

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Diploma in Civil Engineering

Semester - V

- A) Course Code : 2020571(020)
- B) Course Title : QUANTITY SURVEYING & COSTING - I
- C) Pre-requisite Course Code and Title :
- D) Rationale :
Preparation of quantity and cost estimates of the various construction items/works is a major job function of a diploma pass outs in the field of construction technology and management. The course therefore, aims in developing in the student competency in preparing estimates of all types of civil engineering structures. For achieving this student is made familiar with the procedures and principles of measuring various works, estimating its cost and computing quantities of material needed. After learning the principles and procedures student applies them to prepare the estimated cost of various types of buildings, earth work and road work. To ensure that the student has developed the desired competence in preparing estimates he may be given appropriate exercises on QSC.
- E) Course Outcomes :
- CO-1 Recognize specifications and demonstrate the purpose of estimate and types of approximate estimates
- CO-2 Calculate the quantities of various items in a building work by using different methods
- CO-3 Prepare detailed estimate of buildings/structure.
- CO-4 Use SOR and analyze rates of different items in building works as per prevailing market rates.
- CO-5 Calculate quantities of earth work in embankments and cutting and estimate quantity of materials for roads

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	2020571 (020)	Quantity Surveying & Costing - I	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

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G) Scheme of Assessment:

Board of Study	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
Civil Engineering	2020571(020)	Quantity Surveying & Costing - I	70	20	30	40	60	220

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.

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CO-1 Recognize specifications and demonstrate the purpose of estimate and types of approximate estimates
(Approx. Hrs: CI+LI= 9+6)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Recognize General Specification and Detailed Specification. SO1.2 Describe approximate method of estimate. SO1.3 Prepare approximate estimates of various construction works using different methods	LE1.1 Prepare approximate estimate of a building by different methods on the basis prevailing market rate.	UNIT-1 Specification and Approximate Estimate 1.1 Specification – Main items of works, General Specification, Detailed Specification, General Specifications, Detailed Specification of different items of works. 1.2 Stage-I or Approximate Estimate 1.2.1 Purpose of estimate and its importance to the field situations, data for estimate, actual cost approximate method of Stage-I estimate, detailed estimate. 1.2.2 Approximate estimate for building-Service unit method , Plinth area method , Cubic content method, Approximate quantity method. 1.2.3 Approximate estimate of highways. 1.2.5 Approximate methods for water supply, sanitary and electrical installations. 1.2.6 Approximate estimate of different civil engineering structure like bridge, culvert, road, dams, over head tanks etc.	SL1.1 Compare the results different types of approximate estimates.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. What is specification? Differentiate general specification and detailed specification.
2. Write General Specification of a First Class Building.
3. Write detailed Specification of cement concrete 1:2:4
4. Explain estimate.
5. Explain the difference between approximate estimate and detailed estimate.
6. Explain Service unit method, Plinth area method, and Cubic content method of approximate estimate.
7. Work out the approximate estimate for a building of 1000 sq m by different approximate methods observing the cost of construction of similar building in the vicinity.
8. Solve numerical problems on approximate estimates.

b. Mini Project:

1. Visit PWD office of your area and observe the cost of construction of a state highway then give approximate estimate for a new state highway road for 10 km length

c. Other Activities (Specify):

1. Prepare a power point presentation for purpose, importance and types of estimate used in construction

CO-2 Calculate the quantities of various items in a building work by using different methods.

(Approx. Hrs: CI+LI= 10+ 4)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Identify the various items of works and their units of measurement in sequence of construction for a building. SO2.2 Calculate the quantities by using different methods SO2.3 Identify the degree of accuracy as per IS 1200 provisions for measurement of various items SO2.4 Take out the quantities from working drawing of buildings SO2.5 Take out the quantities of existing building and building during construction.	LE 2.1 From a given detailed drawing and specification of a building take out the quantities of different items of works.	Unit 2.0 Taking Out Quantities 2.1 Units of measurements, different items of work required in estimating building works 2.2 Rules and methods of measurement of work, general rules, measurement of different work ,accuracy in measurement 2.3 Calculating quantities of long and short wall method centerline method 2.4 Standard conversion used in measurements, 2.5 Taking out quantities from working drawing of buildings 2.6 Taking out quantities of existing buildings and buildings during construction.	SL2.1 Read and understand different types of detailed structural and working drawings.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. State the main items of work in building.
2. State general rules of measurement.
3. In a tabular format explain mode of measurement of different items of work as per IS 1200 recommendations.
3. Differentiate long and short wall and centerline method of estimate.
4. Solve numerical problems on method of estimate.

b. Mini Project:

1. From a given working drawing of a building
2. List out all items of works in sequence of construction
3. Write down the units and mode of measurements for each items

CO- 3 Prepare detailed estimate of buildings.

(Approx. Hrs: CI+LI= 10+12)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Select the pre-requisite for detailed estimate. SO3.2 Prepare abstract of quantities SO3.3 Classify the different types of estimates SO3.4 Prepare a detailed estimate of single storied and multistoried buildings	LE3.1 Workout the quantities of all items of work for a single storied residential building with flat roof LE3.2 Workout the quantities of all items of work for a single storied residential building with pitched roof LE3.3 Workout the quantities of all items of work for a shop cum residential double storied building	Unit-3 Detailed Estimate Of Buildings 3.1 Pre-requisite for stage II estimates or detailed estimate 3.2 Preparation of abstract from quantity sheets 3.3 Percentage provision to be made in stage II estimate for some items Classification of estimates - Original work - Special repair work - Addition/Alternation work - Revised estimate - Annual repairs - Final estimate 3.4 Preparation of detailed estimate for: - Small building - Small building with pitched roof - Shop cum residential multi-storied building - Prepare abstract of cost for the above estimates.	SL3.1 Prepare estimate by programming in a spread sheet

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. From given working drawings and specifications of a building
 - a. Work out actual quantities of each item of work.
 - b. Prepare an abstract of items from detailed estimate

b. Mini Project:

1. Visit a recently constructed building in the vicinity-
 - a. Identify and measure the quantities of different items of works.
 - b. Prepare abstract of items.

CO-4 Use SOR and analyze rates of different items in building works as per prevailing market rates.

(Approx. Hrs: CI+LI= 10+6)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Use SOR to know the rates of items and their required specifications SO4.2 Identify the purpose of rate analysis SO4.3 Calculate quantity of material ,labour and equipments required in per unit quantity of work SO4.4 Know prevailing market rates of different types of materials ,labour and tools and plants SO4.5 Prepare rate analysis for different items of work in building	LE 4.1 Rate analysis for: a. Brick masonry b.Excavation in foundation c.Cement concrete d.Cement mortar e.Flooring f.Woodwork. g. special work	Unit -4 Schedule of Rates and Analysis of Rates 4.1 Schedule Of Rates Information available in schedule of rates with specialization of particular item such as: Labour rates, Material rates ,Transportation rates 4.2 Analysis of Rates 4.2.1 Purpose of rates analysis 4.2.2 Task artisan per day 4.2.3 Materials required for major items 4.2.4 Labour required for major items 4.2.5 Analysis of major items of work	SL 4.1.Perform a market survey for arriving at the local prevailing rates of materials labour and T&P

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. List out the specification and rates of different items of building works from PWD SOR and compare the rates from RES SOR.
2. Enumerate the purposes of rate analysis.
3. Calculate quantity of materials and labours for per unit item of works.
4. Prepare rate analysis for different items of work in building

b. Mini Project:

1. Prepare the estimate of any building by using SOR & prevailing market rates.

CO- 5 Calculate quantities of earth work in embankments and cutting and estimate quantity of materials for roads.

(Approx. Hrs: CI+LI= 9+4)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>SO5.1 Calculate the area of cross section in embankment and cutting</p> <p>SO5.2 Compute the earthwork for series of cross sections by using Prismoidal & Trapezoidal formulae</p> <p>SO5.3 Calculate the estimate of earth work for a given length of road</p> <p>SO5.4 Illustrate in a diagram soling coat ,inter coat and top coat and calculate their quantities</p>	<p>LE5.1 Estimate of earth work for different sections.</p> <p>LE5.2 Estimate of road of 1 K.M. length for pavement surface.</p> <p>W.B.M., Bitumen</p>	<p>UNIT-5 Earthwork and Road Estimate</p> <p>5.1 Earthwork Estimate</p> <p>5.1.1 Calculation of area of cross section for given cross sections: Fully cutting section , Partly cutting and partly embankment section, Fully embankment section</p> <p>5.1.2 Mid sectional area method and mean sectional area method ,Calculation of earth work by using Prismoidal formula And Trapezoidal formula, lead and lift</p> <p>, Estimate of earth work for a given length of road</p> <p>5.2 Road Estimate</p> <p>Items of work in flexible pavement, estimation of soling coat ,inter coat and top coat in road work.</p>	<p>SL 5.1 Study the markets rates and SOR for earth work elements of an road</p> <p>SL 5.2 Prepare an detailed estimate of a identified section length of rural roads on per KM basis</p>

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 lead and lift.
2. Explain Mid sectional area method and mean sectional area method.
3. Explain Prismoidal formula And Trapezoidal formula
4. Draw existing ground level and formation level from given RL of formation and ground and calculate quantity of earth work by different methods also comment on the result.
5. Estimate the cost of earth work for portion of road .

b. Mini Project:

1. Prepare a detailed estimate for the construction of a new state highway for 1 km length .

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 and Stage1 estimate	4	6	4	14
II	Taking out quantities	4	6	4	14
III	Detailed estimation of buildings	4	6	4	14
IV	SOR and Analysis of rates	4	6	4	14
V	Earthwork Estimates	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	Prepare approximate estimate of a building by different methods on the basis prevailing market rate.	30	24	6
LE2.1	From a given detailed drawing and specification of a building take out the quantities of different items of works.			
LE3.1	Workout the quantities of all items of work for a single storied residential building with flat roof			
LE3.2	Workout the quantities of all items of work for a single storied residential building with pitched roof			
LE3.3	Workout the quantities of all items of work for a shop cum residential double storied building			
LE 4.1	Rate analysis for: a. Brick masonry b. Excavation in foundation c. Cement concrete d. Cement mortar e. Flooring f. Woodwork.			
LE5.1	Estimate of earth work for different sections.			

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LE5.2	Estimate of road of 1 K.M. length for pavement surface. W.B.M. Bitumen			
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* 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 40 Marks as per assessment scheme

K) Suggested Instructional/Implementation Strategies:

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

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1.	Estimating and Costing	B.N.Dutta	B.N. Dutta, S.D. Dutta & Co., Tagore Path, Motilal Bose Road, Lucknow	Latest Revised
2.	Estimating, Costing, specification & Valuation in civil engineering	M. CHAKRABORTI	M. CHAKRABORTI 21 B Bhabananda road Kolkata-7000 26	Latest Revised Edition
3.	Estimating, Costing & Valuation	Rangwala	Charotar Publications, Station Road	Latest Revised Edition
4.	Estimating,& Costing	Anand Birdi, J.C. Kapoor	Dhanpet Rai & Sons, Delhi & Julandhar	Latest Revised Edition
5	Estimating & Costing Vol. I & II	J.C. Malhotra,	Khanna	Latest Revised

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			Publishers, 28, Nath Market, Nai Sarak, New Delhi	Edition
6	Current Schedule of rates from	PWD/PHE/Irrigation /CPWD	Govt. publications	Latest

(b) Open source software and website address :

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

M) List of Major Laboratory Equipment and Tools: NIL - NOT APPLICABLE

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number

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N) Mapping of POs & 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 Recognize specifications and demonstrate the purpose of estimate and types of approximate estimates	2	3	2	3	2	-	-	1	1	2	-	-
CO-2 Calculate the quantities of various items in a building work by using different methods	2	3	2	3	2	-	-	1	1	2	-	-
CO-3 Prepare detailed estimate of buildings/structure.	2	3	2	3	2	-	-	1	1	2	-	-
CO-4 Use SOR and analyze rates of different items in building works as per prevailing market rates.	2	3	2	3	2	-	-	1	1	2	-	-
CO-5 Calculate quantities of earth work in embankments and cutting and estimate quantity of materials for roads	2	3	2	3	2	-	-	1	1	2	-	-

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O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,8,9,10 PSO1,2	CO-1 Recognize specifications and demonstrate the purpose of estimate and types of approximate estimates	SO1.1 SO1.2 SO1.3	LE 1.1	1.1 1.2.1-1.2.6	SL.1.1
PO-1,2, 3,4,5,8,9,10 PSO1,2	CO-2 Calculate the quantities of various items in a building work by using different methods	SO.2.1 SO 2.4 SO.2.2 SO 2.5 SO 2.3	LE. 2.1	2.1-2.6	SL.2.1
PO-1,2,3,4,5,8,9,10 PSO1,2	CO-3 Prepare detailed estimate of buildings /structure.	SO.3.1 SO3.2 SO3.3 SO3.4	LE. 3.1 LE 3.2 LE 3.3	3.1-3.4	SL3.1
PO-1,2,3,4,5,8,9,10 PSO1,2	CO-4 Use SOR and analyze rates of different items in building works as per prevailing market rates.	SO.2.1 SO 2.4 SO.2.2 SO 2.5 SO 2.3	LE.4.1	4.1 4.2.1-4.2.5	SL.4.1
PO-1,2,3,4,5,8,9,10 PSO1,2	CO-5 Calculate quantities of earth work in embankments and cutting and estimate quantity of materials for roads	SO5.1 SO5.2 SO5.3 SO5.4	LE.5.1 LE.5.2	5.1.1-5.1.2 5.2	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

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- A) Course Code : 2020572(020)
 B) Course Title : STRUCTURAL DESIGN AND DRAFTING-I
 C) Pre- requisite Course Code and Title :

- D) Rationale :
 Design of reinforced Concrete Structures will be taught as per IS 456 – 2000. Most of the residential buildings, Commercial and Public Buildings are designed using R. C. C. due to their long durability and flexibility in size and shape of structures and its members. So, Design of R.C.C. components like slab, beam, column and footing using Limit State Method is required to be understood. Also precise and correct detailing of reinforcement in structure drawing is also required in order to execute smooth construction of RCC structures. Hence this course will provide a detailed knowledge of reinforcement as per IS 456-2000.

