacheometric constant			
LI2.2	Determine the distance and R.L. of a point when line of sight is horizontal.			
LI3.1.	Determine the elements of simple circular curve.			
LI 3.2.	Determine the data for setting out curve from offset of long Chord.			
LI 3.3.	Determine the data for setting out curve By Rankine (one theodolite) method			
LI 4.1	Identify the parts of the Total Station			
LI 4.2	Set out the total station on a station			
LI 4.3	Set out station by setting up a back sight			
LI 4.4	Set out station by setting up a Azimuth Mark			
LI 4.5	Measure the horizontal Angle			
LI 4.6	Measure the vertical angle			
LI 4.7	Measure the deflection angle			
LI 5.1	Study about GIS components.			
LI 5.2	Study about various software available for GIS analysis.			
LI 5.3	Measurement of Latitude and Longitude of any place using GPS			



\* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

**Legend :** PRA: Process Assessment, PDA : Product Assessment

**Note :** Only one experiment has to performed at the end semester examination of 30 Marks as per assessment scheme.

**K) Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Industrial visits
5. Industrial Training
6. Field Trips
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)

**L) Suggested Learning Resources:**

**(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Surveying and levelling Vol-I & II	T. P. Kanetkar & S. V. Kulkarni	Pune Vidyarthi Griha Prakashan	Latest edition
2	Surveying and Levelling Vol-I & II	Dr. B. C. Punmia	Laxmi Publications Pvt. Ltd.	17 <sup>th</sup> edition
3	Surveying and Levelling Vol-I & II	S. K. Duggal	Tata Mc Graw Hill	4 <sup>th</sup> edition
4	Surveying and Levelling Vol-I & II	S.K.Hussain, M.S. Nagaraj	S. Chand and Co.	Latest edition

**(b) Open source software and website address :**

1. <https://www.esri.com>
2. <https://civiltoday.com>
3. <https://theconstructor.org>
4. <http://www.gisresources.com>

**M) List of Major Laboratory Equipment and Tools:**

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Transit Vernier Theodolite	20" accuracy, erect image with Aluminum Telescopic stand.	LI 1.1, LI 1.2, LI 1.3 LI 1.4, LI1.5,LI 3.3
2	Tacheometer	Theodolite fitted with stadia diaphragm	LI 2.1,LI 2.2,
3	Total Station	Telescope - Magnification 30x,image erect Distance measurement – Range 1000 m, accuracy 2mm, Angle Measurement – accuracy 1" With display panel and key board.	LI 4.1, LI4.2, LI4.3, LI 4.4, LI4.5,LI4.6,LI4.7
4	GPS receiver and antenna		LI5.1,LI5.2,LI5.3

## N) Mapping of POs &amp; PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline Knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO-1 Measure horizontal and vertical angles in the field using theodolite.	1	3	3	3	1	1	1	2	1	2	1	1
CO-2 Measure linear distances and angles in the field using tacheometer.	1	3	3	3	1	1	1	2	1	2	1	1
CO-3 Set out horizontal and vertical curves in the field.	1	3	3	3	1	1	1	2	1	2	1	1
CO-4 Carry out field survey work using modern equipments.	1	3	3	3	1	1	1	2	1	2	1	1
CO-5 Apply GIS & GPS for field survey.	1	3	3	3	1	1	1	2	1	2	1	1

## O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,8,10 PSO-1,2	CO-1 Measure horizontal and vertical angles in the field using theodolite.	SO1.1 SO1.2 SO1.3	LE1.1 LE1.5 LE1.2 LE1.3 LE1.4	Unit 1.1,1.2,1.3,1.4,1.5,1.6,1.7	SL 1.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-2 Measure linear distances and angles in the field using tacheometer.	SO.2.1 SO.2.2 SO2.3	LE 2.1 LE 2.2	Unit 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8, 2.9,2.10, 2.11,2.12	SL 2.1,2.2
PO-1,2,3,4,5,8,10 PSO-1,2	CO-3 Set out horizontal and vertical curves in the field.	SO.3.1 SO3.2 SO3.3	LE3.1 LE3.2 LE3.3	Unit 3.1,3.2,3.3,3.4,3.5,3.6	SL 3.1,3.2
PO-1,2,3,4,5,8,10 PSO-1,2	CO-4 Carry out field survey work using modern equipments.	SO4.1 SO4.2 SO4.3	LE4.1 LE4.6 LE4.2 LE4.3 LE4.4 LE4.5	Unit 4.1,4.2,4.3,4.4,4.5,4.6,4.7	SL 4.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-5 Apply GIS & GPS for field survey.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LE5.1 LE5.2 LE5.3	Unit 5.1,5.2,5.3,5.4,5.5,5.6	SL 5.1,5.2

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## **VII. Course Curriculum Detailing (Semester- IV)**

- A) Course Code : 2020472(020)  
 B) Course Title : STRENGTH OF MATERIAL  
 C) Pre- requisite Course Code and Title :  
 D) **Rationale** : Strength of material is the computation of deformations, deflections and internal forces or stresses (*stress equivalents*) within structures, either for design or for performance evaluation of existing structures. This subject is to develop the concept of analysis of determinate structures under various types of transverse & direct loading. Analysis of structural members under the effect of principal stresses & strains is also incorporated to give an exposure of compound stresses to the students. At diploma level students are expected to study about these aspects of analysis and design of various structures so as to develop their understanding in order to apply their knowledge in construction industry.

E) **Course Outcomes** :

- CO - 1 Recognize the concepts of stress and strains in a simple structure.  
 CO -2 Draw shear force and bending moment diagrams of determinate structures  
 CO -3 Calculate bending stresses and shear stresses in various types of sections  
 CO -4 (a) Compute the compound stresses on inclined planes  
 (b) Calculate slopes and deflection in a beam  
 CO – 5 (a) Draw bending moment diagrams of fixed beams  
 (b) Compute safe load and analyze the critical loads for columns.

F) **Scheme of Studies:**

Board of Study	Course Code	Course	Scheme of Studies (Hours/Week)			Credit L+ T+P/2
			L	T	P	
Civil Engineering	2020472(020)	Strength of Material	3	1	2	5

L- Lecture , T- Tutorial, P- Practical,

**Legend:** Lecture (L)→CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture and others) .

**Practical (P) →LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies ) .**

**Tutorial (T) →SL: Self Learning**

**G) Scheme of Assessment:**

Board of Study	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
Civil Engineering	2020472(020)	Strength of Material	70	20	30	30	50	200

**ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment**

**Legend - PRA : Process Assessment, PDA : Product Assessment**

- Note: i) TA in Theory includes Sessional work (SW) and attendance (ATT) with weightage of 70% and 30% of total respectively.**
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**H) Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

**CO-1 Recognize the concepts of simple stress and strains in a simple structure.**  
(Approx. Hrs: CI+LI= 12+16)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define various mechanical properties of materials SO1.2 Analyze the simple stress strain curve of mild steel SO1.3 Calculate different types of direct stresses and strains SO1.4 Describe	LE1.1 Perform Tension Test on Mild Steel/ Aluminum on Universal Testing machine .Perform Compression test on cast iron on Universal Testing Machine. LE1.2 Plot Stress-Strain Curve for ductile materials like Mild Steel, Aluminum under tensile loading as per IS 1608.	<b>UNIT-1 Simple stresses and strains</b> 1.1 Mechanical properties of material: strength, elasticity ,plasticity, ductility, brittleness, malleability, toughness, hardness and rigidity & stiffness 1.2 Direct Stress, linear Strain, Hook's Law. Stress Strain curve of Mild Steel.	SL1.1 Draw Stress strain diagrams for different materials and compare it with that of mild

Session Outcomes	Laboratory Instruction	Class room Instruction	Self Learning
and relate three moduli of elasticity. SO1.5 Compute strain energy due to sudden, gradual and impact loading SO1.6 Define and Differentiate between resilience ,proof resilience and modulus of resilience	LE1.3 Determine Young's Modulus of Elasticity of different materials. Beam simply supported at ends. LE1.4 Calculate Impact Value of Mild Steel using IZOD Impact Test Apparatus. LE1.5 Determine energy absorption capacity of Ductile and Brittle materials such as MS, Al, Br and Cu, by conducting Charpy Impact test as per IS 1598.	Modulus of Elasticity. Yield stress, breaking stress, working stress & ultimate stress and factor of Safety  1.3 Principle of superposition, Stresses in bars of different sections., Stresses in composite bars  1.4 Lateral Strain and Poission's ratio ,Volumetric strain due to uni-axial, biaxial and triaxial force and change in volume  1.5 Shear stress, Principle of shear stress, Shear Modulus, Bulk Modulus and Relationship among C, E and K  1.6 Strain energy, resilience, proof resilience, modulus of resilience for Gradual, Sudden and Impact Load.	steel

**SW-1 Suggested Sessional Work (SW):****a. Assignments:**

1. Explain Hooke's Law.
2. What is composite section? Explain the determination of stress developed in a composite bar.
3. Explain the difference between primary strain and secondary strain.
4. Define shear stress and state the principle of shear stress.
5. Define Shear Modulus and Bulk Modulus. State the relationship between C,E and K.
6. Solve numerical problems related to simple stresses and strains, volumetric strain, elastic constants and strain energy.

**b. Mini Project:**

- (a) Perform tensile strength test on mild steel in UTM prepare the stress-strain graph explain in detail all the necessary points on the curve

**c. Other Activities (Specify):**

1. Prepare a power point presentation on different mechanical properties of materials and change in their properties with increase and decrease of carbon content.

**CO-2 Draw shear force and bending moment diagrams of determinate structures****(Approx. Hrs: CI+LI = 13+4)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
SO2.1 Recognize various types of beams SO2.2 Identify various types of loading conditions in beams SO2.3 calculate support reaction SO 2.4 Draw shear force and bending moment diagram under different loading and support conditions	LE2.1 Estimate Maximum Bending moment and shear force for simply supported and cantilever beam under point load and UDL using Combined Shear Force and Bending Moment apparatus	<b>Unit 2.0 Shear force and bending moment</b> 2.1 Types of beams - cantilever, simply supported, fixed, overhanging, continuous beams 2.2 Types of loading- point load, uniformly distributed load, UDL, reactions 2.3 Concept of shear force and bending moment, sign convention. 2.4 Relation between bending moment, shear force and rate of loading 2.5 Shear force and bending moment diagrams for simply supported beams, simply supported beams with overhangs and cantilever subjected to point loads, UDL, point of contraflexure. 2.6 Load and bending moment diagram from Shear Force Diagram.	SL2.1 Compare the variations in bending moment diagram and shear force diagram of point load and UDL with their equations  SL2.2 Draw the deflection curve for simply supported beam using bending moment diagram

**SW-2 Suggested Sessional Work (SW) :**

- Assignments**

1. Explain shear force and bending moment. Discuss the importance of shear force and bending moment.
2. Explain relationship between bending moment, shear force and rate of loading.
3. Solve numerical problems on shear force and bending moment for different cases.

- Mini Project:**

1. Prepare a model of wood showing various beams and their supports also compare the variation in their bending moment diagrams for point loads and UDL



• **Other Activities (Specify):**

1. Prepare a chart to show SF and BM diagrams and its max values for various loading conditions in simply supported beams.
2. Prepare a chart to show SF and BM diagrams for various loading conditions in cantilever beam.

**CO- 3 Calculate bending stresses and shear stresses in various types of sections**

(Approx. Hrs: CI+LI = 13+4)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Explain the concepts of bending and its assumption SO3.2 Identify the nature of stresses due bending SO3.3 Calculate the moment of resistance SO3.4 Apply the theory of bending in symmetrical and unsymmetrical structures types of sections SO3.5 Draw shear stress diagrams for various cross sections SO3.6 Relate maximum minimum and average shear stress for various sections	LE3.1 Measure flexural rigidity (EI) for a given beam using 'Slope and Deflection' apparatus and compare it with theoretical value	<b>Unit-3</b> <b>3.1 Bending Stresses in Beams:</b> 3.1.1 Concept of pure bending, theory of simple bending, assumptions in theory of bending, neutral axis. 3.1.2 Bending Stresses and their nature, bending stress distribution diagram, 3.1.3 Moment of resistance. 3.1.4 Application of theory of bending to symmetrical and unsymmetrical sections. <b>3.2 Shear stresses in beams:</b> 3.2.1 Shear stress equation, meaning of terms in the equation, shear stress distribution for rectangular, hollow rectangular, circular sections and hollow circular sections, I section, T section channel section, diamond section, triangular section. 3.2.2 Relation between max. shear stress and average shear stress for rectangular section, circular section, triangular section.	SL3.1 Derive the expression for shear stress in a rectangular beam

**SW-3 Suggested Sessional Work (SW) :**

- Assignments:**

1. Explain pure bending and simple bending.
2. State the assumptions made in theory of simple bending. Draw strain and stress diagram due to bending with the help of these assumptions.
3. State the expression for shear stress at any point on the cross section of a beam. Show that for a rectangular section distribution of shear stress is parabolic.
4. Solve the numerical problems related to bending stresses and shear stress.