The latest good practice of design is based on Limit State Method. Hence, knowledge of this latest method is most important for civil engineers. The working stress method is also essential for knowledge purpose. LSM of design has been followed and introduction to WSM and Pre-stress Method has been included.

- E) Course Outcomes
 CO -1 Recognize the basic concepts of RCC, IS Code 456-2000 and Working Stress method of design.
 CO- 2 Design and draft rectangular beams for flexure, shear and bond.
 CO- 3 Design and draft slabs, continuous slab and flanged beams
 CO- 4 Design and draft column and column footing
 CO- 5 (a) Design and Draft the stair cases.
 (b) Recognize prestressed concrete.

- 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	2020572(020)	Structural Design and Drafting-I	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 tudy	Course Code	Course	Scheme of Examination					
			Theory			Practical		Total
			ESE	CT	TA	ESE	TA	Marks
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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 Recognize the basic concepts of RCC, IS Code 456-2000 and Working Stress method of design. (Approx. Hrs: CI+LI =10+2)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1Describe RCC and material used in construction of RCC. SO1.2Analyse singly and doubly reinforced beams by WSM. SO 1.3 Recognize IS Code 456-2000	LE 1.1 Preparation of structural plan for framing of a building showing position of columns and beams.	UNIT 1- Reinforced Cement Concrete, IS Code 456-2000 and Working Stress Method of Design 1.1Reinforced Cement Concrete -S.I. Units, structural components, meaning of R.C.C., purpose of reinforcement, Materials of reinforcement, Steel as a reinforcing material, Type of steel used for reinforcement mild steel, tor steel, Different mixes of concrete to be used for R.C.C. work. 1.2 IS Code 456-2000 -Effective span, Control of deflection, Modification factor for Tensile and compressive steel ,Cover to reinforcement Vertical and horizontal, Spacing of reinforcement , Max and min reinforcement , Development length ,Shear reinforcement, Curtailment and bending of bars, Min. positive and negative reinforcement at support, Min length of reinforcement inside support Live load and dead load. 1.3 Working Stress Method:	SL.1 Compare the stress strain curve of mild steel ,Fe415 and Fe500 bars

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Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
		Permissible stresses in steel and concrete, assumption for design in flexure, under reinforced, over reinforced and balanced section, design constants for balanced sections analysis of singly and doubly reinforced beams.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the use of reinforcement in RCC structures.
2. Describe in brief different types of steel reinforcement.
3. Write short notes on cover and spacing of reinforcement.
4. Explain check for deflection for RCC beam and slab.
5. State the assumptions made in working stress method of design.
6. Differentiate between balanced, under reinforced and over reinforced section with suitable sketches
7. Solve numerical problems on working stress method of design.

b. Mini Project:

1. Visit an ongoing construction project and identify the various components of RCC and prestressed structures and compare the components used in RCC and prestress and their purpose.

CO-2 Design and draft rectangular beams for flexure ,shear and bond.

(Approx. Hrs: CI+LI =10+10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>SO 2.1 Explain the terms related to strength, loadings and safety factors in limit state method of design.</p> <p>SO 2.2 Identify the stress –strain curves of concrete and steel.</p> <p>SO 2.3 Analyze for flexure, shear, development length.</p> <p>SO 2.4 Design singly reinforced rectangular beams, doubly reinforced rectangular beams and lintel with chajja.</p>	<p>LE 2.1 Draw Longitudinal section, cross section of singly reinforced beam with bar bending schedule.</p> <p>LE 2.2 Draw Longitudinal section, cross section of doubly reinforced beam.</p> <p>LE 2.3 Draw R.C.C chajja with lintel.</p>	<p>Unit 2- Limit State Method of Design & Design of Rectangular Beams</p> <p>2.1 Limit State Method of Design - Concept of limit state method, limit state of collapse ,limit state of serviceability, characteristic strength of materials ,characteristic load, partial safety factors ,design values, stress-strain curve for concrete and steel</p> <p>2.2 Design and drafting of rectangular beams</p> <p>2.2.1 Limit state of collapse for flexure , assumptions, stress block parameters, neutral axis, analysis and design of singly and doubly</p>	<p>SL2.1 Read and understand different types of detailed structural and working drawings of beams.</p>

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Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
		reinforced section 2.2.2 Limit state of collapse for shear , nominal shear stress, design shear strength of concrete with and without reinforcement ,minimum shear reinforcement ,design of shear reinforcement 2.2.3 Development length & anchorage length: concept and necessity of development length, design bond stress, overlap length , necessity of hook and bend. 2.2.4 Design singly and doubly reinforced beam and check for deflection, cracking and anchorage length. 2.2.4 Design of lintels – loading on lintel, design of lintel and lintel with chajja	

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain limit state of collapse and limit state of serviceability
2. Define characteristic strength of materials, characteristic load, and partial safety factors.
3. Explain stress block parameters and derive expression for limiting moment of resistance.
4. Describe the necessity of providing development length in RCC structures.
5. Explain diagonal tension crack in a beam.
6. Solve numerical problems on design of singly reinforced rectangular beams, doubly reinforced rectangular beams and lintel with chajja.

b. Mini Project:

1. From working drawing of a residential building identify the design details of beams at plinth level lintel level and slab level and check the design by self calculation.

CO- 3 Design and draft flanged beams, slabs ,continuous slab and flanged beams .

(Approx. Hrs: CI+LI=10+10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Design and draft flanged beams SO 3.2 Design and draft one way simply supported slab SO3.3 Design and draft one way continuous slab	LE 3.1 Draw one way slab. LE 3.2 Draw two way slab. LE 3.3 Draw continuous slab and flanged beam.	Unit-3 Design of flanged beams, slabs ,continuous slab and flanged beams . 3.1 Flanged beam- Properties of flanged beams, moment of resistance and	SL3.1 Study design method of continuous beam and show reinforcement detail. SL3.2 Study

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Session Outcomes	Laboratory Instruction (LI)	Class room Instruction	Self Learning
SO 3.4 Design and draft two way simply supported slab		<p>design of singly reinforced Flanged beam.</p> <p>3.2 Design of slabs : Dead loads, imposed loads, thickness of slabs, modification factors, effective span, reinforcement in slab, design of one way slab and two way slabs, check for cracking, check for development length.</p> <p>a. Design and drafting of one way simply supported slab</p> <p>b. One way continuous slab – effective span, bending moment and shear force coefficient, design and drafting of three span continuous slab.</p> <p>c. Two way slab – design and drafting simply supported slab on four sides.</p>	design method of two way slab with corners held down.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain flanged beams and state the method of determination of neutral axis, limiting moment of resistance and area of steel.
2. Explain how to calculate effective span for simply supported and continuous slab and beam.
3. Explain how beams and slabs are checked for deflection, cracking, anchorage length.
4. Explain bending moment and shear force coefficient.
5. Solve numerical problems on design of flanged beams, one way and two way slab.

b. Mini Project:

1. Visit a construction site and study reinforcement details of slabs and beams.

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CO-4 Design and draft column and column footing.

(Approx. Hrs: CI+LI=9+6)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify the types of column SO4.2 Calculate the ultimate load for axially loaded column SO4.3 Design and draft the axially loaded column SO4.4 Design and draft the column footing	LE 4.1 Draw square column with pad footing. LE 4.2 Draw square column with sloped footing.	UNIT -4 Column & Column footing 4.1 Column -Types of column- short and long column, axially loaded column, columns subjected to bending, effective length, slenderness limit, minimum eccentricity, IS code provisions for longitudinal and lateral reinforcement, ultimate load for axially loaded columns, columns with helical reinforcement, assumptions made for limit state design of column, axial ultimate on a column, design and drafting of axially loaded square, rectangular and circular columns. 4.2 Column Footing -Isolated footing, square and rectangular, sloped footing, design principles for column footing, thickness of footing, design for one way shear, design for two way shear or punching shear, design for flexure, design for load transfer at column base, design of square, rectangular, circular pad and sloped footing.	SL4.1 Study combined footing.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Differentiate long short and long column.
2. State assumptions for limit state design of column.
3. State IS code provisions for longitudinal and lateral reinforcement in column.
4. Explain ultimate load for helically reinforced circular column.
5. Solve numerical problems on design of columns.
6. Explain design principle for one way shear, two way shear, flexure and load transfer at column base in footing design.
7. Solve numerical problems on design of isolated footings.

b. Mini Project:

1. Visit a construction site and study reinforcement details of columns and footings and beams.

CO- 5 (a) Design and Draft the stair cases.

(b) Recognize Prestressed concrete.

(Approx. Hrs: CI+LI=9+4)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Identify different types of staircases SO5.2 Calculate the effective span and loading for stairs SO 5.3 Design and draft staircase SO 5.4.Explain prestressed concrete.	LE5.1 Draw doglegged stair case.	UNIT-5 Design of Stair Case and Prestressed Concrete 5.1 Design of Stair Case – Components of stairs, IS code provisions for design of staircase ,geometrical classification of stair case, structural classification of star, effective span and loading for stairs, design and drafting straight , cantilever stair, doglegged stair case and open newel staircase. 5.2 Prestressed Concrete- Principles of pre-stressing, materials for presressed concrete ,methods of prestressing, advantages and disadvantages of pre-stressing .	SL 5.1 Study design of tread riser stair.

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. Classify the staircase on the basis of structural arrangement of staircase.
2. Explain the methods of calculating effective span in design of staircase in different cases.
3. Explain the method of calculation of dead load and live load in design of stair case.
4. Solve numerical problems in design of staircases.
5. What is prestressed concrete? State the materials used in prestressed concrete.
6. Differentiate between pre tensioning and post tensioning of beams

b. Mini Project:

1. Visit a construction site and study reinforcement details of staircase.
2. Visit a construction site and study prestressed concrete construction.

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

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

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
1	Reinforced Cement Concrete, IS Code 456-2000 and Working Stress Method of Design	4	6	4	14
2	Limit State Method of Design & Design of Rectangular Beams	4	6	4	14
3	Design of flanged beams, slabs, continuous slab and flanged beams	4	6	4	14
4	Column & column footing	4	6	4	14
5	Design of Stair Case and Prestressed 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	Preparation of structural plan for framing of a building showing position of columns and beams.	30	24	6
LE 2.1	Draw Longitudinal section, cross section of singly reinforced beam with bar bending schedule.			
LE 2.2	Draw Longitudinal section, cross section of doubly reinforced beam			
LE 2.3	Draw R.C.C chajja with lintel.			
LE 3.1	Draw one way slab.			
LE 3.2	Draw two way slab.			
LE 3.3	Draw continuous slab and flanged beam.			
LE 4.1	Draw square column with pad footing.			
LE 4.2	Draw square column with sloped footing.			
LE 5.1	Draw doglegged stair case.			