- Other Activities (Specify):**

1. Prepare a power point presentation showing bending stress and shear stress distribution for cross sections generally adopted in the field

**CO- 4 (a) Compute the compound stresses on inclined planes and draw Mohr's circle of stress.****(b) Calculate slope and deflection in a beam.****(Approx. Hrs: CI+LI= 13+6)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1 Calculate the stresses in inclined plane SO 4.2 identify the principal planes and calculate the principal stresses SO4.3 calculate slopes and deflections in beams under different loading conditions	LE 4.1 Measure principal stresses and strains in a beam made of aluminum and loaded as a cantilever, and compare them with theoretical values using 'Principal stress and strain Apparatus'. LE 4.2 Investigate the effect of beam length and width on deflection of beam and compare it with theoretical value using 'Slope and Deflection' apparatus.	<b>Unit-4</b> <b>4.1Compound stresses</b> 4.1.1 Stresses on inclined plane with different stress conditions, 4.1.2 Principal planes and principal stresses, Analytical method and Graphical method using Mohr's stress circle method. <b>4.2 Slope and deflection</b> and their interrelation, Macaulay's Method for determination slope and deflection, Maximum values slope and deflection for u.d.l. and point loads for Simply supported, cantilever and fixed beams	SL4.1 Define conjugate beams and M/EI diagrams(overview only)

**SW-4 Suggested Sessional Work (SW) :**

- Assignments:**

1. Define principal planes and principal stresses and explain their uses.
2. State the expression for major and minor principal stresses on a plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress.
3. Solve numerical problems on inclined planes by analytical and graphical method.
4. Define slope, deflection and radius of curvature. State the relationship between these.
5. Solve numerical problems on slope and deflection.

- **Mini Project:**

1. Draw the stress conditions for different c/s of beams under three point and two point loading condition along longitudinal axis , identify the points of pure bending and pure shear in the beam and draw the mohr circle diagram and deflection diagram for the same
2. Analyse the failure of mild steel under tensile load performed in chapter1 and relate it with the concept of principal stress (Cup and Cone failure) Prepare a report for the above cases

- **Other Activities (Specify):**

1. List out the other methods used to find slopes and deflection in a beam other than macaulys theorem.

**CO- 5 (a) Draw bending moment diagrams of fixed beams**

**(b) Compute safe load and analyze the critical loads for columns.**

**(Approx. Hrs: CI+LI = 13+2)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Compute fixed end moments for different loading conditions SO5.2 Draw bending moment diagrams for fixed beams SO5.3 Differentiate between short and long columns SO5.4 Compute effective lengths of column according to their end conditions SO5.5 Identify the modes of failure in columns SO5.6 Calculate the buckling loads of column	LE5.1 Measure the buckling load of three different slenderness ratio long columns of same lengths using 'Behaviour of column and struts' apparatus.	<b>Unit-5</b> <b>5.1 FIXED BEAM</b> 5.1.1 Concept, Advantages & drawbacks 5.1.2 Computation of fixed end moments for a fixed beam for following loading (i) Single point load central/eccentric (ii) two point loads (iii) u.d.l. over entire span. 5.1.3 Drawing of B.M. diagrams indicating the maximum +ve and -ve values. <b>5.2 Column</b> 5.2.1 Column & Strut 5.2.2 Short & Long Column 5.2.3 End Condition of Column and effective Length of Column & Modes of Failure in column 5.2.4 Radius of Gyration , Slenderness Ratio 5.2.5 Euler's Crippling Load Formula. 5.2.6 Rankine's Formula for columns.	SL5.1 List out the examples of indeterminate structures from field  SL5.2 Nature of buckling for different end conditions in column.  SL5.3 Prepare a list of building components that can be considered as compression members and also mention about their end conditions.

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

**SW-5 Suggested Sessional Work (SW) :**

**a. Assignments:**

1. What is meant by fixed beam? State the advantages of fixed beam.
2. Solve numerical problems on shear force and bending moment diagram for fixed beams.
3. Distinguish long columns and short columns.
4. Define effective length of column and give it's value for different end conditions.
5. Explain the term slenderness ratio.
6. State Euler's Crippling Load formula. Explain the limitation of Euler's formula.
7. State Rankine's Formula for columns. What is advantage of this formula?
8. Solve numerical problems on columns.

**b. Mini Project:**

- (a) Prepare a model of a column and make provision for all types of end conditions. Try to predict the equivalent length from it.

**Note:** Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

**I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):**

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
I	Simple stress and strain	4	6	4	14
II	Shear force and bending moment	4	6	4	14
III	Bending stress and shear stress	4	6	4	14
IV	Compound stress, slope and deflection	4	6	4	14
V	Fixed beam and column	4	6	4	14
Total		20	30	20	70

**Legend:** R: Remember, U: Understand, A: Apply and above

**J) Suggested Specification Table (For ESA of Laboratory Instruction\*):**

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
LE1.1	Perform Compression test on cast iron on Universal Testing Machine .	25	20	5
LE1.2	Plot Stress-Strain Curve for ductile materials like Mild Steel, Aluminium under tensile loading as per IS 1608.			
LE1.3	Determine Young's Modulus of Elasticity of different materials' beam simply supported at ends.			
LE1.4	Calculate Impact Value/toughness of Mild Steel using IZOD Impact Test Apparatus as per IS 1757.			
LE1.5	Determine energy absorption capacity of Ductile and Brittle materials such as MS, Al, Br and Cu, by conducting Charpy Impact test as per IS 1598			
LE2.1	Estimate Maximum Bending moment and shear force for simply supported and cantilever beam under point load and UDL using Combined Shear Force and Bending Moment apparatus.			
LE 3.1	Measure flexural rigidity (EI) for a given beam using 'Slope and Deflection' apparatus and compare it with theoretical value.			
LE4.1	Measure principal stresses and strains in a beam made of aluminum and loaded as a cantilever, and compare them with theoretical values using 'Principal stress and strain. Apparatus.			
LE4.2	Investigate the effect of beam length and width on deflection of beam and compare it with theoretical value using 'Slope and Deflection' apparatus.			
LE5.1	Measure the buckling load of three different slenderness ratio long columns of same lengths using 'Behaviour of column and struts' apparatus.			

\* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

**Legend :** PRA: Process Assessment, PDA : Product Assessment

**Note :** Only one experiment has to performed at the end semester examination of 30 Marks as per assessment scheme

**(K) Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Industrial visits
4. Industrial Training
5. Demonstration
6. Others

**L) Suggested Learning Resources:****(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Strength of Material and Mechanics of Structures	Strength of Material and Mechanics of Structures	Dr. B C Punamia	Laxmi Publications (p) Ltd. New Delhi, 10/e, 2015, ISBN-13: 978-8131809259
2	Strength of Material	Strength of Material	S Ramamurutham	Dhanpat Rai Publishing Company Private Limited- New Delhi; Eighth edition, 2014, ISBN-13: 978-9384378264
3	Strength of Material	Strength of Material	Timoshenko and Gere	CBS, 2 edition, 2006, ISBN-13: 978-8123908946
4	Theory of Structures	Theory of Structures	R S Khurmi	S. Chand Publishing, New Delhi, 2006, ISBN-13: 978-8121928229
5	Strength of Materials	Strength of Materials	R.K. Rajput	S. Chand Publishing (6th Edition) (2015) ISBN-13: 978-9385401367
6	Strength of Materials	Strength of Materials	Rattan S.S.	McGraw Hill Education; Third edition, 2016, ISBN-13: 978-9385965517

**(b) Open source software and website address :**

1. [nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm](http://nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm)
2. [en.wikipedia.org/wiki/Shear\\_and\\_moment\\_diagram](https://en.wikipedia.org/wiki/Shear_and_moment_diagram)

3. [www.freestudy.co.uk/mech%20prin%20h2/stress.pdf](http://www.freestudy.co.uk/mech%20prin%20h2/stress.pdf)
4. [www.engineerstudent.co.uk/stress\\_and\\_strain.html](http://www.engineerstudent.co.uk/stress_and_strain.html)
5. [https://www.iit.edu/arc/workshops/pdfs/Moment\\_Inertia.pdf](https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf)

**M) List of Major Laboratory Equipment and Tools:**

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	<b>Universal Testing Machine</b>	<p><b>Universal Testing Machine:</b> Capacity - 100 tonnes. Type: Mechanical type digital, electrically Operated. Accessories: (1) Tensile test attachment for flat and round specimen up to 32 mm. (2) Compression test attachment (3) Shear test attachment with sizes of bushes 5,6,8,10,12,16,20,24 mm, (4) Transverse test attachment with bending Punch, (5) Service tools, (6) Operation and maintenance manuals - 2 nos. (7) Hardness attachment</p> <p><b>Digital Extensometer:</b> Least count - 0.001 mm. Max. Extension = 5 mm. Single dial gauge for 30,40 mm. 60 mm, 80 mm, 100 mm, 125 mm gauge length.</p>	LE1.1 to LE 1.4
2	Impact Testing Machine (Izod/Charpy)	<p><b>CHARPY Test Apparatus:</b> Pendulum drop angle 140°; Pendulum effective Wt 20-25 kg; Striking velocity of pendulum 5-6 m/sec; Pendulum impact energy 300 j; Min scale graduation 2 J; Distance of axis of pendulum rotation from center of specimen to specimen hit by pendulum 815 mm.</p> <p><b>IZOD Impact Test Apparatus:</b> Pendulum drop angle: 90°-120; Pendulum effective Wt: 20-25 kg; Striking velocity of pendulum: 3-4 m/sec; Pendulum impact energy: 168 j; Min scale graduation: 2 J; Distance of axis of pendulum rotation from center of specimen to specimen hit by pendulum : 815 mm</p>	LE1.5
3	Combined Shear Force and Bending Moment apparatus	Combined Shear Force and Bending Moment apparatus	LE2.1
4	Slope and Deflection of Beam Apparatus	A bench mounted apparatus with a steel base with support at ends. The supports can be fitted with knife edges or clamp plates. A steel beam and two load hangers are together with two dial gauges for	LE3.1 ,LE4.2

		measuring beam deflections and slopes, Micrometer, Calipers, Scale, Weights and hanger.	
5	Principal stress and strain measuring instrument.	1. Cantilever flexure frame 2. 2024-T6 high-strength aluminum alloy beam; 3x25x320 mm or similar. 3. P-3500 strain indicator or equivalent 4. Micrometer 5. Calipers 6. Scale 7. Weights and hanger	LE4.1
6	Behaviour of Column and Struts Apparatus	Apparatus consist of four spring steel columns which are put along a vertical wooden board. These four columns have different end conditions as below: 1. Both ends pinned 2. Both ends fixed 3. One end pinned and other fixed 4. One end fixed and other end free Micrometer, Calipers, Scale, Weights and hanger.	LE5.1



## N) Mapping of POs &amp; PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO -1 Recognise concepts of simple stress and strains in a structure.	3	3	2	2	2	0	0	2	0	1	2	1
CO -2 Draw shear force and bending moment diagrams for determinate structures	2	2	3	2	2	0	0	1	0	2	2	1
CO -3 Calculate bending stresses and shear stresses in various types of sections	2	2	3	2	2	0	0	1	0	2	2	1
CO -4 (a) Compute the compound stresses on inclined planes. (b) Calculate slope and deflection in a beam.	2	2	3	2	2	0	0	1	0	2	2	2
CO-5 (a) Draw bending moment diagrams of fixed beams (b) Compute safe load and analyze the critical loads for columns.	2	2	3	2	2	0	0	1	0	2	2	1

## O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,8,10 PSO-1,2	CO -1 Recognise concepts of simple stress and strains in a structure.	SO 1.1    SO 1.4 SO 1.2    SO 1.5 SO 1.3    SO1.6	LE 1.1    LE 1.4 LE 1.2    LE 1.5 LE 1.3	1.1    1.4 1.2    1.5 1.3    1.6	SL1.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO -2 Draw shear force and bending moment diagrams for determinate structures	SO 2.1 SO 2.2 SO 2.3 SO 2.4	LE2.1	2.1    2.4 2.2    2.5 2.3 2.4	SL2.1 SL2.2
PO-1,2,3,4,5,8,10 PSO-1,2	CO -3 Calculate bending stresses and shear stresses in various types of sections	SO 3.1    SO 3.4 SO 3.2    SO 3.5 SO 3.3    SO 3.6	LE3.1	3.1.1    3.1.4 3.1.2    3.2.1 3.1.3    3.2.2	SL3.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO -4 (a) Compute the compound stresses on inclined planes.  (b) Calculate slope and deflection in a beam.	SO 4.1 SO 4.2 SO 4.3	LE4.1 LE4.2	4.1.1 4.1.2 4.2	SL4.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-5 (a) Draw bending moment diagrams of fixed beams  (b) Compute safe load and analyze the critical loads for columns.	SO 5.1    SO 5.4 SO 5.2    SO 5.5 SO 5.3    SO 5.6	LE 5.1	5.1.1    5.2.3 5.1.2    5.2.4 5.1.3    5.2.5 5.2.1    5.2.6 5.2.2	SL5.1 SL5.2 SL5.3

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

## **VII. Course Curriculum Detailing (Semester- IV)**

- A) Course Code : 2020473(020)  
 B) Course Title : PUBLIC HEALTH ENGINEERING  
 C) Pre- requisite Course Code and Title :

D) Rationale :

Water is one of the basic needs of human. The requirement of water for various utilities is essential to understand and accordingly engineers need to provide it in sufficient quantity with ensuring quality. A diploma engineer must be well aware and well educated and trained to meet the water and sanitary requirement of the public. For sustainable development and environment, proper collection, conveyance and disposal of wastewater and solid refuse are necessary. This again reinforces the necessity of study of water supply and sanitary engineering in the civil engineering.

This course is aimed mainly at study of water supply and sanitary engineering which is primarily for urban and semi urban area but since lot of our people live in the villages a chapter on rural sanitation has also been included. The knowledge and application of such aspects is essential in developing a good technician who should be conversant with the collection, conveyance, treatment, maintenance and disposal of water and wastewater.

E) Course Outcomes :

- CO-1 Calculate the demand of water as per the requirements and identify the sources of water.  
 CO-2 Recognize water treatment method.  
 CO-3 Suggest conveyance and distribution system of water as per the requirement.  
 CO-4 Supervise the laying of pipeline works for collection and conveyance of sewage and plan and plan house drainage, rural sanitation and solid waste disposal.  
 CO-5 Recognize the process of sewage treatment and disposal in urban areas.

F) Scheme of Studies:

Board of Study	Course Code	Course	Scheme of Studies (Hours/Week)			Credit L+ T+P/2
			L	T	P	
Civil Engineering	2020473 (020)	Public Health Engineering	3	-	2	4

L- Lecture, T- Tutorial, P- Practical,

Legend: Lecture (L) → CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture and others).

Practical (P) → LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies).

Tutorial (T) → SL: Self Learning

**G) Scheme of Assessment:**

Board of Study	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
Civil Engineering	2020473 (020)	Public Health Engineering	70	20	30	30	50	200

**ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment**

**Legend - PRA : Process Assessment, PDA : Product Assessment**

**Note: i) TA in Theory includes Sessional work (SW) and attendance (ATT) with weightage of 70% and 30% of total respectively.**

**ii) TA in practical includes performance of PRA,PDA and Viva-Voce with weightage of 50%,40% and 10% respectively.**

**iii) 85% attendance is essential in theory and practical classes to appear in Examination.**

**H) Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

**CO-1 Calculate the demand of water as per the requirement and identify the sources of water.**

**(Approx. Hrs: CI+LI = 9)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Forecast population by different methods. SO1.2 Explain reasons of variation in demand. SO1.3 Enumerate demand rates for different types of buildings. SO1.4 Identify the sources of water in view of water supply scheme		<b>UNIT-1 Quantity of Water and Sources of Water</b> <b>1.1 Introduction</b> 1.1.1 Natural and manmade hydrological cycles 1.1.2 Duties of Public Health Engineer <b>1.2 Quantity of Water</b> 1.2.1 Population forecast by arithmetical increase, geometrical increase and incremental increase methods, graphical extension method, graphical comparison method 1.2.2 Criteria for method selection, 1.2.3 Water demand – per capita demand, domestic use, institutional use, public or civic use, fire demand, industrial use, water	SL1.1 Students are advised to collect information of water demand in different weather from their own locality and compare with per day per capita standard demand.

Session Outcomes	Laboratory	Class room Instruction (CI)	Self Learning
		<p>system losses.</p> <p>1.2.4 Factors influencing demand rate, variations in demand,</p> <p>1.2.5 Demand rates for various uses.</p> <p>1.2.6 Design period, total water demand of a city.</p> <p><b>1.3 Sources of Water</b></p> <p>1.3.1 Surface sources – natural and artificial, intake, selection of site for intakes and types of intakes, river, intakes for reservoir, lake and canal</p> <p>1.3.2 Ground water- aquifer, open well, tube well, types of tube well, methods for drilling tube well, selection of site for a tube well, section of a tube well, infiltration gallery,</p> <p>1.3.3 Yield of well- yield of an open well, constant level pumping test and recuperation test, yield of tube well- confined and unconfined aquifer.</p>	

**SW-1 Suggested Sessional Work (SW):****a. Assignments:**

1. Draw hydrological cycle showing details.
2. Enumerate various methods to determine population forecast.
3. What do you understand by per capita demand of water? How is it determined?
4. Explain fire demand.
5. Write a note on variations in rate of demand. Explain how it is taken into account in the design of various units of water treatment plant?
6. Solve numerical problems on population forecast and calculation of water demand.
7. Show, with the help of sketches, various types of wells.
8. Write a note on drainage gallery.
9. Explain river and reservoir intake with sketches.
10. Explain yield of tube well.

**b. Mini Project:**

1. Prepare a report regarding fire demand of a commercial or public building.
2. Compare a natural source and tap water regarding their quality parameters.

**c. Other Activities (Specify):**

1. Forecast population of your city after 20 years by different methods.

**CO-2 Recognize water treatment method.****(Approx. Hrs: CI+LI= 9+32)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Demonstrate various quality test on water and correlate with I.S. Code. SO2.2 Explain sedimentation process. SO2.3 Describe filtration process. SO 2.4 Explain water softening. SO2.5 Explain disinfection.	LE2.1 Determine turbidity of water sample. LE2.2 Determine dissolved oxygen of given sample. LE2.3 Determine pH value of water. LE2.4 Perform jar test for coagulation. LE2.5 Determine BOD of given sample LE2.6 determine residual chlorine in water LE2.7 Determine total dissolved solids of water sample. LE2.8 Determination of total hardness of water by EDTA method.	<b>Unit 2 Quality of water and Treatment of water</b> <b>2.1 Quality of water</b> 2.1.1 Requirement of water for domestic use, impurities in water, impurities in water from different sources, 2.1.2 Physical ,Chemical and Microbiological tests, standards of potable water as per I.S. & WHO, collection of water sample, Physical tests- colour, taste and odour, turbidity test, chemical tests for total solids, chlorides, hardness, pH value, dissolve oxygen, (DO),biochemical oxygen demand, common water borne disease, microbiological examination of water : E-coli index and MPN. <b>2.2 Treatment of water</b> 2.2.1 Objectives of water treatment, Location & Layout of treatment plant, Basic principles of working of treatment plant. 2.2.2 Sedimentation - sedimentation, plain sedimentation and sedimentation with coagulation, quiescent and continuous flow type sedimentation tanks, plain sedimentation tanks, sedimentation tanks for coagulation. 2.2.3 Filtration- filtration, slow sand filters, rapid sand filter, comparison between slow and rapid	SL2.1 Recognize miscellaneous treatments- removal of Manganese and Iron, removal of colour, odour and taste, fluoridation, defluoridation, desalination.

Session Outcomes	Laboratory Instruction	Class room Instruction (CI)	Self Learning (SL)
		sand filter, pressure filter. 2.2.4 Water softening-hardness of water, temporary and permanent hardness, removal of temporary hardness, removal of permanent hardness-lime soda process, zeolite process, demineralization. 2.2.5 Disinfection-requirements of disinfectant, methods of disinfection ,chlorination, forms of application of chlorine, method of application of chlorine, types of chlorination on the basis of its stage of application.	

**SW-2 Suggested Sessional Work (SW) :****a. Assignments:**

1. Give the standards of potable water as per IS and WHO.
2. List the various tastes conducted to check the quality of water.
3. Explain E-coli index and MPN.
4. Prepare a layout of a complete water treatment plant showing different components
5. What do you understand by coagulation and flocculation? Why are they necessary?
6. Draw neat sketches of (i) circular plain sedimentation tank (ii) circular clarifier.
7. Compare slow sand filters and rapid sand gravity filter.
8. Describe, with the help of neat sketches, a slow sand filter.
9. Explain, with the help of neat sketches, working of a rapid sand gravity filter.
10. Differentiate between permanent and temporary hardness.
11. Explain lime soda method of removing hardness of water.
12. Explain zeolite method of water softening.
13. Explain the method of application of chlorine to water to be disinfected with the help of neat sketch.
14. Define plain chlorination, prechlorination, post chlorination, double chlorination, break point chlorination, super chlorination, dechlorination.

**b. Mini Project:**

1. Student will collect water sample and test for various impurities of any natural source in their vicinity.

**c. Other Activities (Specify):**

1. Visit to water treatment plant.



**CO- 3 Suggest conveyance and distribution system of water as per the requirement****(Approx. Hrs: CI+LI=10)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
<p>SO3.1 Enumerate types of pumps and their suitability for different purpose.</p> <p>SO3.2 Identify various fittings in pipeline works.</p> <p>SO3.3 Identify different components of distribution system.</p> <p>SO3.4 Identify different layouts of distribution system.</p>		<p><b>Unit 3 Pumping ,Conveyance and Distribution of Water And Water Supply for Building</b></p> <p><b>3.1 Pumping</b> -Necessity of pumping, types of water pumps and their selection, reciprocating pump, centrifugal pump, submersible and air lift pumps, Efficiency of pump, WHP and BHP.</p> <p><b>3.2 Conveyance of water -</b> Type of pipes and their comparison, pipe joints, pipe laying, corrosion and its prevention in pipe, pipe appurtenances – sluice valves or gate valves, air valves, reflux valves, pressure relief valves, altitude valves, scour valves.</p> <p><b>3.3 Distribution of Water-</b> Requirements of a good distribution system, methods of distribution, pressure in distribution mains, systems of water supply, storage and distribution reservoir, layout of distribution system.</p> <p><b>3.4 Water Supply for Building</b> – materials for service pipe, service connection, water meter, globe valve and gate valve.</p>	<p>SL 3.1 Capacity of distribution reservoir</p>

**SW-3 Suggested Sessional Work (SW) :****a. Assignments:**

1. Give the classification of pumps. State the factors upon which selection of a particular type of pump depends.
  2. Explain criteria for selection of types of pipes.
  3. Draw neat sketches of joints in cast iron pipe.
  4. State the comparative merits and demerits of cast iron, steel and concrete pipes.
  5. State uses of different pipe appurtenances.
  6. Discuss in brief various methods of water distribution.
  7. Compare continuous and intermittent system of water supply.
  8. Write a note on distribution reservoirs. Where are these located?
  9. Discuss with the help of diagram various layouts of the distribution system.
  10. Sketch a typical service connection.
2. Identify and draw sketches of fittings in water supply works.