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* 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 40 Marks as per assessment scheme.

K) Suggested Instructional/Implementation Strategies:

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

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Reinforced Concrete Design	N.Krishnaraju R.N.Pranesh	New Age International Publishers, New Delhi	Latest Revised
2.	Reinforced Cement Concrete Vol I	H J Shah	Charotar Publishing House Anand	Latest Revised Edition
3.	Reinforced Cement Concrete Design	N C Sinha and S K Roy	Charotar Publications, Station Road	Latest Revised Edition
4.	Design of Reinforced Concrete Structures	Dr B C Punmia	S Chand New Delhi	Latest Revised Edition
5	Limit State Design of Reinforced Concrete	P.C. Varghase	Prentice Hall of India.	Latest Revised Edition
6	N. Krishna Raju	Prestressed Concrete	Mc Graw Hill India	Latest Revised Edition
6	IS: 456-2000, 875-1984, 432-Part-I 1786		BIS	Latest Revised Edition
7	Design SP:16 Hand Book		BIS	Latest Revised Edition

(b) Open source software and website address :

1. <https://civiltoday.com>
2. <https://www.isse.org.in>
3. <https://nptel.ac.in>

M) List of Major Laboratory Equipment and Tools: NIL

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number

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N) Mapping of POs & 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 Recognize the basic concepts of RCC, IS Code 456-2000 and Working Stress method of design	1	3	3	3	2	2	2	2	-	3	3	3
CO- 2 Design and draft rectangular beams for flexure, shear and bond	1	3	3	3	2	2	2	2	-	3	3	3
CO- 3 Design and draft slabs, continuous slab and flanged beams	1	3	3	3	2	2	2	2	-	3	3	3
CO- 4 Design and draft column and column footing	1	3	3	3	2	2	2	2		3	3	3
CO- 5 (a) Design and Draft the stair cases (b) Recognize prestressed concrete	1	3	3	3	2	2	2	2		3	3	3

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O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1-8,10 PSO-1,2	CO-1 Recognize the basic concepts of RCC, IS Code 456-2000 and Working Stress method of design.	SO1.1 SO1.2 SO1.3	LE 1.1	1.1 1.2 1.3	SL.1.1
PO-1-8,10 PSO-1,2	CO-2 Design and draft rectangular beams for flexure ,shear and bond .	SO.2.1 SO.2.2 SO2.3 SO2.4	LE. 2.1 LE. 2.2 LE. 2.3	2.1 2.2.1 – 2.2.4	SL.2.1
PO-1-8,10 PSO-1,2	CO-3 Design and draft flanged beams, slabs , continuous slab and flanged beams .	SO.3.1 SO3.2 SO3.3 SO3.4	LE. 3.1 LE 3.2 LE 3.3	3.1 3.2	SL3.1 SL3.2
PO-1-8,10 PSO-1,2	CO-4 Design and draft column and column footing.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LE.4.1 LE.4.2	4.1 4.2	SL.4.1
PO-1-8,10 PSO-1,2	CO-5 (a) Design and Draft the stair cases. (b) Recognize Prestressed concrete.	SO5.1 SO5.2 SO5.3 SO5.4	LE.5.1	5.1 5.2	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

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Semester - V

- A) Course Code : 2020573(020)
 B) Course Title : Water Resource Engineering
 C) Pre-requisite Course Code and Title :
 D) Rationale : In India water requirement is rapidly increasing due to vast industrial development and population growth. We are mostly dependent on rain as a predominant source of water. Looking to scarcity of water in our country, it is essential to store the water in appropriate manner for anticipated requirement. Irrigation engineering is the artificial process of applying water to the soil to help in growing agriculture crops or maintaining the landscapes when there is shortage of natural water by rain. It deals with the analysis and design of irrigation systems which include dams, weir, barrage, canals, drains and other supporting system etc. This course has been designed to develop theoretical and practical knowledge in order to implement the irrigation designs and operate irrigation systems.

E) Course Outcomes :

CO 1 Comprehends the basic aspects of hydrology and apply it.

CO 2 Describes basic terminology related with water requirement of crops and computes frequency of irrigation and discharges at the outlets.

CO 3 Recognize the data required for planning of irrigation project and select suitable dam based on site condition.

CO 4 Explain the components and construction of earthen and gravity dam..

CO 5 Recognize diversion headwork's and canal irrigation system.

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	2020573 (020)	Water Resource Engineering	3	-	-	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	2020573 (020)	Water Resource Engineering	70	20	30	-	-	120

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 Comprehends the basic aspects of hydrology and apply it.

(Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1 Explain hydrology and hydrologic cycle SO 1.2 Compute average annual rainfall and run off SO 1.3 Compute the flood discharge. SO 1.4 Describe the methods of stream flow measurement.		Unit1. Hydrology 1.1 Definition, Hydrologic cycle, the water budget equation, catchment area. 1.2 Precipitation, forms of precipitation , measurement of rainfall, rain gauge and types, rain gauge density as per IS and WMO, computation of average rainfall over a basin, mean annual rainfall. 1.3 Losses from precipitation, ,Evaporation, infiltration 1.4 Runoff, factor affecting run off, computation of runoff 1.5 Hydrograph, unit hydrograph, peak flow determination, 1.6 Stream flow measurement – area velocity method, weir method, stage discharge curve.	SL 1.1 Describe rain fall season in India

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain hydrological cycle with sketch.
2. Explain factors affecting selection of rain gauges.
3. Describe various types of rain gauges with neat sketch.
4. Compute average annual rainfall of any catchment area using arithmetic mean method, theissen polygon method and isohytel method.
5. Elaborate Factors affecting runoff?
6. Solve simple numerical problems in on average rainfall.
7. Explain hydrograph, unit hydrograph and assumption of unit hydrograph theory.

8. Explain methods of peak flow determination.
9. Describe the methods of stream flow measurement.

b. Mini Project

1. Collect data of rainfall and flood of any catchment area, and study the rainfall pattern.
2. Collect runoff data for any particular storm and draw hydrograph.

CO-2 Describes basic terminology related with water requirement of crops and computes frequency of irrigation and discharges at the outlets.

(Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>SO 2.1 Explain necessity, advantages, ill effects of irrigation.</p> <p>SO 2.2 Compute duty and delta for various crops.</p> <p>SO 2.3 Evaluate frequency of irrigation on the basis of soil moisture regime concept.</p> <p>SO 2.4 Explain water logging, cause and control</p>		<p>Unit-2 Water requirements of crops</p> <p>2.1 IRRIGATION: Definition, necessity, advantages, disadvantages, types of irrigation, methods of irrigation – surface, sub surface, sprinkler and drip irrigation.</p> <p>2.2 Water requirements of crop: functions and quality of irrigation water, crop period/ base period, duty, delta. Importance of duty, factors on which duty depends, delta and duty for certain crops measures for improving duty of water, relationship between duty and delta, and numerical problems, principal crops and crop seasons, important terms.</p> <p>2.3 Functions of irrigation water, classes and availability of soil water, soil moisture constants, limiting soil moisture conditions, consumptive use of water, estimating depth and frequency of irrigation on the basis of soil moisture regime concept irrigation efficiencies, crop rotation, assessment of irrigation water.</p> <p>2.4 Water logging: cause and control.</p>	<p>SL 2.1 Describe lift irrigation.</p>

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain free flooding and check flooding method of irrigation.
2. Describe furrow method.
3. Write a note on sub surface method of irrigation, stating clearly the conditions under which this method is suitable.
4. Write short notes on –
(a) Sprinkler method of irrigation (b) Drip irrigation system
5. Define the terms-available moisture, saturation capacity, field capacity, wilting point, optimum water.
6. Define the terms 'duty' and 'delta'. Derive a relationship between the two.
7. Define the following-
GCA, CCA, Kor depth, Kor period, outlet factor, capacity factor, crop ratio, overlap allowance
8. Explain water logging, cause and control.
9. Discuss in brief the function of irrigation water.
10. Solve numerical problems on duty, delta and frequency of irrigation.

b. Mini Project:

1. Tabulate water requirement of certain important Indian crops.

CO- 3 Recognize the data required for planning of irrigation project and select type dam based on site condition.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1 Explain necessary data required for irrigation project. SO 3.2 Explain types of dam and factor governing its selection SO 3.3 Compare earthen dam and gravity dam.		Unit-3.0 Reservoir Planning 3.1 Purposes of reservoir, classification of reservoir based on purpose, investigation for reservoir planning, Engineering surveys, area elevation curve, storage elevation curve, Geological investigation, Hydrological investigation, factors affecting selection of site for a reservoir. 3.2 Zones of storages and various water levels, storage capacity and yield of reservoir. 3.3 Dams: various types of dam, factors governing the selection of type of dam, factors for selection of site for a dam. 3.4 Comparison of earthen and gravity dams with respect to foundation, seepage, construction and maintenance	SL 3.1 Analyze Reasonability and feasibility of irrigation projects

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. What do you understand by multipurpose reservoir?
2. Describe in brief various investigations required for reservoir planning.
3. What are the factors on selection of site of reservoir depend?
4. Define the terms surcharge storage, valley storage, minimum pool level, maximum pool level, safe yield.
5. Draw area elevation curve, storage elevation curve and state their use.
6. Classify types of dam with example.
7. Explain factor governing selection of dam.
8. Compare earthen dam and gravity dam.

b. Mini Project:

1. Prepare model of dam showing different components.
2. Summarize various types of dam constructed all over India with all details (river, catchment area Hydro electricity, year of construction, location etc)

CO -4 Explain the components and construction of earthen and gravity dam.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Explain component, construction and failure of earthen dam. SO4.2 Explain component, construction and failure gravity dam. SO4.3 Explain function, types and location of spillway.		4. Dam and spillway 4.1 Earthen Dams – Types of earth dam, causes of failure of earthen dams, criteria for safe design of earth dam, section of an earth dam, components and their function, seepage, control of seepage through embankment and foundation, construction of earth dam, equipments used in construction of earth dam. 4.2 Gravity Dams –identification and definition of forces acting on a gravity dam, modes of failure and criteria for structural stability of gravity dam, elementary and practical profile, typical cross section, drainage gallery, joints in gravity dam, control of cracking in concrete dams, construction of gravity dam. 4.3 Spillways-Definition, function, location, straight drop spillway, ogee spillway, side channel spillway, trough spillway, conduit spillway, shaft spillway, siphon spillway, spillway crest gates,	SL 4.1 Explain dissipaters in spillways. SL 4.2 Describe outlet works in dams.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain, with the help of a neat sketch, the components of a zoned embankment, with their functions.
2. List the causes of failure of earth dams. State criteria for safe design of earth dam.
3. Describe methods of control of seepage through embankment and foundation of earth dam.
4. State various forces acting on a gravity dam.
5. Discuss modes of failure and criteria for structural stability of gravity dam.
6. What do you understand by elementary and practical profile of a gravity dam? Draw a typical cross section of a gravity dam.
7. Write short notes on the following –
(a) Drainage gallery (b) Joints in concrete dam.
8. What are the functions of spillway. Enumerate types of spillways.
9. Write a note on ogee spillway.
10. Draw neat sketches of the following –
(i) Saddle siphon spillway (ii) Radial Gate
(iii) Outlet structure through earth dam (iv) Outlet structure through gravity dam

b. Mini Project:

1. Study of important Dams in India.

c. Other activity

1. Visit a dam site and prepare a technical report.

CO- 5 Recognize diversion headwork's and canal irrigation system.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Differentiates weir and barrage. SO5.2 Explains components of diversion head works. SO5.3 Explains canal alignment. SO 5.4 Recognize canal outlets, canal regulation works and cross drainage works.		<p>Unit- 5 Diversion Headworks and Canal Irrigation System</p> <p>5.1 Diversion Headworks – diversion headwork, weir, barrage, component parts of a diversion headworks, diversion weir and its types, location of diversion headworks, causes of failure of weirs and its remedy, types of regulation at head regulator, silt control at headworks.</p> <p>5.2 Canal Irrigation System - 5.2.1 Canals-classification of canals, alignment of canal, general considerations for alignment, schedule of area statistics, cross section of canal, maintenance of irrigation channels, water logging-causes, ill effects and remedial measure, canal losses, canal lining –necessity and advantages, 5.2.2 Canal Outlets – requirements of canal outlets, types of outlets, non-modular pipe</p>	SL 5.1 Study of types of canal lining.