**b. Mini Project:**

1. Submit a report on corrosion in pipes, its effects and their remedies.

**c. Other Activities (Specify):**

1. To collect leaflets, photographs of different types of pumps, pipes and fittings in a report file.

**CO-4 Supervise the laying of pipeline works for collection and conveyance of sewage and plan house drainage, rural sanitation and solid waste disposal.****(Approx. Hrs: CI+LI = 10)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Enumerate types of sewage and disposal system. SO4.2 Identify different components of sewerage system. SO4.3 Explain principles of Rural sanitation. SO4.4 Explain methods of solid waste disposal.		<b>Unit 4. Collection and Conveyance of Sewage, House Drainage, Rural Sanitation and Solid Waste Disposal</b> <b>4.1 Collection and Conveyance of Sewage</b> -conservancy system, water carriage sewerage system, separate, combined and partially separate system, dry weather flow, storm water flow, types of sewer, materials of sewer, shapes of sewer, laying of sewer, cleaning and maintenance of sewer, sewer appurtenances- inlets, clean outs, manholes, flushing tanks, grease and oil traps, ventilation of sewer, overflow weirs, leaping weir, siphon spillway. <b>4.2 House Drainage</b> – principles of house drainage, pipes in house drainage, traps, classification of traps, sanitary fittings, and systems of plumbing. <b>4.3 Rural Sanitation</b> - provision of safe and potable water for domestic purpose, collection and disposal of dry refuse,	SL4.1 Explore recycling and reuse of plastics, paper and glass from solid waste.

		collection and disposal of sullage, excretal waste disposal through privies, different types of privies. <b>4.4 Solid Waste Disposal</b> – solid waste or refuse, quantity and composition of refuse, collection of refuse, transport of refuse, disposal of refuse-controlled tipping, land filling, trenching, dumping into the sea, pulverization, incineration, composting.	
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**SW-4 Suggested Sessional Work (SW) :****a. Assignments:**

1. Compare conservancy system and water carriage system.
2. Discuss relative merits of separate and combined system of sewage disposal.
3. Explain the factors on which dry weather flow depends.
4. Draw commonly used shapes of sewer. Discuss their suitability.
5. Describe the various stages of sewer construction.
6. State the purpose of ventilation of sewer. Explain methods of ventilation of sewer.
7. Explain flushing tanks for sewer.
8. Explain the terms : soil pipe, waste pipe, vent pipe
9. Explain, with the help of diagram, various systems of plumbing used for house drainage.
10. Discuss in brief essentials of rural sanitation.
11. Discuss in brief various types of solid waste/refuse. Give the composition of refuse for an average Indian city.
12. Write short notes on –  
(a) Incineration of refuse (b) , recycling and reuse of plastics, paper and glass from solid waste

**b. Mini Project:**

1. Prepare a brief report on garbage collection and disposal.

**c. Other Activities (Specify):**

1. To visit and study garbage collection and disposal system by local authorities.

**CO- 5 Recognize the process of sewage treatment and disposal in urban areas.****(Approx. Hrs: CI+LI= 10)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Recognize waste water characteristics. SO5.2 Explain preliminary and primary treatment of sewage. SO5.3 Explain secondary treatment of sewage. SO5.4 Recognize treatment and disposal of sludge.		<b>Unit 5 Waste Water Characteristics and Sewage Treatment</b> <b>5.1 Waste Water Characteristics</b> – Constituents of sewage, characteristics of waste water, aerobic and anaerobic decomposition of organic matter, physical, chemical and biological characteristics of sewage, micro organisms found in waste water.	SL5.1 Study intermittent sand filter and contact bed. SL5.2 Study dewatering of sludge.

SO5.4Design septic tanks for different users		<p><b>5.2 Sewage Treatment-</b></p> <p>5.2.1 Objectives of sewage treatment, preliminary treatment, primary treatment, secondary treatment, final treatment, Layout of treatment plant.</p> <p>5.2.2 Preliminary Treatment and Primary Treatment- screening, fixed bar type screen, disc type fine screen, grit chamber, detritus tanks, skimming tank, sedimentation and chemical clarification, classification of settling tanks, rectangular, circular and hopper bottom settling tanks.</p> <p>5.2.3 Secondary treatment – biological treatment process – aerobic and an aerobic processes, biological treatment techniques-attached growth, suspended growth and combined processes, trickling filters, construction of trickling filters, activated sludge process, flow diagram of activated sludge process, conventional activated sludge process, secondary settling tank for activated sludge process.</p> <p>5.2.4 Treatment and disposal of sludge- flow chart for sludge treatment and disposal, sludge thickening or concentration, anaerobic digestion, conventional digester, methods of final disposal of sludge-, septic tank, design and construction feature of septic tank, effluent disposal in septic tank.</p>	
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**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

**SW-5 Suggested Sessional Work (SW) :****a. Assignments:**

1. Give a brief list of various constituents of waste water.
2. Differentiate aerobic and anaerobic decomposition of organic matter.
3. Give the list of micro organisms found in waste water.
4. Give the list of treatment under preliminary, primary, secondary and final treatment of sewage and draw a flow diagram of sewage treatment plant for large sized cities.
5. Write a note on grit chamber.
6. What do you understand by sedimentation of waste water? Describe in brief rectangular settling tank with a neat sketch.
7. Explain the principle of trickling filter.
8. Draw a neat sketch of trickling filter.
9. What is activated sludge process? Draw flow diagram of activated sludge process.
10. Draw a neat sketch of secondary settling tank for activated sludge process.
11. Draw a flow chart for treatment and disposal of sludge.
12. Explain in brief various methods of final disposal of sludge.
13. Describe, with the help of neat sketch, the components of septic tank, along with the function of each.

**b. Mini Project:**

1. Prepare a display board showing different components of water supply.

**c. Other Activities (Specify):**

1. Visit a village to study existing garbage disposal and sanitation being adopted.

**Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.**

**I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):**

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
I	Introduction & Quantity of water	4	6	4	14
II	Sources and Quality of water	4	6	4	14
III	Pumps And Pipes	4	6	4	14
IV	Water supply and sanitation system	4	6	4	14
V	Domestic water supply, sewage treatment and Rural sanitation and disposal in urban and rural areas.	4	6	4	14
Total		20	30	20	70

**Legend:** R: Remember, U: Understand, A: Apply and above

**J) Suggested Specification Table (For ESA of Laboratory Instruction\*):**

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
LE 2.1	To determine turbidity of water sample	25	20	5
LE 2.2	To determine dissolved oxygen of given sample			
LE 2.3	To determine pH value of water			
LE 2.4	To perform jar test for coagulation			
LE 2.5	To determine BOD of given sample			
LE 2.6	To determine residual chlorine in water			
LE 2.7	To determine total dissolved solids			
LE 2.8	LE2.8 Determination of total hardness of water by EDTA method.			

\* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

**Legend :** PRA: Process Assessment, PDA : Product Assessment

**Note :** Only one experiment has to performed at the end semester examination of 30 Marks as per assessment scheme

**K) Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field visit

8. Demonstration
9. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)

**L) Suggested Learning Resources:**

**(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Textbook of water supply and sanitary engg.	G.S.Birdie	Dhanpat rai & sons, Delhi.	Latest Revised
2.	Text book of water supply and sanitary engineering	S.K. Garg	Khanna publisher New Delhi	Latest Revised Edition
3.	Elements of Public Health Engineering	K.N. Duggal	S. Chand Publication	Latest Revised Edition
4.	Lok swasthya Abhiyantriki	A.K. Saxena	Deepak prakashan Gwalior	Latest Revised Edition
5	I.S. 1172,1742, 2065, 2470, and 5329.			
6	Jan swasthya Abhiyantriki	Shivanand Kamde	University Book Publishing House, Jaipur	Latest Revised Edition
6	The committee on PHE manual and code of practice, the ministry of health, govt. of India,PHE manual and code of practice-sections I,II,III and IV.			

**(b) Open source software and website address :**

1. <https://civiltoday.com>
2. <https://nptel.ac.in>

**M) List of Major Laboratory Equipment and Tools:**

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Turbidity meter	Digital turbidity meter	LE2.1
2	pH meter	Digital pH meter	LE 2.3
3	Jar Test Apparatus	Jar Test Apparatus with multiple spindle stirrer	LE 2.4
4	BOD Bottles	BOD Bottles 300 ml capacity	LE 2.5
	Incubator	Incubator to be controlled at 20 <sup>0</sup> C or at any desired temperature.	LE 2.5
5	TDS meter	Digital TDS meter	LE 2.7

6	Burette	Borosil	LE 2.3, LE 2.2, LE 2.8, LE 2.6
7	Pipette	Borosil	LE 2.2, LE 2.8
8	Conical Flask- 10, 50, 100, 250, 500 ml	Borosil	LE 2.2, LE 2.3, LE 2.8, LE 2.6
9	Measuring Cylinder 10, 50, 100, 250, 500 ml	Borosil	LE 2.2, LE 2.8, LE 2.6
10	Jar Bottle	Borosil	LE 2.2, LE 2.3, LE 2.8, LE 2.6
11	Reagent Bottle 100ml	Borosil	LE 2.2, LE 2.3, LE 2.8, LE 2.6
12	Wash bottle 500 ml	Borosil	LE 2.2, LE 2.3, LE 2.8, LE 2.6
13	Distillation assembly	Steel body 4 liters capacity, with c.p. wall mounting cap and brass cock, flexible tubing, 220—230 AC	LE 2.2, LE 2.3, LE 2.6, LE 2.8



## N) Mapping of POs &amp; PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO-1 Calculate the demand of water as per the requirements and identify the sources of water	-	3	3	2	2	3	-	2	1	3	3	3
CO-2 Recognize water treatment method	-	3	3	2	2	3	-	2	1	3	3	3
CO-3 Suggest conveyance and distribution system of water as per the requirement	-	3	3	2	2	3	-	2	1	3	3	3
CO-4 Supervise the laying of pipeline works for collection and conveyance of sewage and plan and plan house drainage, rural sanitation and solid waste disposal	-	3	3	2	2	3	-	2	1	3	3	3
CO-5 Recognize the process of sewage treatment and disposal in urban areas	-	3	3	2	2	3	-	2	1	3	3	3

## O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO--1-10 PSO-1,2	CO-1 Calculate the demand of water as per the requirements and identify the sources of water	SO1.1 SO1.2 SO1.3 SO1.4		1.1.1 to 1.1.2 1.2.1 to 1.2.6 1.3.1 to 1.3.3	SL.1.1
PO--1-10 PSO-1,2	CO-2 Recognize water treatment method	SO.2.1 SO.2.2 SO2.3 SO2.4 SO2.5	LE 2.1    LE2.5 LE 2.2    LE2.6 LE 2.3    LE2.7 LE 2.4    LE2.8	2.1.1 to 2.1.2 2.2.1 to 2.2.5	SL.2.1
PO--1-10 PSO-1,2	CO-3 Suggest conveyance and distribution system of water as per the requirement	SO.3.1 SO3.2 SO3.3 SO3.4		3.1 3.2 3.3 3.4	SL3.1
PO--1-10 PSO-1,2	CO-4 Supervise the laying of pipeline works for collection and conveyance of sewage and plan and plan house drainage, rural sanitation and solid waste disposal	SO4.1 SO4.2 SO4.3 SO4.4		4.1 4.2 4.3 4.4	SL.4.1
PO--1-10 PSO-1,2	CO-5 Recognize the process of sewage treatment and disposal in urban areas	SO5.1 SO5.2 SO5.3 SO5.4		5.1 5.2.1 to 5.2.4	SL.5.1 SL 5.2

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

## **VII. Course Curriculum Detailing (Semester- IV)**

A) Course Code : 2020474(020)

B) Course Title : Concrete Technology

C) Pre-requisite Course Code and Title :

D) **Rationale** : Cement mortar and concrete are the most widely used and versatile construction materials. It is the material of choice where strength, impermeability, durability, performance, fire resistance and abrasion resistance are required. Concrete is generally a site-made material unlike other materials of construction and as such can vary to a great extent in its quality, properties and performance owing to use of natural materials except cement. The knowledge of concrete and its properties in the plastic condition and in hardened condition are highly important in order to make Civil Engineering Structure safe and serviceable. This course focuses on students' acquisition of knowledge, skills & practices in concrete works. The knowledge and application of such aspects is essential in developing a good technician who should be conversant with the tests of various components of concrete and site practices to maintain quality of concrete works.

E) **Course Outcomes** :

**CO 1 Identify the need of concrete and importance of each ingredient.**

**CO 2 Prepare concrete for different civil engineering works as per IS specification.**

**CO 3 Identify concrete for desired properties in hardened concrete and Use of special concrete.**

**CO 4 Prepare concrete mix design as per IS method.**

**CO 5 Apply prevention and repair techniques on concrete cracks.**

F) **Scheme of Studies:**

Board of Study	Course Code	Course	Scheme of Studies (Hours/Week)			Credit L+ T+P/2
			L	T	P	
Civil Engineering	2020474(020)	Concrete Technology	2	-	2	3

L- Lecture , T- Tutorial, P- Practical,

**Legend: Lecture (L) → CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture and others) .**

**Practical (P) → LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies ).**

**Tutorial (T) → SL:Self Learning**

**G) Scheme of Assessment:**

Board of Study	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
Civil Engineering	2020474(020)	Concrete Technology	70	20	30	30	50	200

ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment

**Legend - PRA : Process Assessment, PDA : Product Assessment**

**Note: i) TA in Theory includes Sessional work (SW) and attendance (ATT) with weightage of 70% and 30% of total respectively.**

**ii) TA in practical includes performance of PRA,PDA and Viva-Voce with weightage of 50%,40% and 10% respectively.**

**iii) 85% attendance is essential in theory and practical classes to appear in Examination.**

**H) Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

**CO-1 Identify the need of concrete and importance of each ingredient.**

(Approx. Hrs: CI+LI = 6+16)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1 Explain the importance of concrete in civil engineering works. SO 1.2 List out the various ingredients of concrete and their function. SO 1.3 Enumerate the quality of water in preparation of concrete. SO 1.4 Explain the importance of cement in concrete. SO 1.5 Explain the	LE 1.1 Determines fine silt in aggregate by field method. LE 1.2. Determine flakiness index and elongation index of coarse aggregate (IS 2386-Part I) LE 1.3. Determine specific gravity and water absorption of aggregate (IS-2386part III for aggregates of size 40 mm to 10 mm) LE 1.4 Determine the compressive strength of Portland cement (IS269) LE 1.5 Perform Field test of cement	<b>Unit-1.0</b> <b>Introduction to Concrete</b> <b>1.1 Introduction</b> 1.1.1 Concrete and its ingredients and their functions 1.1.2 Various mixes and grades 1.1.3 Various types of concrete and their uses 1.1.4 Advantages and disadvantages of concrete. <b>1.2 Ingredients of concrete</b> <b>(A) Water:</b> Requirements of quality of water in concrete as per IS:456-2000 and its function. <b>(B) Cement</b> 1.3.1 Function of cement in concrete 1.3.2 Ingredients of ordinary	SL 1.1 Identify traditional construction materials used other than concrete. SL 1.2 Identify alternative materials used for concrete instead of basic materials. SL 1.3 Explore the possibilities of use of recycled Concrete

Session Outcomes	Laboratory Instruction	Class room Instruction (CI)	Self Learning
importance of aggregate concrete.	LE 1.6 Determine of bulk density and voids of aggregates ((IS-2386part III) LE1.7Determine Fineness modulus of fine and coarse aggregate by sieve analysis. LE1.8Determine particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)	Portland cement and their function 1.3.3 Bougue's compounds and its functions 1.3.4 test on cement: fineness, standard consistency, initial & final setting times, compressive strength & soundness 1.3.4 Different types and Grades of cement as per IS Codes <b>1.4 Aggregates</b> 1.4.1 Classification: According to size, shape, texture and source. 1.4.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials soundness 1.4.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in- aggregate; fineness modulus; interpretation of grading charts	

**SW-1 Suggested Sessional Work (SW):****a. Assignments:**

1. Explain advantages and disadvantages of concrete.
2. Identify the major Bouge's compounds of cement? Discuss their roll in hydration of cement.
3. Differentiate between (a) Setting and hardening of cement (b) Quick setting and rapid hardening cement.
4. Explain consistency, initial and final setting time of cement.
5. How the aggregate classified according size, shape and texture.
6. Explain grading of aggregate and its significance? Describe the process of sieve analysis for determination of fineness modulus of an aggregate.
7. Discuss bulking of sand. If the sand is measured by volume and no allowance is made for bulking of sand, what will be its effect on concrete?

**b. Mini Project**

1. Find the compressive strength of concrete block using different aggregates.
2. Find the compressive strength of concrete block using different types of cement.
3. Find the compressive strength of concrete block using binding materials and different aggregates.

**CO-2 Prepare concrete for different civil engineering works as per IS specification.****(Approx. Hrs: CI+LI = 7+6)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>SO2.1 Describes basic terminology related to fresh concrete.</p> <p>SO2.2 Explain and recommend workability of concrete for different civil engineering works.</p> <p>SO 2.3 Explain concrete manufacturing process.</p> <p>SO 2.4 identify admixture for different concrete works.</p>	<p>LE2.1 Test for workability ( slump test): (a) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump (b) To test cube strength of concrete with varying water cement ratio</p> <p>LE2.2 Compaction factor test for workability (IS: 1199)</p>	<p><b>Unit-2 Fresh concrete</b></p> <p>2.1 Fresh concrete and its properties - water cement ratio, Workability, hardness, Segregation and bleeding</p> <p>2.2 Factors affecting workability</p> <p>2.1.3 Methods of measurement of workability</p> <p>Slump Test &amp; Compaction Factor Test Vee Bee consistometer, flow table test</p> <p>2.1.4 Recommended slumps for placement in various conditions as per IS:456-2000/SP-23</p> <p>2.1.5 Relation between workability and strength of concrete</p> <p>2.2 Batching of materials, Methods of mixing of concrete – Hand &amp; Machine Mixing, mixing time , Transportation and Placing of concrete.</p> <p>2.3 Ready mixed concrete ,proportioning ready mixed concrete, production of ready mixed concrete</p> <p>2.4 Methods of compaction of concrete and its suitability , Factors affecting compaction</p> <p>2.5 Finishing of concrete</p> <p>2.6 Curing and its importance , its methods and suitability ,Effect of curing on development of strength of concrete</p> <p>2.7 Admixtures and its benefits , Types of Admixtures - Accelerator and Retarder Plasticizer and Super Plasticizer and Air entraining admixture , Utility of Admixtures</p>	<p>SL 2.1 Identify effect of poor workability during construction.</p> <p>SL 2.2 Identify ill effect of segregation, bleeding, harshness on structure.</p> <p>SL 2.3 Explain effect of improper curing in construction</p> <p>SL 2.4 Identify new admixtures used in construction now a days.</p>

**SW-2 Suggested Sessional Work (SW) :****a. Assignments:**

1. List the limiting values of water cement ratios and cement content according to IS 456-2000 for some important situations?
2. Compare different methods to measure workability of concrete and recommend values for placement in various conditions.
3. Explain the effect of vibration on the strength of concrete? Explain the different types of vibrators.
4. Differentiate between volume batching and weigh batching in concrete mix procedure.
5. Explain methods of transportation of concrete.
6. Explain the ready mixed concrete with its classification.
7. Define curing of concrete and list methods of curing.

**b. Mini Project:**

1. Plot the effect of W/C ratio on Compressive Strength of Concrete using different admixtures.
2. Compare compressive strength of concrete using different admixtures.

**c. Other Activities (Specify):**

1. PPT on Prepare concrete for different civil engineering works as per IS specification.

**CO- 3 Identify desired properties in hardened concrete and Use of special concrete.****(Approx. Hrs: CI+LI = 6+8)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1 Describes basic terminologies related to hardened concrete. SO 3.2 Explain and perform various tests related to hardened concrete. SO 3.3 Identify use of special concrete for different construction works.	LE3.1. Conduct Split Cylinder Test  LE 3.2. Determine the compressive strength of concrete cubes.  LE 3.3 conduct Non destructive test on concrete (a) Rebound hammer test  LE 3.4 determine flexural strength of concrete beam	<b>Hardened Concrete</b> 3.1 Hardened Concrete and its Properties 3.2 Compressive Strength, Tensile Strength, Bond Strength, Flexure Strength Durability, impermeability 3.3 Factors affecting Compressive Strength 3.4 IS Test Procedure to find Compressive & Tensile Strength of Concrete, Acceptance Criteria, Mean Strength & Standard Deviation 3.5 Durability of Concrete & factors affecting it 3.6 Economy of Concrete & factors affecting it 3.7 Methods of Non Destructive Test of Concrete Rebound Hammer Test, Ultrasonic Pulse Velocity Test  3.9 Introduction to Special concrete: Light weight concrete, Mass concrete, Fibre reinforced concrete, Polymer concrete, High	SL 3.1 Explain Creep of Concrete & its effect, factors affecting Creep SL 3.2 State Importance of NDT. SL 3.3 summarizes different types of special concrete.



Session Outcomes	Laboratory Instruction (LI)	Class room Instruction	Self Learning
		density concrete, No fines concrete, Ferro cement, Shortcrete	

**SW-3 Suggested Sessional Work (SW) :****a. Assignments:**

1. Enumerate the fundamental factors influencing the compressive strength of concrete.
2. How are the compressive and flexural strength of concrete determined?
3. Discuss the various aspect of durability of concrete. What measures are suggested by IS 456-2000 to ensure durable structures.
4. What is non destructive test of hardened concrete? Describe ultrasonic pulse velocity test.
5. Discuss the properties of structural lightweight concrete and its applications.
6. Define is shotcrete? Explain the procedure of shotcreting a surface.
7. Explain fibre reinforced concrete and its advantages.
8. Explain ferrocement.
9. Enlist polymer concrete composites.

**CO- 4 Prepare concrete mix design as per IS method.****(Approx. Hrs: CI+LI = 7+2)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Explain the need of quality control. SO4.2 Interpret concrete mix design. SO4.3 Perform Concrete Mix Design as per I. S. Method	LE 4.1 Perform Concrete Mix Design by weight batching as per I. S. Method.	<b>Concrete Mix design</b> 4.1 Factors causing variation in quality of concrete, 4.2 Field Control , Advantages of Quality control. 4.3 Statistical Quality control. 4.4.1 Concrete Mix Design and its importance. 4.4.2 Nominal Mix and Design Mix. 4.4.3 Factors affecting concrete mix design. 4.4.4 Different methods of Mix Design and its suitability. 4.5 I.S. method to design a Concrete Mix As per IS 10262-2009. 4.6 Example of Mix design as per I.S. method 4.7 safety precautions observed	SL4.1 Distinguish the volumetric analysis and analytical (by weight) analysis.  SL 4.2 Compare the mix design using different quality of aggregates.

**SW-4 Suggested Sessional Work (SW):****a. Assignments:**

1. Briefly explain the factors causing variation in the quality of concrete. What parameters are used in measuring this variability?
2. Identify the advantages of quality control?

3. Enlist the factors governing the design of concrete mix.
4. Describe the procedure for concrete mix proportioning using IS 10262-2009 with the help of its flow chart.
5. Define trial mixes and how do they help in achieving the objectives of mix design?

**b. Mini Project**

1. Mix design for given set of data.

**CO- 5 Apply prevention and repair techniques on concrete cracks.**

(Approx. Hrs: CI+LI = 6)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Identifies the cause for deterioration/defects of concrete and its prevention. SO5.2 Identifies the cause for corrosion in reinforcement and its prevention. SO5.3 Explains Types, causes and remedies of concrete cracks before hardening and after hardening. SO5.4 Summarize materials to use for repair cracks. SO5.5 Apply different methods to repair cracks in concrete.		<b>Defects and Repair of concrete</b> 5.1 Deterioration of concrete, Types of deteriorations and its effects, Prevention of concrete deterioration 5.2 Corrosion of reinforcement, Effect of corrosion of reinforcement in concrete and remedial measures 5.3 Types, causes and remedies of concrete cracks before hardening and after hardening 5.4 Evaluation of cracks, methods of evaluation of cracks 5.5 Prevention of cracks , Materials for repair of cracks ,Methods used for repair of cracked Concrete 5.6 Repair and strengthening of column, repair of concrete floor slab system, overlays and surface treatments, underwater repairs. 5.7 Strengthening of damaged structures, section enlargement, Strengthening of beams and slabs.	5.1 Latest research and development in the field of concrete technology 5.2 Journals available in the library, its publishers, Editors and place of publications. 5.3 The various authorities in the field of concrete technology and their field of specialization.

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

**SW-5 Suggested Sessional Work (SW) :****a. Assignments:**

1. Enumerate types of deteriorations, its effects and Prevention.
2. Explain effect of corrosion and its remedial measures.
3. Explain briefly the purpose and procedure for the damage assessment in concrete element.
4. Write short notes on materials and methods used for repair of cracks in Concrete.
5. Explain briefly the strengthening of deficient structures.