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Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self
		outlet, flexible pipe outlet, Gibb's rigid module. 5.2.3 Canal Regulation Works - canal regulation works, canal falls-necessity and location, head regulators and cross regulators, canal escapes. 5.2.4 Cross Drainage Works - Types of cross drainage works, selection of type of cross drainage work, aqueduct and siphon aqueduct.	

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. Differentiate between weir and barrage.
2. Explain with help of diagram, the various component parts, along with their functions, of a diversion headwork.
3. Draw neat sketches of vertical drop weir and sloping weir of concrete.
4. Define main canal, branch canal, major distributary, minor distributary and water course.
5. State various considerations for alignment of canal.
6. Draw typical cross section of canal (a) wholly in cutting (b) wholly in filling (c) partly in cutting and partly in filling
7. Explain the terms free board in canals, permanent land width, inspection road, berm, counter berm, dowla.
8. What is water logging? State its ill effects.
9. State the requirements of a good lining material.
10. State the requirements of a canal outlet.
11. Describe the working of Gibb's module with a neat sketch.
12. List canal regulation works and state their functions.
13. Draw a neat sketch of (a) distributary head regulator (b) canal escape
14. Describe with the help of sketches various types of cross drainage work.

b. Other activity

1. Visit any diversion head work and prepare a technical report.

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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	Hydrology	4	6	4	14
II	Water requirements of crop	4	6	4	14
III	Reservoir Planning	4	6	4	14
IV	Dam and spillway	4	6	4	14
V	Diversion headwork and canal irrigation system	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*): NA

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	

* 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 NA Marks as per assessment scheme.

K) Suggested Instructional/Implementation Strategies:

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

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1.	Irrigation engineering and hydraulics structures	S.K. GARG	KHANNA PUBLISHERS	
2.	Irrigation and water power engineering	B C Punamia	Laxmi publication	
3.	Engineering hydrology	K SUBRAMANYA	TATA MCGRAW HILL	
4	Irrigation Engineering	N N BASAK	TATA MCGRAW HILL	

(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: NA

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1			
2			
3			

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N) Mapping of POs & 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 comprehends the basic aspects of hydrology and apply it.	1	3	1	2	3	2	1	2	-	2	3	3
CO-2 Describes basic terminology related with water requirement of crops and computes frequency of irrigation and discharges at the outlets.	1	3	1	2	3	2	1	2	-	2	3	3
CO-3 Recognize the data required for planning of irrigation project and select type of dam based on site condition.	1	3	1	2	3	2	1	2	-	2	3	3
CO-4 Explain the components and construction of earthen and gravity dam.	1	3	1	2	3	2	1	2	-	2	3	3
CO-5 Recognize diversion headwork's and canal irrigation system.	1	3	1	2	3	2	1	2	-	2	3	3

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O) **Course Curriculum Map:**

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-1 comprehends the basic aspects of hydrology and apply it.	SO1.1 SO1.2 SO1.3 SO1.4		1.1-1.6	SL 1.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-2 Describes basic terminology related with water requirement of crops and computes frequency of irrigation and discharges at the outlets.	SO2.1 SO2.2 SO2.3 SO2.4		2.1-2.4	SL 2.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-3 Recognize the data required for planning of irrigation project and select type of dam based on site condition.	SO3.1 SO3.2 SO3.3		3.1-3.4	SL 3.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-4 Explain the components and construction of earthen and gravity dam.	SO4.1 SO4.2 SO4.3		4.1-4.3	SL 4.1 SL 4.2
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-5 Recognize diversion headwork's and canal irrigation system.	SO5.1 SO5.2 SO5.3 SO5.4		5.1 5.2.1-5.2.4	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

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- A) Course Code : 2020574(020)
 B) Course Title : GEOTECH ENGINEERING
 C) Pre- requisite Course Code and Title :
 D) Rationale : Knowledge and understanding of soil and its engineering properties are very important for engineers working at site in order to make Civil Engineering Structures safe and serviceable. In INDIA, from region to region soil varies in properties and characteristics. Under different loading conditions soil is subjected to various stresses and problems like water logging, liquefaction of soil, seepage through soil and settlement. At diploma level students are expected to study about these aspects of soil so as to develop their understanding in order to apply their knowledge in construction industry.

E) Course Outcome :

- CO- 1 Interpret the weight and volume relationship for soil and classify the soil on the basis of index properties.
 CO- 2 Explain permeability, discharge from well and seepage.
 CO- 3 Explain shear strength of soil.
 CO- 4 Describe compaction and Earth Pressure.
 CO- 5 Describe Bearing Capacity, Site Investigation of soil and stabilization of soil.

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	202574(020)	Geotech Engineering	2	1	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	2020574 (020)	Geotech Engineering	70	20	30	40	60	220

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 Interpret the weight and volume relationship for soil and classify the soil on the basis of index properties.

(Approx. Hrs: CI+LI=10 +16)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1 Explain different terms and establish weight and volume relationship for soil. SO1. 2 Explain various index properties. SO 1.3 Explain and apply soil classification for field problem.	LE 1.1 Determine water content by oven drying method as per IS code. LE 1.2 Determine Specific Gravity of soil by Pycnometer as per IS code. LE 1.3 Determine bulk unit weight and dry unit weight of soil in field by core cutter method as per IS Code. LE 1.4 Determination of bulk unit weight dry and unit weight of soil in field by sand replacement method as per IS Code. LE 1.5 Determination of Liquid limit of given soil sample as per IS Code. LE 1.6 Determination of Plastic limit of given soil sample as per IS Code. LE 1.7 Determination of Shrinkage limit of given soil sample as per IS Code. LE 1.8 Determination of grain size distribution of given soil sample by sieve analysis.	Unit1- Weight and Volume Relationships, Index Properties and Classification Of Soil 1.1 Weight and Volume Relationships 1.1.1 Definition of soil and soil mechanics or Geotechnical Engineering, field application of Geotechnical Engineering 1.1.2 Soil as a three phase system, types of soil water, water content, Void ratio, porosity and degree of saturation, water content, density and unit weights, specific gravity ,density index and relative compaction and functional relationship among them . 1.2.3 Determination of water content, specific gravity and bulk density 1.2 Index Properties And Soil Classification 1.2.1 Particle size analysis, mechanical sieve analysis, sedimentation analysis, Stoke's law, pipette method and hydrometer method , particle size distribution curve and its interpretation 1.2.2 Consistency of soil, stages of consistency, Atterberg's limits of consistency, relationship between consistency limits,	SL 1.1 Determination of water content by pycnometer method . SL 1.2 Explain field identification of soil

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Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
		Determination of liquid limit, plastic limit and shrinkage limit. 1.2.3 Particle size classification of soils & IS classification of soil.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Explain the application of geotechnical engineering in foundation design and construction and pavement design.
2. Explain and draw three phase system for soil.
3. Differentiate absorbed water and adsorbed water.
4. Define water content, void ratio, specific gravity, bulk unit weight, density index.
5. Establish relationship between bulk unit weight, specific gravity, void ratio and degree of saturation.
6. State Stoke's law. Explain how it is used in particle size analysis?
7. Draw particle size distribution curve. Define uniformity coefficient and coefficient of curvature.
8. Explain consistency limits. Define liquid limit, plastic limit and shrinkage limit.
9. Give grain size classification scale as per IS.
10. Explain IS classification system based on USCS.
11. Solve numerical problems on weight and volume relationships and index properties.

b. Mini Project:

1. Classify the soil collected from a particular site as per IS Soil classification.

CO- 2 Explain permeability, discharge from well and seepage.

(Approx. Hrs: CI+LI=9+4)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>SO 2.1 Describe permeability and factors affecting permeability.</p> <p>SO 2.2 Demonstrate constant head permeability and falling head permeability test.</p> <p>SO2.3 Determine discharge from well in confined and unconfined aquifer.</p> <p>SO 2.3 Explain seepage through soil and properties of flow net.</p>	<p>LE 2.1 Determination of coefficient of permeability by constant head test</p> <p>LE 2.2 Determination of coefficient of permeability by falling head test.</p>	<p>Unit 2-Permeability,Well Hydraulics and Seepage</p> <p>2.1 Permeability</p> <p>2.1.1 Definition of permeability, Darcy's law of permeability, coefficient of permeability, Factors affecting permeability.</p> <p>2.1.2 Determination of coefficient of permeability by constant head and falling head permeability tests.</p> <p>2.2 Well Hydraulics</p> <p>2.2.1 Aquifer, aquiclude, aquifuge, coefficient of transmissibility</p> <p>2.2.2 Formulae for discharge through</p>	<p>SL 2.1 Enlist typical values of coefficient of permeability for different soil.</p>

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Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
		<p>unconfined and confined aquifer for steady radial flow by Dupuit's Theory (no derivation), field determination of coefficient of permeability and coefficient of transmissibility</p> <p>2.3 Seepage</p> <p>2.3.1 Seepage through earthen structures, head, gradient and potential, seepage velocity, seepage pressure, quick sand condition.</p> <p>2.3.2 Flow net, characteristics of flow net, application of flow net (no numerical problems) ,phreatic line.</p>	

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Define coefficient of permeability and state Darcy's Law.
2. State Factors affecting permeability.
3. Draw neat sketches of constant head and variable head test arrangement.
4. Define aquifer, coefficient of transmissibility, draw down at well.
5. Draw neat sketches representing flow conditions in confined and unconfined aquifer.
6. Solve simple numerical problems on permeability and well hydraulics.
7. Define potential, hydraulic gradient and seepage pressure.
8. Define flow lines, equipotential lines and phreatic line.
9. Explain quick sand condition.
10. State properties of flow net and its uses.

b. Mini project:

1. Visit a nearby earthen dam and study seepage control measures.

CO- 3 Explain shear strength of soil.

(Approx. Hrs: CI+LI=10 +8)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>SO3.1 Recognize shear strength of soil</p> <p>SO3.2 Explain components of shearing resistance of soil.</p>	<p>LE 3.1 Determination of shear strength of soil using direct shear test.</p> <p>LE 3.2 Determination of shear strength of soil using</p>	<p>Unit 3- Shear Strength of Soil</p> <p>3.1 Shear failure of soil, concept of shear strength of soil, components of</p>	<p>SL 3.1 Determine total pressure and effective pressure for</p>

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Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
SO3.3 Explain Mohr-Coulomb failure theory and strength envelop. SO3.4 Determine shear strength parameters of soil.	Laboratory Vane shear test LE 3.3 Determination of shear strength of soil using laboratory tri-axial test. LE 3.4 Determination of shear strength of soil using unconfined compressive strength test.	shearing resistance of soil – cohesion, internal friction 3.2 Mohr-Coulomb failure theory, Strength envelope, strength equation 3.3 Effective stress principle-total pressure, effective pressure, neutral pressure, shear strength equation in terms of effective pressure, Mohr's stress circle. 3.4 Determination of shear strength- types of shear test depending upon drainage condition, Direct shear test, Tri-axial test Unconfined compression test, Vane shear test,.	different soil water conditions.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain shear strength of soil.
2. State Mohr-Coulomb failure theory and draw Strength envelope for different types of soil.
3. Define total pressure, effective pressure, neutral pressure and express shear strength in terms of effective stress.
4. Describe box shear test with neat sketch.
5. Describe triaxial test with neat sketch.
6. Draw Mohr's stress circle for stress for stress condition in box shear test.
7. Solve simple numerical problems on shear strength of soil.

b. Mini project:

1. Find the shear strength of soil from any site.

CO- 4 Describe compaction and earth Pressure.

(Approx. Hrs: CI+LI=9+4)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Explains compaction, factors affecting compaction and test on compaction. SO4.2 Recognize field methods of	LE 4.1 Determination of MDD & OMC by standard proctor test on given soil sample as per IS Code LE 4.2 Determination of MDD & OMC by modified proctor test on given soil	Unit 4- Compaction of Soil and Earth Pressure 4.1 Compaction of Soil 4.1 Concept of compaction, purpose of compaction field situations where compaction is required.	SL 4.1 Effect of compaction on various soil properties. SL 4.2 California bearing ratio, CBR test, significance

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compaction field compaction control. SO4.3 Explain earth pressure on structure. SO 4.4 Calculate active and passive earth pressure of soil on structure.	sample as per IS Code	4.2 Standard proctor test – test procedure as per IS code, compaction curve, optimum moisture content, maximum dry density, zero air voids line. 4.3 Modified proctor test 4.4 Factors affecting compaction 4.5 Field methods of compaction – rolling, ramming & vibration and suitability of various compaction equipments, placement water content, field compaction control. 4.6 Difference between compaction and consolidation 4.7 Earth Pressure - 4.7.1 Definition of active earth pressure, Neutral pressure and passive earth pressure, 4.7.2 Structures subjected to earth pressure in the field. 4.7.3 Rankine's theory 4.7.4 Calculation of active and passive earth pressure (simple cases).	of CBR value
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SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Difference between compaction and consolidation.
2. State field methods of compaction
3. State factors affecting compaction.
4. Difference between light compaction and heavy compaction test.
5. Write a note on field compaction control.
6. Difference between active and passive earth pressure.
7. Assumptions of Rankine's earth pressure theory
8. Describe the states of active and passive earth pressure in detail.
9. Solve simple numerical problems on compaction and earth pressure.

b. Mini project

1. Proctor test and modified Proctor test for compaction and comparison of result.

CO- 5 Describe Bearing Capacity, Site Investigation of soil and stabilization of soil.

(Approx. Hrs: CI+LI=10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain bearing capacity of soil and Terzaghi's	--	Unit 5-Bearing Capacity of Soils , Stabilization of soil	SL 5.1 Explain types of bearing capacity

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Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning (SL)
<p>assumption.</p> <p>SO5.1 Apply Field methods for determination of bearing capacity of soil.</p> <p>SO5.3 Explain methods of soil stabilization</p> <p>SO5.4 Explain Methods of site exploration & boring.</p>		<p>and Site Investigation And Sub Soil Exploration</p> <p>5.1 Bearing Capacity of Soils</p> <p>5.1.1 Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure</p> <p>5.1.2 Terzaghi's analysis and assumptions made.</p> <p>5.1.3 Effect of water table on bearing capacity</p> <p>5.1.4 IS code method for computing bearing capacity.</p> <p>5.1.5 Field methods for determination of bearing capacity – Plate load test and standard penetration test. Test procedures as Per IS:1888 & IS:2131</p> <p>5.1.6 Typical values of bearing capacity from building code IS:1904</p> <p>5.1.6 Liquefaction(in brief)</p> <p>5.2 Stabilization of soil</p> <p>5.2.1 Concept of soil stabilization, necessity of soil stabilization,</p> <p>5.2.2 Different methods of soil stabilization – Mechanical soil stabilization, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization</p> <p>5.3 Site Investigation And Sub Soil Exploration</p> <p>5.3.1 Necessity of site investigation & sub-soil exploration.</p> <p>5.3.2 Method of site exploration open excavation & boring</p> <p>5.3.3 Criteria for deciding the location and number of</p>	<p>failures.</p> <p>SL5.2 Depth of exploration for various structure.</p>

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Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning (SL)
		test pits and bores 5.3.4 Methods of exploration, disturbed & undisturbed soil samples for lab testing.	

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 Ultimate bearing capacity, safe bearing capacity and allowable bearing pressure.
2. State Terzaghi's analysis and assumptions made.
3. Explain effect of water table on bearing capacity.
4. Explain IS code method for computing bearing capacity.
5. Describe plate bearing test.
6. Different methods of soil stabilization with their suitability.
7. Method of site exploration open excavation & boring.
8. Disturbed & undisturbed soil samples for lab testing.

b. Mini Project:

1. Compute ultimate bearing capacity, safe bearing capacity and allowable bearing capacity of soil.
2. Collect data from Site Investigation and Sub Soil Exploration of nearby project.

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	Interpret the weight and volume relationship for soil and classify the soil on the basis of index properties.	4	6	4	14
II	Explain permeability, discharge from well and seepage.	4	6	4	14
III	Explain shear strength of soil.	4	6	4	14
IV	Describe compaction and Earth Pressure	4	6	4	14
V	Describe Bearing Capacity, Site Investigation of soil and stabilization of soil.	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	Determine water content by oven drying method as per IS code.	30	24	6
LE 1.2	Determine Specific Gravity of soil by Pycnometer as per IS code.			
LE 1.3	Determine bulk unit weight and dry unit weight of soil in field by core cutter method as per IS Code.			
LE 1.4	Determination of bulk unit weight dry and unit weight of soil in field by sand replacement method as per IS Code.			
LE 1.5	Determination of Liquid limit of given soil sample as per IS Code			
LE 1.6	Determination of Plastic limit of given soil sample as per IS Code.			
LE 1.7	Determination of Shrinkage limit of given soil sample as per IS Code.			
LE 1.8	Determination of grain size distribution of given soil sample by sieve			
LE2.1	Determination of coefficient of permeability by constant head test			
LE2.2	Determination of coefficient of permeability by falling head test.			
LE 3.1	Determination of shear strength of soil using direct shear test.			
LE 3.2	Determination of shear strength of soil using Laboratory Vane shear test			
LE 3.3	Determination of shear strength of soil using Laboratory tri-axial test			
LE 3.4	Determination of shear strength of soil using unconfined compressive strength test			
LE 4.1	Determination of MDD & OMC by standard proctor test on given soil sample as per IS Code			
LE 4.2	Determination of MDD & OMC by modified proctor test on given soil sample as per IS Code			

* 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 be performed at the end semester examination of 40 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. Demonstration
7. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
8. Brainstorming
9. Others

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Soil Mechanics and Foundations	B.C. Punmia	Laxmi Publication	Latest edition
2	Soil Mechanics and Foundation Engineering	K R Arora	Standard Publishers	Latest edition
3	Laboratory Manual on Soil Mechanics	Ravi Kumar Sharma	I K International Publishin House	Latest Edition
4	Soil Mechanics and Foundation Engineering	V N S Murthy	UBS Publisher	Latest Edition
5	Modern Geo Technical Engineering	Dr Alam Singh	Jodhpur University	Latest Edition
6	Soil Sampling & Testing Manual	Dr A K Duggal	NITTTR Chandigarh	
7	Basic and applied soil mechanics	Gopal ranjan and A S Rao	New Age international publishers	Latest edition

(b) Open source software and website address:

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

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M) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Water content determination apparatus	Thermostatically controlled oven, with interior of non corroding material to maintain temperature between 105 to 110 degree centigrade, non-corrodible air tight containers , desiccators with desiccating agent,	LE1.1, LE1.3, LE1.4
2	Pycnometer with complete set	Pycnometer of about 900ml capacity with conical brass cap and washer screwed at itstop, Glass Rod	LE1.2
3	Core cutter apparatus for field density	Cylindrical core cutter of steel , 130 mm long and 10 cm internal diameter with a wall thickness of 3mm bevelled at one end,steel dolly 2.5cm high and 10cm of internal diameter with wall thichness 7.5mm fitted with a lip to enable it to be fitted on the top of the core cutter. steel rammer having 9kg mass ,palette knife, steel rule ,spade or pickaxe or grafting tool straight edge.	LE1.3
4	Sand Replacement Apparatus for Field Capacity	a) sand pouring cylinder of about 3litre capacity, mounted above a pouring cone and separated by a shuttre cover plate and a shutter B) Cylindrical calibrating container 10cm internal diameter and 15cm internal depth fitted with flange approximately 5cm wide and about 5mm thick C) Glass plate about 45cm square and 1cm thick D) Metal tray with central circular hole of diameter equal to diameter of pouring cone E) Tools for excavating hole, F) IS sieve 600 micron and 300 micron	LE1.4
5	Grain size distribution by sieve complete set	a) set of IS sieve : 100mm, 63mm 20mm 10mm,4.75mm, 2mm, 1mm, 600micron, 425micron, 300 micron, 212 micron, 150 micron, 75 micron size B) Four large metal or plastic water tight trays, C) Sieve brushes and a wire brush, D) Mechanical sieve shaker	LE1.8
6	Liquid limit apparatus	a) mechanical liquid limit device (casagrande type) consisting of a brass cup and carriage , mounted on base micarta number 221 A B) Grooving tool 'a' (Casagrande or BS tool) and grooving tool 'b' (ASTM) tool, C) Porcelain dish, about 12cm in diameter with flat bottom. D) Flexible spatula with blade about 8cm along and 2cm wide, E) a rod of 3mm diameter.	LE1.5
7	Shrinkage limit apparatus	a) shrinkage dish of non corroding metal having flat bottom and 45 mm in diameter and 15 mm in height internally (3 numbers) B) Glass cup 50 to	LE1.7

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		55 mm in diameter and 25mm in height, the top rim of which is ground smooth and level. C) Glass plate 75mm*75mm one plate should be plane glass and other should have three metal prongs. D) Mercury	
8	Constant head permeability apparatus	Constant head permeameter complete with all accessories, Thermometer	LE2.1
9	Variable head permeability apparatus	Permeability cell 100 mm inside diameter, manometer glass tubes ,wooden panel soaking reservoir ,with overflow tube with accessories.	LE 2.2
10	Standard and modified proctor test	Cylindrical metal mould of capacity ,metal rammer fitted with a detachable base and removable collar approximately 60mm high, Metal rammer fitted with a detachable base as per IS.	LE 4.1, LE 4.2
10	Direct shear test apparatus	Shear box equipment consisting of : shear box 60mm square and 50 mm deep, Container for shear box , Grid plates two pair, one pair plain and other pair perforated, porous stone one pair 6mm thick ,base plate with cross grooves on its top face to fit into the shear box , Loading pad with a steel , loading frame to distribute the load from yoke over the specimen, proving ring with dial gauge accurate to 0.002mm to measure the shear force, micrometer dial gauge, two no. accurate to 0.01mm to measure horizontal and vertical displacement during shear, suitable for operation on 230V, 50 Hz, Single phase, AC supply.	LE3.1
11	Triaxial Shear Test Apparatus	One loading unit with motorized load frame of capacity 5000 kgf, for single unit, for single cell mounting,The loading unit is fitted with one dial gauge bracket,One Triaxial Cell for 38 mm dia specimen, stationary bushing,Lateral Pressure assembly. 0-10kg/cm sq. complete with foot pump and rubber hose.One dial gauge 0.01 mm X 25 mm for strain measurement. One high sensitive Proving Ring, capacity 200/250 kg with Calibration Report and carrying case as per IS suitable for operation on 230V, 50 Hz, Single phase, AC supply.	LE3.3
12	Unconfined compressive strength test Apparatus	Load frame 50kN capacity, electrically cum Manually Operated with 3 rates of strains 1.25mm, 1.50mm, 2.50mm/min , split Mould 38mm dia ,det of donning dools,det of donning dlates with springs as per IS	LE3.4
13	Vane Shear Test Apparatus	Consists of a torque head ,vane shaft ,dial gauge graduated in degrees.with set	LE3.2

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		of springs one each approx. 2 kg-cm, 4 kg-cm and 8 kg-cm in a wooden carrying case preferably electrically operated, rate of rotation is 1/16 RPM as per IS suitable for operation on 230V, 50 Hz, Single phase, AC supply.	
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N) Mapping of POs & 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 Interpret the weight and volume relationship for soil and classify the soil on the basis of index properties.	2	3	3	3	2	1	-	1	1	2	3	3
CO-2 Explain permeability, discharge from well and seepage.	2	3	3	3	2	1	-	1	1	2	3	3
CO-3 Explain shear strength of soil.	2	3	3	3	2	1	-	1	1	2	3	3
CO- 4 Describe compaction and Earth Pressure.	2	3	3	3	2	1	-	1	1	2	3	3
CO- 5 Describe Bearing Capacity, Site Investigation of soil and stabilization of soil.	2	3	3	3	2	1	-	1	1	2	3	3

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O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,8,9,10 PSO1,2	CO-1 Interpret the weight and volume relationship for soil and classify the soil on the basis of index properties.	SO1.1 SO1.2 SO1.3	LE 1.1 LE 1.5 LE 1.2 LE 1.6 LE 1.3 LE 1.7 LE 1.4 LE 1.8	1.1.1-1.1.3 1.2.1-1.2.3	SL 1.1 SL 1.2
PO-1,2,3,4,5,6,8,9,10 PSO1,2	CO-2 Explain permeability, discharge from well and seepage.	SO2.1 SO2.2 SO2.3	LE. 2.1 LE. 2.2	2.1.1-2.1.2 2.2.1-2.2.2 2.3.1-2.3.2	SL 2.1
PO-1,2,3,4,5,6,8,9,10 PSO1,2	CO-3 Explain shear strength of soil.	SO3.1 SO3.2 SO3.3 SO3.4	LE3.1 LE3.2 LE3.3 LE3.4	3.1 3.2 3.3 3.4	SL 3.1
PO-1,2,3,4,5,6,8,9,10 PSO1,2	CO- 4 Describe compaction and earth pressure	SO4.1 SO4.2 SO4.3 SO4.4	LE4.1 LE4.2	4.1-4.6 4.7.1-4.7.4	SL 4.1 SL 4.2
PO-1,2,3,4,5,6,8,9,10 PSO1,2	CO- 5 Describe Bearing Capacity, Site Investigation of soil and stabilization of soil.	SO5.1 SO5.2 SO5.3 SO5.4		5.1.1-5.1.6 5.2.1-5.2.2 5.3.1-5.3.4	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



CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

V - SEMESTER CIVIL ENGINEERING

Scheme of Studies

Session-2020

SN	Board of Studies	Category	Code	Course Title	Hours per week			Total Contact hrs/week	Credits L+T+P/2
					L	T	P		
1	Civil Engg.	Program Core Course	2020571 (020)	Quantity Surveying & Costing-I	3	0	0	3	3
2	Civil Engg.	Program Core Course	2020572 (020)	Structural Design & Drafting-I	3	0	0	3	3
3	Civil Engg.	Program Core Course	2020573 (020)	Water Resources Engineering	3	0	0	3	3
4	Civil Engg.	Program Core Course	2020574 (020)	Geotech Engineering	2	1	0	3	3
5	Civil Engg.	Program Elective Course	2020581 (020)	Elective-I Advanced Construction Technology	3	0	0	3	3
			2020582 (020)	Traffic Engineering					
			2020583 (020)	Pavement Design Construction & Maintenance					
6	Civil Engg.	Program Core Course	2020561 (020)	Quantity Surveying & Costing-I (Lab)	0	0	2	2	1
7	Civil Engg.	Program Core Course	2020562 (020)	Structural Design & Drafting-I (Lab)	0	0	2	2	1
8	Civil Engg.	Program Core Course	2020563 (020)	Geotech Engineering (Lab)	0	0	2	2	1
9	Civil Engg.	Summer Internship – (6 weeks) after IVth Sem	2020564 (020)	Summer Internship	0	0	0	0	3
10	Civil Engg.	-	-	Major Project	0	0	2	2	^
Total					14	1	8	23	21



CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

V - SEMESTER CIVIL ENGINEERING

Scheme of Examination

Session-2020

SN	Board of Studies	Category	Code	Course Title	Maximum Marks			Total	Credits
					ESE	CT	TA		
1	Civil Engg.	Program Core Course	2020571 (020)	Quantity Surveying & Costing-I	70	20	30	120	3
2	Civil Engg.	Program Core Course	2020572 (020)	Structural Design & Drafting-I	70	20	30	120	3
3	Civil Engg.	Program Core Course	2020573 (020)	Water Resources Engineering	70	20	30	120	3
4	Civil Engg.	Program Core Course	2020574 (020)	Geotech Engineering	70	20	30	120	3
5	Civil Engg.	Program Elective Course		Elective-I	70	20	30	120	3
			2020575 (020)	Advanced Construction Technology					
			2020576 (020)	Traffic Engineering					
			2020577 (020)	Pavement Design Construction & Maintenance					
6	Civil Engg.	Program Core Course	2020591 (020)	Quantity Surveying & Costing-I (Lab)	40	0	60	100	1
7	Civil Engg.	Program Core Course	2020592 (020)	Structural Design & Drafting-I (Lab)	40	0	60	100	1
8	Civil Engg.	Program Core Course	2020593 (020)	Geotech Engineering (Lab)	40	0	60	100	1
9	Civil Engg.	Summer Internship – (6 weeks) after IVth Sem	2020594 (020)	Summer Internship	0	0	100	100	3
10	Civil Engg.	-	-	Major Project	0	0	0	0	^
Total					470	100	430	1000	21

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Diploma in Civil Engineering

Semester - V

- A) Course Code : 2020581(020)
 B) Course Title : ADVANCED CONSTRUCTION TECHNOLOGY
 C) Pre-requisite Course Code and Title :
 D) Rationale :

The term 'advanced construction technology' covers a wide range of modern techniques and practices that encompass latest developments in materials technology, design procedures, quantity surveying, facilities management, services, structural analysis and design, and management studies. Incorporating advanced construction technology into practice can increase levels of quality, efficiency, safety, sustainability and value for money. However, there is often a conflict between traditional industry methods and innovative new practices, and this is often blamed for the relatively slow rate of technology transfer within the industry. The knowledge of different materials in advanced construction, different methods in concreting, and the relevance of advanced construction methods for particular site condition and requisite hoisting and conveying machinery for the given situation will be very important for a Diploma Engineer.

- E) Course Outcomes :
 CO-1 Recognize advanced construction materials.
 CO-2 Explain relevant method of concreting and equipment according to type of construction.
 CO-3 Identify advanced technology in construction.
 CO-4 Describe hoisting and conveying equipments.
 CO-5 Identify miscellaneous machineries and equipments.

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	2020581 (020)	Advanced Construction Technology	3	-	-	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	2020581 (020)	Advance Construction Technology	70	20	30	-	-	120

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 : Recognize advanced construction materials.

(Approx. Hrs: CI+LI= 10 Hrs)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Identify Use and properties of steel, polypropylene, carbon and glass fibers. SO1.2 Explain use and properties of PVC, RPVC, HDPE, FRP, GRP. SO1.3 Explain Properties and uses of acoustics materials, wall claddings, plaster boards, micro-silica, SO1.4 Describe Use of waste products and industrial by products in bricks, blocks, concrete and mortar.	--	Unit 1- Advanced Construction Materials 1.1 Fibres: Use and properties of steel, polypropylene, carbon and glass fibers. 1.2 Plastics: Use and properties of PVC, RPVC, HDPE, FRP, GRP. 1.3 Miscellaneous Materials: Properties and uses of acoustics materials, wall claddings, plaster boards, micro-silica, waterproofing materials, adhesives. Use of waste products and industrial by products in bricks, blocks, concrete and mortar.	SL 1.1 Study PVC,RPVC, HDPE,FRP, GRP available in the market.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Define steel fiber. Explain the effect of use of steel fibers on properties of concrete.
2. What are polypropylene fibers? What are the advantages and disadvantages of their use in concrete?
3. What is carbon reinforced concrete? What are Carbon fibers used for?
4. What are the different uses of fiber glass construction?
5. Write short notes on PVC,RPVC, HDPE,FRP and GRP.
6. Describe acoustic materials.
7. Describe use of waste products and industrial by products in bricks, blocks, concrete and mortar.

b. Mini Project:

1. Compare strength of PCC and Steel fiber reinforced concrete.

CO-2 : Explain relevant method of concreting and equipment according to type of construction.

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Explain necessity and use of ready mix concrete. SO2.2 Describe Underwater Concreting Procedure SO2.3 Explain roller compacted concrete and Self-compacting concrete. SO2.4 Explain foam concrete.	--	Unit 2- Advanced Concreting Methods and Equipments 2.1 Ready Mix Concrete: Necessity and use of ready mix concrete. 2.2 Products and equipments for ready mix concrete plant. Conveying of ready mix concrete, transit mixers. 2.3 Vibrators for concrete consolidation: Internal, needle, surface, platform and form vibrators. 2.4 Underwater Concreting: Procedure and equipments required for tremie method, Drop bucket method. Properties, workability and water cement ratio of the concrete. 2.5 Special concrete: procedure and uses of special concretes: Roller compacted concrete, Self-compacting concrete (SCC), Foam concrete, shotcreting.	SL2.1 Study mass concrete.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. What is ready mixed concrete? State the advantages of ready mixed concrete.
2. Classify ready mixed concrete.
3. Describe production of ready mix concrete.
4. Explain different types of vibrators for concrete.
5. Explain Underwater Concreting.
6. Describe roller compacted concrete.
7. What is self compacting concrete? What are the advantages and disadvantages of self compacting concrete?
8. Describe characteristics of self compacting concrete in the fresh condition. How is its flowability measured?
9. What is foamed concrete? State its types, advantages and disadvantages.
10. Write a note on shotcreting.

c. Mini Project:

1. Show in tabular form typical mix proportions of plain cement concrete, roller compacted concrete and Self Compacting Concrete.

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Semester - V

CO-3 : Identify advanced technology in construction.

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Describe launching of girder. SO3.2 Differentiate slip forms, climbing forms and table forms. SO3.3 Describe prefabricated building elements. SO3.4 Identify components of reinforced soil.	--	Unit 3 - Advanced Technology in Constructions 3.1 Construction of bridges and flyovers: Construction of solid foundation and pile foundation, launching of girder. 3.2 Construction of multi-storied building: pumping of concrete, slip forms, climbing forms, table forms, tower cranes, plumb laser, platforms, chute and lifts, protection screen. 3.3 Prefabricated construction: Methods of prefabrication, Plant fabrication and site fabrication, All prefabricated building elements such as wall panels, slab panels, beams, columns, door and window frames etc. Equipments and machineries used for placing and Jointing of prefabricated elements. 3.4 Concept of reinforced soil, strengthening of embankments by soil reinforcing techniques using geo-synthetics, types, function of geosynthetic material, components of reinforced soil, construction procedure, advantages,	SL3.1 Study Construction of solid foundation and pile foundation.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain with sketches rigging and transport of Prestressed Concrete Beam.
2. Describe bridge building with launching gantry. Balanced cantilever bridge construction, incremental launching, cable stayed bridge construction,
3. Write a note on the use of belt conveyors and tower cranes in the construction of multistoried building.
5. Explain slip forms, climbing forms, table forms, tower cranes, plumb laser, platforms, chute and lifts, protection screen.
6. Describe prefabricated construction.
7. Explain the concept of reinforced soil. State its advantages.
8. Write a note on geo synthetic material.
9. Explain construction procedure of reinforced soil.

b. Mini Project:

1. Visit a flyover construction site and study its construction.

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Semester - V

CO 4 : Describe hoisting and conveying equipments.

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify equipments and machineries required for foundation and super structure of bridges and flyovers. SO4.2 Recognize different types of cranes. SO 4.3 Compare conveyor haul system as compared to other material movement systems.	--	Unit-4 Equipments for construction of flyovers, Hoisting and Conveying Equipments 4.1 Equipments and machineries required for foundation and super structure of bridges and flyovers, Pile driving equipments, Pile hammers 4.2 Hoisting Equipments: Principles and working of Derrick-Pole, Gin Pole, Crane, Power driven scotch derrick crane, Hand operated crane, Locomotive crane, Tower crane, Lattice Girder, Winches, Elevators, ladders. Crawler cranes, Truck mounted cranes, Gantry cranes, Mast cranes. 4.3 Conveying Equipments: Working of belt conveyers, types of belts and conveying mechanism, Capacity and use of dumpers, tractors and trucks.	

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. State the major equipments with their uses for construction of bridges and flyovers.
2. Write a note on the use of belt conveyors and tower cranes in the construction of multis toried building.
3. What is the utility of cranes in the construction of buildings?
4. Give a labeled neat sketch of Derrick crane.
5. Name the various types of cranes used building construction. Describe the cranes particularly useful for construction of –(i) Pre-fabricated houses (ii) Tall buildings in congested area.
6. State Capacity and use of dumpers, tractors and trucks.
7. Compare the merits and demerits of conveyor haul system as compared to other material movement systems.

a. Mini Project: Visit a flyover construction site and study equipments used in construction.

c. Other Activities (Specify):

CO 5 Identify miscellaneous machineries and equipments.

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

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Describe scrapers and graders. SO5.2 State uses of power shovel and dragline. SO5.3 Identify different	--	Unit 5– Miscellaneous Machineries and Equipments 5.1 Excavation Equipments: Use, working and output of following machinery – bull dozers, scrapers, graders, Clam Shell, trenching	SL5.1 State the equipment used for site clearance.

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Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning (SL)
compacting equipments for earth work. SO5.4 Recognise hot mix bitumen plant, and bitumen paver. SO5.5 Explain blasting operation rock excavation.		equipment, Tunnel boring machine, Wheel mounted belt loaders, power shovels, JCB, and drag lines. 5.2 Compacting Equipments: Output of different types of rollers such as plain rollers, ship footed rollers, vibratory, pneumatic rollers rammers. 5.3 Miscellaneous Equipments: Hot mix bitumen plant, bitumen paver, grouting equipment, guniting equipments, 5.4 Selection of drilling pattern for blasting, bentonite/mud slurry in drilling, Explosives for blasting, Dynamite, process of using explosives.	