**b. Mini Project:**

Prepare a report on cracks in the college building and its causes.

**c. Other Activities (Specify):**

1. Describe common types of repairs of cracks.
- .

**Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.**

**I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):**

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
I	Introduction to Concrete	4	6	4	14
II	Fresh concrete	4	6	4	14
III	Hardened Concrete	4	6	4	14
IV	Concrete Mix design	4	6	4	14
V	Defects and Repair of concrete	4	6	4	14
Total		20	30	20	70

Legend: R: Remember, U: Understand, A: Apply and above

**J) Suggested Specification Table (For ESA of Laboratory Instruction\*):**

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
LE 1.1	Determines fine silt in aggregate by field method.	25	20	05
LE 1.2	Determine flakiness index and elongation index of coarse aggregate (IS 2386-Part I)			
LE 1.3	Determine specific gravity and water absorption of aggregate (IS2386part III for aggregates of size 40 mm to 10 mm)			
LE 1.4	Determine the compressive strength of Portland cement (IS-269) LE 1.6 Perform Field test of cement			
LE 1.5	Determine of bulk density and voids of aggregates ((IS2386part III)			
LE 1.6	Determine particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)			
LE 1.7	7Determine Fineness modulus of fine and coarse aggregate by sieve analysis.			
LE 1.8	Determine particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)			

LE2.1	Test for workability (slump test): (a) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump (b) To test cube strength of concrete with varying water cement ratio			
LE2.2	Compaction factor test for workability (IS: 1199)			
LE3.1.	Conduct Split Cylinder Test			
LE 3.2.	Determine the compressive strength of concrete cubes.			
LE 3.3	conduct Non destructive test on concrete (a) Rebound hammer test (b) Ultrasonic pulse velocity test			
LE 3.4	Determine flexural strength of concrete beam			
LE 4.1	Perform Concrete Mix Design by weight batching as per I. S. Method.			

\* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

**Legend :** PRA: Process Assessment, PDA : Product Assessment

**Note :** Only one experiment has to performed at the end semester examination of 30 Marks as per assessment scheme

**K) Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Industrial visits
5. Industrial Training
6. Field Trips
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
9. Brainstorming
10. Others

**L) Suggested Learning Resources:****(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Concrete Technology	M. S. Shetty	S. Chand	
2	Concrete Technology	M. L. Gambhir	Tata Mcgraw Hill Education Private Limited	5 <sup>th</sup> , 2013
3	Concrete Technology	S. S. Bhavikatti	I. K. International Publishing House	2015
4	Concrete Technology	A.R.Santhakumar	Oxphord University Press	

**(b) Open source software and website address :**

1. nptel.ac.in
2. swayam portal

**M) List of Major Laboratory Equipment and Tools:**

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Flakiness and Elongation gauge	As per IS CODE 2386Part I	LE 1.2
2	Weighing Machine	50 kg, 10 kg, 1 kg	LE 1.2,, LE 1.3, LE 1.4, LE 1.7, LE 1.8,LE 4.1
3	Sieve set	IS standard sieve sets 80 mm, 40 mm, 20 mm, 10 mm, 4.75 mm, 30 cm dia sieve with lid and pan	LE 1.7, LE 1.8, LE 4.1
4	Sieve Shaker	motorised	LE 1.7 , LE 1.8
6	Automatic electric Oven	Automatic electric Oven	LE 1.3
7	Compression testing	2000 KN Compression testing machine, 9	LE 1.4, LE 3.2

	machine with mould and complete set	nos 7.06 X 7.06 X 7.06 cm <sup>3</sup> mould, 9 nos 15 X 15 X 15 T cm <sup>3</sup> mould ,temping Rod, spatula	
8	Vibrating table	Electrically operated	LE 3.2
9	Sieve set for FA	IS standard sieve sets 4.75 mm, 2.36 mm, 1.18 mm, 600 microns, 300 microns, 150 microns, 90 microns , 75 microns, 20 cm dia sieve with lid and pan	LE 1.7, LE 1.8, LE 4.1
9	Slump cone apparatus	Slump cone apparatus set as per IS code	LE 2.1
10	Compaction factor test IS: 1199	Compaction factor apparatus complete set as per code IS: 1199	LE 2.2
12	Split cylinder test apparatus for tensile strength of concrete	10 cm X 30 cm cylinder	LE 3.1
13	Rebound hammer apparatus	IS I 3311	LE 3.3
14	UTM	20 Ton capacity,	LE 3.2 ,LE 3.4

## N) Mapping of POs &amp; PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline Knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO 1 Identify the need of concrete and importance of each ingredient.	-	3	3	2	-	1	-	1	-	2	3	3
CO 2 Prepare concrete for different civil engineering works as per IS specification.	-	3	3	2	-	1	-	1	-	2	3	3
CO- 3 Identify desired properties in hardened concrete and Use of special concrete.	-	3	3	2	-	1	-	1	-	2	3	3
CO- 4 Prepare concrete mix design as per IS method.	-	3	3	2	-	1	-	1	-	2	3	3
CO- 5 Apply prevention and repair techniques on concrete cracks.	-	3	3	2	-	1	-	1	-	2	3	3



## O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-2,3,4,6,8,10 PSO-1,2	CO - 1 Identify the need of concrete and importance of each ingredient.	SO1.1 SO1.2 SO1.3 SO 1.4 SO 1.5	LE1.1 LE 1.5 LE1.2 LE 1.6 LE1.3 LE 1.7 LE 1.4 LE 1.8	1.1.1-1.1.4 1.2 1.3.1-1.3.4 1.4.1-1.4.3	SL 1.1 SL 1.2
PO-2,3,4,6,8,10 PSO-1,2	CO - 2 Prepare concrete for different civil engineering works as per IS specification	SO.2.1 SO.2.2 SO2.3 SO 2.4	LE. 2.1 LE. 2.2	2.1.1-2.1.5 2.2-2.7	SL 2.1 SL 2.2 SL 2.3 SL 2.4
PO-2,3,4,6,8,10 PSO-1,2	CO- 3 Identify desired properties in hardened concrete and Use of special concrete.	SO.3.1 SO3.2 SO3.3	LE3.1 LE 3.2 LE3.3 LE3.4	3.1-3.9	SL 3.1 SL 3.2 SL 3.3
PO-2,3,4,6,8,10 PSO-1,2	CO- 4 Prepare concrete mix design as per IS method.	SO4.1 SO4.2 SO4.3	LE4.1	4.1-4.3 4.4.1-4.4.4 4.5-4.7	SL 4.1 SL 4.2
PO-2,3,4,6,8,10 PSO-1,2	CO- 5 Apply prevention and repair techniques on concrete cracks.	SO5.1 SO5.2 SO5.3 SO 5.4 SO 5.5		5.1-5.7	SL 5.1 SL 5.2 SL 5.3

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

## **VII. Course Curriculum Detailing (Semester- IV)**

- A) **Course Code** : 2020475(020)  
B) **Course Title** : TRANSPORTATION ENGINEERING  
C) **Pre- requisite Course Code and Title** :

D) **Rationale** :

Transportation engineering has been identified as one of the most important subject for civil engineers. This subject covers Highway, Railway and Bridges.

Highway engineering is one of the major areas Civil Engineering construction where employment for Diploma civil engineers for its construction and maintenance having very vast scope. In this scenario standards of highway engineering are continuously being improved with latest technology. Highway engineers must know highway geometrics, materials for highway construction and construction methods the knowledge of roads drainage system its maintenance is also needed for Civil Engineering diploma pass-outs.

Railway and bridges are important elements of transportation engineering. Curriculum intends to give adequate knowledge about railway as well as bridge engineering. It is to cater the needs of the technician engaged in the survey, investigation, planning and construction of railway and bridges. This subject aims at basic knowledge about railway and bridges in respect of their various types, materials used, functions of component parts, methods of construction, aspects of supervision and maintenance. Site visits will be of immense value for attaining this goal.

E) **Course Outcomes** :

**CO-1 Plan a new road, explain road geometric parameters and recognize traffic engineering.**

**CO-2 Supervise highway construction as per the given drawings and specifications.**

**CO-3 (a) Explain railway track geometrics.**

**(b) Describe railway track materials.**

**CO-4 Explain points and crossings and track junctions; stations and yards and signaling ,control system and Interlocking .**

**CO-5 (a) Explain Site Selection & investigation for bridge, waterway and describe bridge substructure.**

**(b) Describe bridge superstructure.**

**F) Scheme of Studies:**

Board of Study	Course Code	Course	Scheme of Studies (Hours/Week)			Credit L+ T+P/2
			L	T	P	
Civil Engineering	2020475 (020)	Transportation Engineering	3	0	2	4

L- Lecture , T- Tutorial, P- Practical,

**Legend: Lecture (L)** → CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture and others) .

**Practical (P)** → LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies ).

**Tutorial (T)** → SL:Self Learning

**G) Scheme of Assessment:**

Board of Study	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
Civil Engineering	2020475 (020)	Transportation Engineering	70	20	30	30	50	200

ESE: End Semester Exam, CT: Class Test , TA: Teachers Assessment

**Legend** - PRA : Process Assessment, PDA : Product Assessment

**Note: i) TA in Theory includes Sessional work (SW) and attendance (ATT) with weightage of 70% and 30% of total respectively.**

**ii) TA in practical includes performance of PRA,PDA and Viva-Voce with weightage of 50%,40% and 10% respectively.**

**iii) 85% attendance is essential in theory and practical classes to appear in Examination.**

**H) Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

**CO1- Plan a new road, explain road geometric parameters and recognize traffic engineering.**

**(Approx. Hrs: CI+LI= 9)**

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Class room Instruction (CI)</b>	<b>Self Learning (SL)</b>
SO1.1 Explain classification of roads as per IRC. SO1.2 Describe highway alignment and recognize surveys for highway alignment. SO1.3 Recognise cross section elements of highway geometrics. SO 1.4 Explain stopping sight distance. SO1.5 Explain superelevation. SO1.6 Describe traffic studies.		<b>UNIT-1 Highway Alignment ,Geometrics And Traffic Engineering</b> <b>1.1 Highway Alignment and Surveys</b> -Classification of roads as per IRC, Highway alignment, requirements of highway alignment, factors controlling alignment, map study, reconnaissance survey, preliminary survey. final location and detailed, surveys, drawings and reports. <b>1.2 Highway Geometrics</b> 1.2.1 Cross Section Elements - pavements characteristics , camber, width of pavement, traffic separators, kerbs, road margins, formation width, right of way, typical cross section of roads as per IRC. 1.2.2 Sight Distance- Sight distance, total reaction time, Stopping Distance ,Stopping Sight Distance, Overtaking Sight Distance, over taking zones, sight distance at intersections. 1.2.3 Horizontal Alignment - Horizontal curves, super elevation ,necessity of superelevation, radius and degree of curve,	SL1.1 Students are advised to study functions of IRC, CRRI, MORTH , NHAI

		<p>extra widening of pavements at horizontal curves, horizontal transition curves, object of providing transition curves.</p> <p>1.2.4 Vertical Alignment – gradient, classification of gradients, compensation in gradient at curves, vertical curves.</p> <p>1.3. Traffic Engineering-</p> <p>1.3.1 Traffic studies- traffic volume studies, origin and destination study, traffic capacity study, passenger car unit (PCU) and capacity of roads as per IRC.</p> <p>1.3.2 Traffic Operation - Traffic regulations, traffic control devices – traffic signs and signals, road marking.</p> <p>1.3.3 Channelization- Traffic islands, unchannelized and channelized intersections, Rotary intersection, advantages and limitations of traffic rotary.</p>	
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### SW-1 Suggested Sessional Work (SW):

#### a. Assignments:

1. State the requirements of an ideal highway alignment. Explain the factors controlling highway alignment.
2. What are the various objectives of preliminary survey for highway alignment?
3. Draw cross section details of a road in embankment and cutting.
4. State the object of providing camber. Give value of camber for different type of road surfaces.
5. State sight distance, stopping distance, stopping sight distance, overtaking sight distance and sight distance at intersections.
6. Define maximum and minimum superelevation. State the objects of providing transition curves.
7. State the object of providing widening pavements on horizontal curves.