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:

- What are the factors affecting selection of tractors? Distinguish between –
 (i) Wheel Type and crawler type tractor.
 (ii) Two wheel and four wheel tractor.
- What are the equipments used for clearing land.
- Explain the operation of power shovel.
- Explain with neat sketches different types of scraper. What are its uses? How is scraper different from a grader?
- Give a comparative account of crawler mounted and wheel mounted bulldozers.
- Explain blasting operation for excavation in rock.

b. Mini Project: Visit earth work construction site and study equipments used in construction.

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

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

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
1	Advanced Construction Materials	4	6	4	14
2	Advanced Concreting Methods and Equipments	4	6	4	14
3	Advanced Technology in Constructions	4	6	4	14
4	Hoisting and Conveying Equipments	4	6	4	14
5	Miscellaneous Machineries and Equipments	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*):NA

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	

* 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 NA Marks as per assessment scheme.

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Field Trips
5. Demonstration
6. Others

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Construction Engineering and Management,	Sharma S C and Deodhar S V	Khanna BookPublishing, New Delhi	
2	Construction Engineering and Management,	Seetharaman S.	Umesh Publication, New Delhi.	
3	Construction Technology	Chudly, R.	ELBS-Longman Group.	

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	Vol. I to II,			
4	Construction Planning Equipment and Methods,	Peurifoy, R. L.	McGraw Hill Co. Ltd. New York.	
5	Construction Management and Planning	Sengupta, B. and Guha	5., McGraw Hill Education, New Delhi.	
6	Materials of Construction	Smith, R. C.,	McGraw Hill Co. Ltd.	
7	Construction Planning and Equipment	Satyanarayana, R Saxena	Standard Publication, New Delhi.	
8	Ghose, D. N.	Materials of Construction	McGraw Hill Publishing Co, New Delhi.	

(b) Open source software and website address :

1. www.nptel.ac.in
2. www.theconstructor.org
3. www.swayam.gov.in

(c) Others:

M) List of Major Laboratory Equipment and Tools: NA

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Semester - V

N) Mapping of POs & 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: Recognize advanced construction materials.	3	2	2	2	3	2	-	2	-	3	2	3
CO-2: Explain relevant method of concreting and equipment according to type of construction.	3	2	2	3	3	-	-	2	-	3	2	3
CO-3: Identify advanced technology in construction.	3	2	2	3	3	-	-	2	-	3	2	3
CO-4: Describe hoisting and conveying equipments.	3	2	2	3	3	-	-	2	-	3	2	3
CO-5: Identify miscellaneous machineries and equipments.	3	2	2	3	3	-	-	2	-	3	2	3

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Semester - V

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 Recognize advanced construction materials.	SO1.1 SO1.2 SO1.3 SO1.4	--	1.1 1.2 1.3	SL 1.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-2 Explain relevant method of concreting and equipment according to type of construction.	SO2.1 SO2.2 SO2.3 SO2.4	--	2.1 2.4 2.2 2.5 2.3	SL 2.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-3 Identify advanced technology in construction.	SO3.1 SO3.2 SO3.3 SO3.4	--	3.1 3.2 3.3 3.4	SL 3.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-4 Describe hoisting and conveying equipments.	SO4.1 SO4.2 SO4.3	--	4.1 4.2 4.3	SL 4.1
PO-1,2,3,4,5,8,10 PSO-1,2	CO-5 Identify miscellaneous machineries and equipments.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	--	5.1 5.2 5.3 5.4	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

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Semester - V

- A) Course Code : 2020582(020)
 B) Course Title : TRAFFIC ENGINEERING
 C) Pre- requisite Course Code and Title :
 D) Rationale : Traffic Engineering deals with traffic planning and design of roads, of frontage development and of parking facilities and with the control of traffic to provide safe, convenient and economic movement of vehicles and pedestrians. Knowledge and understanding of the basic concept of Traffic Engineering is highly essential for the engineers designing and executing the road laying projects in order to make road transport system safe and workable. Students are expected to perform various traffic surveys, analyze data and interpret the results and design of traffic control device appropriately in order to apply their knowledge in designing efficient and safe road transport systems.

E) Course Outcomes:

CO1: Analyze road traffic characteristics.

CO2: Undertake various types of road traffic studies.

CO3: Use relevant road traffic signs, signal and markings and describe intersection design.

CO4: Describe intersection control.

CO5 : Suggest measures for highway safety.

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	2020582 (020)	Traffic Engineering	3	-	0	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	2020582 (020)	Traffic Engineering	70	20	30	-	-	120

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: Analyze road traffic characteristics.

Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define traffic engineering and describe its objects and scope. SO1.2 Recognize the relationship between speed, volume and density of traffic SO1.3 Identify the vehicular characteristics. SO1.4 Recognize and road characteristics. SO1.5 Explain various factors affecting reaction time.	--	Unit 1– Road Traffic Characteristics 1.1 Traffic engineering- Definition, objects, scope 1.2 Relationship between speed, volume and density of traffic 1.3 Road user's characteristics- physical, mental, emotional factors. 1.4 Vehicular characteristics- width, length, height, weight, speed, efficiency of brakes. 1.5 Road characteristics - gradient, curve of a road, design speed, friction between road and tyre surface. 1.6 Reaction time - factors affecting reaction time. PIEV Theory.	SL1.1 Study pedestrian and bicyclists characteristics.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Establish the Relationship between speed, volume and density of traffic
2. Explain PIEV Theory.
3. What are the factors affecting Reaction Time?
4. Explain Road user's characteristics
5. Describe Vehicular characteristics
6. Explain Road characteristics

b. Mini Project:

Make a chart of vehicular characteristics of different types of vehicle in your city.

CO2: Undertake various types of road traffic studies.

(Approx. Hrs: CI+LI = 1)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.2 Recognize different methods of traffic volume count. SO2.2 Explain representation and data and analysis of traffic count data. SO2.3 Explain Spot speed studies, and its presentation. SO2.4 Describe journey speed and travel time survey. SO2.5 Identify Methods of Origin and Destination study	--	Unit 2- Traffic Studies 2.1 Traffic volume study – manual count, automatic count, intrusive methods, non intrusive methods, types of volume counts, representation and analysis of data. 2.2 Necessity of Origin and Destination study and its methods. 2.3 Speed studies - Spot speed studies, and its presentation, time mean speed, space mean speed, journey speed and travel time survey, delay/queuing survey.	SL2.1 Need and method of parking study.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Differentiate (a) manual count and automatic count.
(b) intrusive methods and non intrusive methods.
2. What are advantages and disadvantages of video image detection as compared with other forms of detection?
3. Describe counts following types of traffic counts-
 - (a) Screen line counts.
 - (b) Cordon counts.
 - (c) Intersection counts.
 - (d) Control Counts.
4. Describe one method for collecting travel time and delay data at a section of highway. Explain how to obtain following information from the data collected- travel time, operation delay, stopped time, fixed delay, travel time delay.
5. Explain Origin and Destination study and its methods.
6. Explain Briefly Speed studies its presen
7. What is the Need of parking studies

- b. Mini Project:** Collect information about traffic count programs carried out by CGPWD, CPWD or any other agencies involved in highway development in your area. What data are collected there?

CO3: Use relevant road traffic signs, signal and markings and describe intersection design.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1 Recognize Traffic control devices, road signs and road markings. SO 3.2 Explain classification of road signs as per IRC: 67. SO3.3 Describe traffic islands. SO3.4Recognise different types of intersection. SO3.4Describe rotary intersection. SO3.5 Explain requirements of intersection at grade and sight distance at intersection. SO3.6 Recognize different types of grade separated intersections	--	Unit 3- Road Signs ,Traffic Markings and Intersection Design 3.1Traffic control devices –definition, necessity, types. Road signs - definition, objects of road signs. 3.2 Classification as per IRC: 67- Mandatory or Regulatory, Cautionary or warning, informatory signs, location of cautionary or warning sign in urban and non-urban areas, Points to be considered while designing and erecting road signs, traffic markings- definition, classification, carriage way, kerb, object marking and reflector markers. 3.3Intersection at grade, grade separated intersection, various forms of intersection, unchannelized and channelized intersection, rotary intersection, design factors of rotary, requirements of intersection at grade, sight distance at intersection. 3.4 Grade separated intersections, advantages, grade separation structures, grade separated intersection with interchange facilities, types - flyovers- partial and full Cloverleaf pattern, Diamond intersection, Trumpet type	SL3.1Study minimum sizes of islands SL3.2 Study access control on highways.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Enlist various traffic control devices and its type
2. Identify the location of Mandatory or Regulatory, Cautionary or warning, informatory sign.
3. What are the different types of traffic marking used? Explain the uses of each.
4. What are the various types of traffic islands? Explain use of each.
5. State the classification of different types of intersection.
6. Describe design factors of rotary intersection.
7. Explain requirements of intersection at grade and sight distance at intersection.
8. Describe different types of grade separated intersections.
9. State the advantages of grade separated intersections.

b. Mini Project: Study traffic pattern at an intersection and suggest suitable layout for the intersection.

CO4: Describe intersection control.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 State properties of effective traffic control device. SO4.2 Describe various types of traffic control signals. SO 4.3 Explain signal timing. SO 4.4 Explain Yellow Change Interval, Cycle Length of Fixed Signals, Minimum Green Time for Pedestrian Movement. SO 4.5 Recognize Actuated Traffic Signals and Coordinated signal System.	--	Unit 4- Intersection Control 4.1 Properties of effective traffic control device and factors considered for traffic control devices, conflicts points at intersection, types of intersection control, 4.2 Traffic signals- Definition, Types, Traffic control signals, pedestrian signals. Types of traffic control signals - Fixed time, manually operated, traffic actuated signals and location of signals. Factors to be considered of installation of traffic signals. 4.3 Terms commonly used in design of traffic signal time, vehicle and pedestrian movement and phase numbering, signal timing policies and process, objective of signal time. 4.4 Signal timing at isolated intersection – Yellow Change Interval, Cycle Length of Fixed Signals, Minimum Green Time for Pedestrian Movement. 4.5 Actuated Traffic Signals, Terms associated with actuated signals, Types of Actuated Signals, Average Phase Duration for Actuated Traffic Signals, Coordinated signal System-basic terminologies and fundamentals.	SL4.1 Study manual on traffic signal design (MUTCD) SL4.2 Study Time Space Diagram, Signal Preemption and/or Priority.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Explain types of Traffic control signals and pedestrian signals
2. Using an appropriate diagram, identify all the possible conflicts points at unsignalised T intersection.
3. Explain yield sign, stop sign and multiway stop sign.
4. What are the factors to be considered for installation of signal.
5. Define the terms commonly used in signal timing.
6. Write short notes on (i) vehicle and pedestrian movement and phase numbering (ii) signal timing policies and process.
7. Explain yellow change interval and cycle lengths of fixed signals.
8. Describe actuated signal.
9. Explain coordinated signal system.

b. Mini Project: Study the working of a signal controlled intersection in your city.

CO5 : Suggest measures for highway safety.

(Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain Strategic Highway Safety Plans. SO5.2 Recognize steps highway safety management. SO5.3 Describe safety effectiveness of some commonly used highway design features. SO5.4 Recognize traffic calming strategies to reduce traffic speed and volume. SO5.5 Explain vertical and horizontal distribution of light. SO5.6 Recognize types of lights and arrangement of illumination for different locations.	--	Unit 5- Highway Safety 5.1 Road Accidents, causes of road accidents, Strategic Highway Safety Plans, definition of terms in highway safety management. 5.2 Steps in highway safety management, Network Screening Process, Diagnosis, Select Counter Measures, Economic Appraisal, Prioritize Project, Safety Effectiveness Evaluation, Effectiveness of safety design features, safety effectiveness of some commonly used highway design features. 5.3 Traffic Calming-concept, traffic calming strategies to reduce traffic speed, traffic calming strategies to reduce volume, safety impact of Intelligent Transportation System (ITS), legislation and enforcement. 5.4 Highway lighting – necessity, distribution of light from luminarie-glare problem, vertical and horizontal distribution of light, mounting height, spacing, types of lights, levels of illumination as per IS 1944-1970, luminarie arrangement, illumination of intersection, traffic rotaries, curves, bridges, high-mast lighting	SL5.1 Study Highway Safety Manual (HSM)

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. Identify causes of road accidents.
2. Briefly explain the steps highway safety management.
3. Describe safety effectiveness of some commonly used highway design features.
4. State traffic calming strategies to reduce traffic speed and volume.
5. Write a note on safety impact of Intelligent Transportation System (ITS).
6. State the necessity of highway lighting.
7. Explain vertical and horizontal distribution of light.