8. Explain compensation in gradient at curves.
9. Explain the term traffic volume. Indicate how the traffic volume data are presented and the results used in traffic engineering.
10. Define traffic density, traffic capacity, passenger car unit (PCU). Give practical capacity values suggested by IRC for different types of roads.
11. Explain various types of traffic signals and their functions.
12. With neat sketches show few typical patterns of unchannelized and channelized intersections. State the advantages and limitations of traffic rotary.
- b. Mini Project:  
Draw a map showing National and State highway net work in Chhattisgarh.

**CO-2 Supervise highway construction as per the given drawings and specifications.**

(Approx. Hrs: CI+LI = 9 + 32)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Explain CBR value. SO2.2 Demonstrate tests on road materials. SO 2.3 Describe properties of bituminous materials. SO2.4 Explain construction of bituminous pavement. SO2.5 Explain construction of concrete pavement. SO2.6 Explain the types and layout of drainage system.	LE2.1 To conduct CBR test of sub base and sub-grade materials LE2.2 To determine Impact value of given aggregate LE2.3 To determine Crushing value of given aggregate LE2.4 To determine Abrasion value of given aggregate LE2.5 To determine Flakiness and Elongation index of given aggregate LE2.6 To determine Penetration value of Bitumen/Tar LE2.7 To determine Ductility of Bitumen/Tar LE2.8 To determine Flash and fire point of Bitumen/Tar LE2.9 To determine Softening point of Bitumen/Tar LE2.10 To determine	Unit 2.0 <b>2.1 Pavement Materials and Highway Construction</b> <b>2.1 Pavement materials -</b> 2.1.1 Significance of subgrade soil, California Bearing Ratio (CBR). 2.1.2 Stone Aggregates-Desirable properties of road aggregate, Tests for road aggregate-crushing test, Abrasion test, impact test, soundness test, shape test, specific gravity and water absorption test. 2.1.3 Bituminous Materials-Bitumen, requirements of bitumen, tests on bitumen – penetration test, ductility test, flash and fire point test,	SL2.1 Study road side arboriculture.

Session Outcomes	Laboratory	Class room	Self Learning
	Viscosity test of Bitumen/Tar	<p>softening point test, viscosity test, cutback bitumen, bituminous emulsion, tar, tests on tar.</p> <p><b>2.2 Highway Construction –</b></p> <p>2.2.1 Earthwork- Excavation, excavation equipments, embankment, construction of embankment, compacting equipments.</p> <p>2.2.2 Construction of earth roads, Gravel roads, WBM Roads</p> <p>2.2.3 Construction of Bituminous Pavements –</p> <p>Types of Bituminous construction, construction procedure with equipments for-surface dressing, penetration macadam, bituminous macadam, premixed bituminous carpet, bituminous concrete.</p> <p>2.2.4 Construction of Cement Concrete Pavements –Materials, plants and equipments, construction steps, joints in cement concrete pavements – expansion joint, contraction joint, construction joint, longitudinal joints.</p> <p><b>2.3 Drainage of Roads</b></p> <p>2.3.1 Importance of Road drainage.</p> <p>2.3.2 Requirements of road drainage system</p> <p>2.3.2 Surface drainage</p>	



Session Outcomes	Laboratory	Class room	Self Learning
		system, cross drainage and subsurface drainage 2.3.4 Drainage of slopes and erosion control.	

**SW-2 Suggested Sessional Work (SW) :****c. Assignments:**

- 1 Explain California Bearing Ratio.
2. Specify the desirable values of various test results on road aggregates.
3. What are the different types of bituminous materials used in road construction? Give the circumstances under which each these material is preferred.
4. Specify the desirable values of various test results on bituminous materials.
5. Write short notes on –
  - (i) Surface dressing
  - (ii) Penetration macadam
  - (iii) Bituminous macadam
  - (iv) Premixed bituminous carpet
  - (v) Bituminous concrete.
6. Enumerate the steps in construction of cement concrete pavement.
7. Explain the following types of joints in cement concrete pavement with neat sketches -
  - (a) Expansion joint
  - (b) Contraction joint
  - (c) Construction joint
  - (d) Longitudinal joint.
- 8 Discuss the importance of highway drainage.
9. What are the requirements of a good highway drainage system?
10. Sketch layout of a road drainage system.

**CO-3 (a) Explain railway track geometrics.****(b) Describe railway track materials.****(Approx. Hrs: CI+LI= 10)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Identify components of railway tracks and draw typical cross sections of railway tracks. SO3.2 Explain superelevation. SO3.3 Explain function of ballast, ballast section and profile SO3.4 Recognise		<b>UNIT-3 (a)Railway Track Geometrics</b> 3.1.1Permanent way, Requirements of ideal permanent way, gauges, selection of gauges, uniformity of gauges, railway track cross sections, coning of wheels. 3.1.2 Gradient, types of gradients, grade compensation. 3.1.3 Degree of curve,	SL 3.1 Study of organization of Indian railways. SL 3.2 Compare Railway and Highway Transport.

Session	Laboratory	Class room Instruction	Self Learning
<p>requirements of sleeper and describe prestressed concrete sleeper.</p> <p>SO3.5 Describe wear of rails, rail joints and creep of rails.</p> <p>SO3.6 Enumerate various rail fixtures and fastenings and state their functions.</p>		<p>superelevation or Cant, Object of providing superelevation, determination of superelevation, cant deficiency, limits of superelevation and Cant deficiency, transition curves and its necessity, curve indicators, purpose, necessity of providing check rails on curves, Extra widening on curves, Extra Clearance on curves</p> <p><b>(b) Railway track Materials</b></p> <p><b>3.2.1 Ballast-</b> functions, requirements of good ballast, types of ballast, ballast size and gradation, ballast section and profile, methods of packing ballasts</p> <p><b>3.2.2 Sleepers-</b> Functions, types of sleeper, requirements of sleeper, prestressed concrete sleeper, merits, demerits, limitations and service life of prestressed concrete sleepers,</p> <p><b>3.2.3 Rails –</b>Function of rail, requirement of rail section, Types of rails sections, Standard rail section, Length of rails, Wear of rails, Cause and methods to reduce wear of rails, rail joints, requirements of an ideal joint, types of rail joints, Welding of rail joints, Length of welded rails, Creep of rails, its indication, effect, measurement, preventions.</p> <p><b>3.2.4 Rail fixtures and fastening-</b>Purpose, types of fastening, Fish plates, requirements of fish plates, section of fish</p>	

Session	Laboratory	Class room Instruction	Self Learning
		plates, slide chair, bearing plates, keys, elastic fastenings, functions of elastic fastenings, elastic rail pad, elastic rail clip.	

**SW-3 Suggested Sessional Work (SW):****a. Assignments:**

1. Mention the requirements of an ideal permanent way.
2. Draw typical cross section of permanent way. Discuss in brief the basic functions of various components of railway track.
3. Define gauge of railway track. Enumerate different gauges used in India.
4. Discuss the necessity and effects of coning of wheels and tilting of rails.
5. Explain the necessity of gradients. Discuss all the types of gradients giving their permissible values.
6. Define superelevation. State the objects of providing superelevation. Explain cant deficiency and negative superelavation.
7. Write short notes on –  
(i) Extra widening on curves (ii) Extra clearance on curve.
8. State functions, requirements of ballast and draw ballast profile.
9. State functions and requirements of sleepers.
10. Describe prestressed concrete sleeper .
11. State the functions of rails. Discuss various causes of wear and suggest suitable measures to reduce wear.
12. Write notes on-  
(i) Creep in rails. (ii) Fish plate joint.  
(iii) Elastic spikes.

**b. Mini Project:**

1. Visit railway track construction and maintenance site and prepare a report on construction and maintenance procedure giving details of railway track materials used.

**CO- 4 Explain points and crossings and track junctions; stations and yards and signaling, control system and Interlocking .****(Approx. Hrs CI+LI = 10 hrs)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Describe points and crossings. SO4.2 Identify track junctions. SO4.3 Explain stations and yards. SO4.4 Recognise equipments in stations and yards.		<b>UNIT 4- Points and Crossings and Track Junctions; Layout of Stations and Yards and Signaling and Control System</b> <b>4.1 Points and Crossings and Track Junctions</b> 4.1.1 Necessity of points and crossings,	<b>LE4.1</b> Study Centralized Traffic Control System and Automatic Train Control system,

Session Outcomes	Laboratory Instruction	Class room	Self
<p>SO4.5 Classify signals and describe semaphore signal and colour light signal.</p> <p>SO4.6 Explain train control system and interlocking.</p>		<p>turnout, important terms used in points and crossings, Points or Switches types of switches; Crossings, types of crossings.</p> <p>4.1.2 Turnouts, Symmetrical split, Three throw switch, double turnout, Diamond crossing, Cross over, Single and Double slip, Scissors cross over, Gathering lines, Triangle</p> <p><b>4.2 Stations and Yards –</b></p> <p>4.2.1 Requirements of a railway station, Classification, and description of railway stations, Passenger platforms- requirements, length and width, clearance, height; Goods platform- requirements, Station Yards- Passenger Bogie Yards, Goods Yards, Marshalling Yards, Locomotive Yards.</p> <p>4.2.2 Necessity of equipments in station yards, Cranes, Weigh Bridges, Loading Gauges, End Loading Ramps, Engine Sheds, Triangle, Turn Table, Traverser, Scotch Block, Derailing switch, Fouling Marks, Buffer Stops, Sand Hump</p> <p><b>4.3 Signaling, Control Systems and Interlocking –</b> Objects of signaling, classification of signals, Semaphore signal, warning signal,</p>	

Session Outcomes	Laboratory Instruction	Class room	Self
		shunting signal, colour light signals, reception and departure signals, control of train movements, Absolute Block System, Automatic Block System, Necessity and functions of interlocking.	

**SW-4 Suggested Sessional Work (SW) :****a. Assignments:**

1. Draw a neat diagram of simple right hand turnout and its various component parts. Define different terms and explain the working principle of turnout.
2. Explain with neat sketch (i) Acute and Obtuse angle crossing (ii) Point and splice rail.
3. Explain the following-
  - (i) Scissors cross over
  - (ii) Three throw switch
  - (iii) Double turnout
  - (iv) Single slip and double slip.
  - (v) Gathering lines
  - (vi) Triangle
4. What are the functions of railway station? Discuss various requirements of railway station.
5. Explain and discuss the following by means of sketches;
  - (i) Way side stations
  - (ii) Junction stations
  - (iii) Terminal stations
6. Describe passenger and goods platform.
7. Explain block stations.
8. Explain marshalling yard with neat sketch.
9. Explain with help of sketches- Turn Table, Buffer Stop, Fouling Mark, Derailing switch.
10. Explain clearly the location and application of Outer signal, Home signal, Starter signal, Advance starter signal, Point indicators.
11. Write short notes on Semaphore signal, Colour light signals.
12. Explain the principle of interlocking.

**b. Mini Project:**

1. Visit railway station and study working of points and crossing and signaling and inter locking system.

**CO-5 (a) Explain Site Selection & investigation for bridge, waterway and describe Bridge substructure.**

**(b) Describe bridge superstructure.**

**(Approx.Hrs CI+LI = 10 hrs)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Identify the components of a given type of bridge with their functions. SO5.2 Explain waterway and economical span the bridge. SO5.3 Identify components of bridge substructure. SO5.4 Describe the type of superstructure for permanent bridge. SO5.5 Describe the construction procedure for given type of bridge.		<b>UNIT 5-(a) Bridge Classification ,Site Investigation and Bridge Substructure</b> <b>5.1.1 Classification-</b> classification of bridge according to span, material, life, alignment, HFL, loading, level of bridge floor. <b>5.1.2 Site Selection &amp; Investigation –</b> factors affecting selection of site for bridge, bridge alignment-factors controlling alignment, bridge site investigation. <b>5.1.3 Waterway-</b> Waterway, economic span, afflux, scouring, free board, Standard values of clearances and freeboard as per IRC. <b>5.1.4 Bridge sub structure-</b> components of bridge –pier, abutment, wing wall, foundation, bearings <b>Unit 5(b) Bridge Super Structure</b> <b>5.2.1 Permanent Bridges-</b> Types of RCC bridges- slab, slab and girder, prestressed concrete bridges, advantages of prestressed concrete bridges, <b>5.2.2 Construction-</b> steps involved bridge construction, erection of steel girder and truss bridges, erection of RCC bridges.	SL5.1 Study Arch, open or slab, pipe and box culverts.

**SW-5 Suggested Sessional Work (SW) :**

**a. Assignments:**

1. State the requirements of an ideal bridge site.
2. Classify the bridges.
3. Describe the aspects to be studied with respect to bridge alignment.
4. What are the components of bridge substructure? Mention the function of each.
5. Discuss the various types of abutments.
6. Describe the usual types of bridge piers.
7. Explain the various types of wing walls.
8. State different types of bridge floors.
9. Draw a neat sketch of RCC bridge.
10. State the advantages of prestressed concrete super structure.
11. Explain the process of construction of prestressed concrete super structure.
12. Explain erection steel bridge.

**b. Mini Project:**

1. Visit nearby bridge construction site and various aspects of construction bridge substructure.

**I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):**

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
<b>I</b>	<b>Highway Alignment and Geometrics and Traffic Engineering</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>14</b>
<b>II</b>	<b>Pavement Materials and Highway Construction</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>14</b>
<b>III</b>	<b>Railway Track Geometrics and Railway track Materials</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>14</b>
<b>IV</b>	<b>Points and Crossings and Track Junctions; Layout of Stations and Yards and Signaling and Control System</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>14</b>
<b>V</b>	<b>Bridge Classification ,Site Investigation , Bridge Substructure and Super Structure</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>14</b>
<b>Total</b>		<b>20</b>	<b>30</b>	<b>20</b>	<b>70</b>

**Legend:** R: Remember, U: Understand, A: Apply and above

**J) Suggested Specification Table (For ESA of Laboratory Instruction\*):**

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
LE 2.1	To conduct CBR test of sub base and sub-grade materials	25	20	5
LE 2.2	To determine Impact value of given aggregate			
LE 2.3	To determine Crushing value of given aggregate			
LE 2.4	To determine Abrasion value of given aggregate			
LE 2.5	To determine Flakiness and Elongation index of given aggregate			
LE 2.6	To determine Penetration value of Bitumen/Tar			

LE 2.7	To determine Ductility test of Bitumen/Tar			
LE 2.8	To determine Flash and Fire point of Bitumen/Tar			
LE 2.9	To determine Softening point of Bitumen/Tar			
LE 2.10	To determine Viscosity test of Bitumen/Tar			

\* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

**Legend :** PRA: Process Assessment, PDA : Product Assessment

**Note :** Only one experiment has to performed at the end semester examination of 30 Marks as per assessment scheme

**K) Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field visit
8. Others

**L) Suggested Learning Resources:**

**(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Highway Engg.	S.K.Khanna &C.E. Justo	Nem chand & Brothers	Latest Revised
2.	Principles & Practice of Highway Engg.	L.R. Kadiyali	Khanna Publications New Delhi	Latest Revised Edition
3.	Course in Highway Engg	S.P. Bindra	Dhanpat Rai Publication New Delhi	Latest Revised Edition
4.	Fundamental Principles of Road Engg.	V.B. Priyant	Charotar Publications, Anand (Gujrat)	Latest Revised Edition



5.	Traffic Engineering (Hindi)	Shivanand Kamde	Deepak prakashan Gwalior (M.P.)	Latest Revised Edition
6.	IRC Publications	-	Indian Roads Congress	Latest Revised Edition
7.	Textbook of Railway Engg	S.C. Saxena nad S.P. Arora	Dhanpatrai & sons, Delhi.	Latest Revised Edition
8.	Railway Bridge and Tunnel Engg.	A K Upadhyay	S K Katariya and sons	Latest Revised Edition
9.	Text book of railway engineering	R.B.Deshpandey United Book corp. pons		Latest Revised Edition
10.	Bridge Engineering	Ponnuswamy S.	McGrawhill Education, New Delh	Latest Revised Edition
11.	Railway Bridge and Tunnel Engg.	ShivanandKamde	University Book Publishing House, Jaipur	Latest Revised Edition

**(b) Open source software and website address :**

1. <https://civiltoday.com>
2. [https:// theconstructor.org](https://theconstructor.org)
3. <https://nptel.ac.in>

**M) List of Major Laboratory Equipment and Tools:**

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	CBR value Test apparatus	As per IS :9669 IS 2720 part (XXXI) The CBR Test Machine is complete with • Load Ring, 50 kN • Digital Dial Gauge with Connection Bracket, Accuracy 25x0.01 mm • Penetration Piston	LE 2.1
2	Aggregate Impact testing apparatus	Consist of steel cap ,steel hammer, cylindrical measures, tamping rod <b>As per IS9377-1979</b>	LE 2.2
3	Crushing value apparatus	Consisting assembly of cylindrical cell with base plate and plunger, tamping rod <b>As per IS :9376</b>	LE 2.3
4	Los Angeles abrasion value apparatus	The apparatus as per IS: 2386 (Part IV) – 1963 consists of:  1. Los Angeles Machine 2. Abrasive charge: Cast iron or steel balls, approximately 48mm in	LE 2.4

		<p>diameter and each weighing between 390 to 445 g; six to twelve balls are required.</p> <p>3.Sieve: 1.70, 2.36, 4.75, 6.3, 10, 12.5, 20, 25, 40, 50, 63, 80 mm IS Sieves.</p> <p>4.Balance of capacity 5 kg or 10 kg</p> <p>5.Drying oven</p> <p>6.Miscellaneous like tray</p>	
5	Flakiness and Elongation index apparatus	Complete assembly is chrome plated which includes frame with the sliding panel with accurate slots of standard width and length. It is fabricated in compliance with <b>IS: 2386</b> standards	LE 2.5
6	Penetration value apparatus	As per IS 1203 Automatic Bitumen Penetrometer Electrically Operated (Digital Timer), including adjustable weight arrangement & standard accessories.	LE 2.6
7	Ductility test of bitumen Apparatus	As per IS -1205 with single gear box	LE 2.7
8	Flash and fire point apparatus	As per IS:1209 Pensky –Martens closed tester consist of cup lid, stirrer device, flame exposor device, Thermometer	LE 2.8
9	Softening point test Apparatus	As per IS:1205 1978 Complete set with steel ball, ring & thermometer	LE 2.8
10	Viscosity test Apparatus	As per IS:1206 Part 2 B-1.1 600 Micron IS Sieve – A circular sieve approximately 100mm diameter and 40 mm height ,Metal or Glass Dish – A small metal or glass dish about 110mm in diameter (such as a clock glass) ,Oven – A well ventilated oven thermostatically controlled to 100 to 1100 C , Balances – 250 g accurate to 0.01 g and 10 kg capacity accurate to 1 g ,Container – A clean, weighed, 1.5- liter container.	LE 2.9

## N) Mapping of POs &amp; PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO-1 Plan a new road, explain road geometric parameters and recognize traffic engineering.	1	3	3	3	3	2	-	3	-	2	3	3
CO-2 Supervise highway construction as per the given drawings and specifications.	1	3	3	3	3	2	-	3	-	2	3	3
CO-3 (a) Explain railway track geometrics. (b) Describe railway track materials.	1	3	3	3	3	2	-	3	-	2	3	3
CO-4 Explain points and crossings and track junctions; stations and yards and signaling, control system and Interlocking	1	3	3	3	3	2	-	3	-	2	3	3
CO-5(a) Explain Site Selection & investigation for bridge, waterway and describe bridge substructure. (b) Describe bridge superstructure.	1	3	3	3	3	2	-	3	-	2	3	3

## O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,8,10 PSO-1,2	CO-1 Plan a new road, explain road geometric parameters and recognize traffic engineering.	SO1.1 SO1.4 SO1.2 SO1.5 SO1.3 SO1.6	—	1.1 1.2.1-1.2.4 1.3.1-1.3.3	SL.1.1
PO-1,2,3,4,5,6,8,10 PSO-1,2	CO-2 Supervise highway construction as per the given drawings and specifications.	SO2.1 SO2.4 SO2.2 SO2.5 SO2.3 SO2.6	LE 2.1 LE2.6 LE 2.2 LE2.7 LE 2.3 LE2.8 LE 2.4 LE2.9 LE 2.5 LE2.10	2.1.1 - 2.1.3 2.2.1 – 2.2.4 2.3.1 - 2.3.4	SL.2.1
PO-1,2,3,4,5,6,8,10 PSO-1,2	CO-3(a) Explain railway track geometrics. (b) Describe railway track materials.	SO3.1 SO3.4 SO3.2 SO3.5 SO3.3 SO3.6	—	3.1.1 – 3.1.3 3.2.1 – 3.2.4	SL3.1 SL3.2
PO-1,2,3,4,5,6,8,10 PSO-1,2	CO-4 Explain points and crossings and track junctions; stations and yards and signaling, control system and Interlocking .	SO4.1 SO4.4 SO4.2 SO4.5 SO4.3 SO4.6		4.1.1-4.1.2 4.2.1-4.2.2 4.3	SL 4.1
PO-1,2,3,4,5,6,8,10 PSO-1,2	CO-5 (a) Explain Site Selection & investigation for bridge, waterway and describe bridge substructure. (b) Describe bridge superstructure.	SO5.1 SO5.4 SO5.2 SO5.5 SO5.3		5.1.1 – 5.1.4 5.2.1 – 5.2.2	SL.5.1

**Legend:** CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction

(Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

## Diploma in Civil Engineering

## Semester-IV

Name of program: Diploma in Engineering  
Branch : Civil Engineering  
Subject : Indian Constitution  
No. Of Periods : 2 Periods/Week

Semester: IV  
Code: NIL  
Total Tutorial Periods: NIL

### Course Content-

#### **Unit 1 – The Constitution - Introduction**

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

#### **Unit 2 – Union Government**

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

#### **Unit 3 – State Government**

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

#### **Unit 4 – Local Administration**

- District Administration
- Municipal Corporation
- Zila Panchayat

#### **Unit 5 – Election Commission**

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

### **Suggested Learning Resources:**

S. No.	Title of Book	Author	Publication
1	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2	The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3	Introduction to the Constitution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

### **Suggested Software/Learning Websites:**

- <https://www.constitution.org/cons/india/const.html>
- <http://www.legislative.gov.in/constitution-of-india>
- <https://www.sci.gov.in/constitution>
- <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

# Chhattisgarh Swami Vivekanand Technical University, Bhilai

Diploma in Civil Engineering

Semester-IV

Name of program: Diploma in Engineering  
Branch : Civil Engineering  
Subject : Physical and Mental fitness  
No. Of Periods : 2 Periods/Week

Semester: IV  
Code: NIL  
Total Tutorial Periods: NIL

Institution need to accord special & significant priority to physical & mental fitness of students and faculty in the campus and nominate a Nodal Officer for Fitness Implementation & Monitoring, whose activities would be monitored by and Institutional Committee. The following indicative guidelines/steps may be taken in this regard:

1. Physical fitness period or session may be incorporated into the academic calendar of the an institution, covering the aspects of sports, yoga, meditation, right diet etc. The physical fitness sessions may be staggered throughout the day to enable all students to participate.
2. Fitness Leaders in each institution to be created. For guiding students into physical fitness, services of students volunteer from the institution, ex-servicemen and other volunteers may be obtained on a daily & voluntary basis. 10 committed persons well versed in physical activity may be involved in the exercise.
3. Proper the utilization of existing infrastructure, encouraging students to climb stairs, walk at least 10,000 steps a day, use cycles within the campus by creating cycling zones etc.
4. (A) Every institution must organize intra institution game/sports competition/tournaments.  
(B) Sports meet : -  
Sports competition will be of four tier competition,  
(1) Intra institution sports meet  
(2) Inter institutional level sports meet at Regional level.  
(3) State level University sports meet.  
(4) National University sports meet.
5. The top leadership of the Institution and professors actively participate with staff and students in fitness activities on a periodic basis to lead by example, eg: cycling, running, aerobics, marathon, meditation activities etc.
6. Incorporating provisions of healthcare and wellness initiatives in the objectives of the institution.
7. Annual health check-ups by volunteer health doctors or voluntary organizations to monitor student health fitness and also maintain a record.
8. Providing guidance regarding a balanced nutritional diet, distribution of pamphlets and information material on the subject.
9. Redressing the emotional concerns of students in mental health. Awareness camps or sensitization workshops on depression, anxiety and stress management may be organized for faculty and students.
10. Inviting health icons and motivational speakers on health & fitness to address students in campus and regular conduct of outdoor sports events in campus.
11. Data pertaining to health & fitness activities of and institution should be placed on the website. Exemplary performers shall be selected subsequently for National level awards.