8. State levels of illumination as per IS 1944-197
9. Describe types of lights and arrangement of illumination for different locations.

- b. **Mini Project:** Survey your institute campus. What pedestrian facilities are provided? How pedestrian safety might be improved?

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

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
1	Road Traffic Characteristics	4	6	4	14
2	Traffic Studies	4	6	4	14
3	Road Signs ,Traffic Markings and Intersection Design	4	6	4	14
4	Intersection Control	4	6	4	14
5	Highway Safety	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*): Not Applicable

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	

* 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 NA Marks as per assessment scheme.

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Industrial visits
5. Field Trips
6. Demonstration

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

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Highway Engineering	Khanna S.K., Justo, C E G and Veeraragavan, A	Nem Chand and Brothers, Roorkee	Latest publication
2	Transportation Engineering	Kadiyali L.R	Khanna publishing house New Delhi	Latest publication
3	Transportation Engineering Vol. I & II, Khanna Publishers. Delhi.	Vazirani, V N , Chaondola, S P,	Khanna Publishers. Delhi.	Latest publication
4	S Traffic planning and design,	Sxena S C	Dhanpat Rai & Sons Delhi	Latest publication
5	Introduction to Traffic Engineering	Kumar R S	University Press (India), Pvt. Ltd.	Latest publication
6	Traffic Engineering	Mike Slinn Pal Mathews Peter Guest	Elsevier India, New Delhi	Latest publication
7	Highway Engineering	Martin Rogers Bernard Enright	Wiley India, New Delhi	Latest publication
8	Traffic and Highway Engineering	Nicholas J.Garber Lester A.Hoe K.ramchndra rao	Cengage Learning India, New Delhi	Latest publication

(b) Open source software and website address:

1. nptel.ac.in
2. swayam portal

M) List of Major Laboratory Equipment and Tools: Not Applicable

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
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N) Mapping of POs & 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
CO1: Analyze road traffic characteristics.	3	3	2	2	3	2	1	2	1	3	3	3
CO2: Undertake various types of road traffic studies.	3	3	2	2	3	2	1	2	1	3	3	3
CO3: Use relevant road traffic signs, signal and markings and describe intersection design.	3	3	2	2	3	2	1	2	1	3	3	3
CO4: Describe intersection control.	3	3	2	2	3	2	1	2	1	3	3	3
CO5: Suggest measures for highway safety.	3	3	2	2	3	2	1	2	1	3	3	3

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O) Course Curriculum Map:

POs & PSOs No.	COs No.& Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO1: Analyze road traffic characteristics	SO1.1 SO1.4 SO1.2 SO1.5 SO1.3	--	1.1 1.4 1.2 1.5 1.3 1.6	SL1.1
PO-1,2,3,4,5,6,7,8,9,10 PSO-1,2	CO2: Undertake various types of road traffic studies.	SO2.1 SO2.4 SO2.2 SO2.5 SO2.3	--	2.1 2.2 2.3	SL2.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO3: Use relevant road traffic signs, signal and markings and describe intersection design.	SO3.1 SO3.5 SO3.2 SO3.6 SO3.3 SO3.4	--	3.1 3.2 3.3 3.4	SL3.1 SL3.2
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO4: Describe intersection control.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	--	4.1 4.2 4.3 4.4 4.5	SL4.1 SL4.2
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO5 : Suggest measures for highway safety.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5 SO5.6	--	5.1 5.2 5.3 5.4	SL5.1

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

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- A) Course Code : 2020583(020)
 B) Course Title : Pavement Design, Construction and Maintenance
 C) Pre- requisite Course Code and Title : Nil
 D) Rationale:

Knowledge and understanding of various factors affecting pavement design, pavement material and construction procedure is essential for diploma engineer. He should have knowledge of traditional techniques along with modern techniques. Knowledge of pavement evaluation and the related maintenance activities is also important. A road with irregular pavement, excess cracks or corrugations and patch affects the costs involved in the operations of vehicles. This underlines the importance of pavement maintenance.

E) Course Outcomes :

CO-1 Identify the basics of pavement Design.

CO-2 Explain design of flexible and rigid pavements.

CO-3 Describe the construction of flexible pavements.

CO-4 Describe the construction of rigid pavements.

CO-5 Supervise the maintenance work of flexible and rigid pavements

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	2020583(020)	Pavement Design, Construction and Maintenance	3	-	-	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	2020583(020)	Pavement Design, Construction and Maintenance	70	20	30	-	-	120

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 basics of pavement Design.

(Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Identify the types of pavements SO1.2 Describe structural components of pavements. SO1.3 Explain Equivalent Single Wheel Load (ESWL). SO 1.4 Explain contact pressure, vehicle damage factor (VDF) and lateral distribution factor. SO1.5 Identify strength characteristics of pavement material for design of pavements.	--	Unit 1- Fundamentals of Pavement Design 1.1 Functions and characteristics of pavement. Types of pavement- Flexible, Rigid and Semi Rigid 1.2 Comparison of Rigid and flexible pavement, structural components of flexible and rigid pavements and their functions, Factors affecting selection of type of pavement. 1.3 Factors affecting pavement design 1.3.1 Design wheel load-Contact pressure, Axle load, traffic volume, Vehicle damage factor, load safety factor, lane distribution factor, lateral distribution of wheel path in a lane, Wheel configuration, Equivalent single wheel load ESWL , 1.3.2 Strength Characteristics of pavement materials- California Bearing Ratio CBR , Elastic moduli of base course and sub-base course material, modulus of sub grade reaction 1.3.3 Climatic variations, Drainage situation	SL1.1 Study IRC 37-2001 for axle load survey data-load equivalency factors and LDF value.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Compare flexible and Rigid pavements
2. What should be the characteristic of a good pavement?

3. State the factors affecting selection of type of pavement.
4. Explain axle load and contact pressure.
5. Explain vehicle damage factor, load safety factor, lane distribution factor and lateral distribution.
6. Explain ESWL.
7. Describe strength characteristics of base course, sub-base course material and sub grade.

b. Mini Project:

1. Visit PWD office and collect the factors considered for design of new highway pavement.

CO-2 Explain design of flexible and rigid pavements.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1 Explain mechanistic empirical method of design of flexible pavement. SO 2.2 State the design criteria for flexible pavement as per IRC37 -2001. SO 2.3 Explain the use of pavement thickness design chart SO 2.4 Identify critical load position for design of rigid pavement. SO 2.5 State Westergaard's stress equation. SO 2.6 Explain the design of joints in concrete pavement.	--	Unit -2 Design of Pavement 2.1 Methods of Flexible Pavement Design 2.1.1 Mechanistic Empirical method of Design- Layered Elastic Model, 2.1.2 IRC37 -2001 guidelines for design of flexible pavement - design criteria, Design procedure , Design Traffic, Pavement thickness design chart, Pavement composition, simple numerical example. 2.1.4 IRC37 -2018 guidelines for design of flexible pavement design-overview 2.2 Design of Concrete Pavement- 2.2.1 Critical load positions, Equivalent radius of resisting section, Wheel load stresses - Westergaard's stress equation, Temperature stresses, Warping stress, Frictional stresses, Combination of stresses 2.2.2 Design of joints -Expansion joints, Contraction joints, Dowel bars ,Tie bars 2.2.3 IRC58- 1988 guidelines for design of concrete pavement (overview only)	SL2.1 Study empirical method of flexible pavement design (IRC 1970 and 1984 method)

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Explain mechanistic empirical method of design of flexible pavement
2. State the design criteria for flexible pavement as per IRC37 -2001.
3. Explain the procedure for flexible pavement design.
4. Solve simple numerical problems for the flexible pavement design
5. State the critical load position for design of rigid pavement.

6. Explain Temperature stresses, warping stress, Frictional stresses, Combination of stresses.
7. Describe Design Expansion joints, Contraction joints, Dowel bars and Tie bars.

b. Mini Project:

1. Visit a highway project site and study design of pavement.

CO- 3 Describe the construction of flexible pavements.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 State the characteristics of GSB. SO3.2 Describe construction of WMM. SO3.3 Identify different types of binder in bituminous construction. SO3.4 Explain Marshall method of mix design. SO3.5 Describe construction of bituminous concrete. SO3.6 Describe construction of SMA	--	Unit -3 Construction of Flexible Pavements 3.1 Characteristics for GSB, Stabilized Layers, WBM, WMM, Crusher Run Macadam , Construction of GSB, Stabilized layers, WBM, WMM, Crusher Run Macadam compaction standards ,Quality Control. 3.2 Binders for Bituminous Construction- Bitumen, Bitumen Emulsions, Cutback Bitumen and Modified Bitumen, Quality control tests of binders. 3.3 Bituminous Mix Design, Marshall method of mix design, Design Criteria, Proportioning of Materials. 3.4 Construction of Bituminous Courses Construction of different types of bituminous layers such as BM, DBM, BC, SMA and Mastic Asphalt , Production and Transportation of Mix, Paving of Mix, Compaction of bituminous surface, Quality Control.	SL3.1 Study earthwork including Sub-grade quality

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. State the characteristics of GSB.
2. Write short notes on WBM, WMM, Crusher Run Macadam
3. Write short notes on Bitumen, Bitumen Emulsions, and Cutback Bitumen.
4. State quality control tests of binders
5. Describe construction of DBM.
6. Describe construction of bituminous concrete.
7. Explain Marshall method of mix design.

b. Mini Project:

1. Visit a highway construction site and study the construction of flexible pavement.

CO- 4 Describe the construction of rigid pavements.

(Approx. Hrs: CI+LI = 10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1 Explain dry lean concrete (DLC) as sub base. SO 4.2 Describe construction of dry lean concrete (DLC) as sub base. SO 4.3 Describe construction of concrete pavement. SO4.4 Describe construction of joints in concrete pavements. SO4.5 Identify quality control test for construction of concrete pavement.	--	Unit -4 Construction of Rigid Pavements 4.1 Sub grade preparation, construction of base and sub base, dry lean concrete (DLC) as sub base. 4.2. Production of Concrete for DLC, Transportation, laying, Compaction, Finishing, Curing of DLC ,Production of Concrete for Pavement Quality Concrete (PQC), Transportation of Concrete for PQC, Separation Membrane Slip Form Paving of PQC including Placing of Concrete, Laying by Slip form Paver, Insertion of Dowel and Tie Bar Compaction, Floating and Finishing of Concrete, Curing 4.3 Initial Saw Cutting of Joint, Material for Transverse Contractions, Expansions and Longitudinal Joints (Dowel Bar, Tie Bar, Sheathing, Expansion Cap, Sealant, Widening of Joints and Sealing 4.4 Quality Control and Quality Assurance, Various tests.	SL4.1 Study IRC 15-2017 guidelines for construction of rigid pavement.

S W-4 Suggested Sessional Work (SW):

a. Assignments:

- 1.Explain dry lean concrete (DLC) as sub base.
- 2.Describe laying and compaction of PQC.
- 3.Describe construction of joints.
- 4.Explain Floating and Finishing of Concrete.
- 5.Describe the materials used for Transverse Contractions, Expansions and Longitudinal Joints.
- 6.Identify quality control tests in construction of concrete pavements.

b. Mini Project:

- 1.Visit highway project site and study construction of concrete pavement,

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CO-5 Supervise the maintenance Work of flexible and rigid pavements.

(Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learnin (SL)
<p>SO5.1Classify pavement maintenance.</p> <p>SO5.2Identify types and causes of damages in flexible pavements.</p> <p>SO5.3Describe Benkelman Beam deflection method.</p> <p>SO5.4 Types of damages in rigid pavement.</p> <p>SO5.5Describe repair of spalled joints, full depth reconstruction, and replacement of dowel bars.</p> <p>SO5.6Explain Falling Weight Deflectometer method.</p>	--	<p>Unit -5 Pavement Evaluation and Maintenance</p> <p>5.1 Definition and purpose of pavement evaluation, types of pavement maintenance - routine, periodic, and special. Need for inspection and maintenance schedule.</p> <p>5.2.1 Types and causes of damages in flexible pavement, surface defects, cracks. Deformations - Rutting, fatigue, settlement and upheaval. Disintegration - loss of aggregate, stripping, pothole, Remedial measures - slurry seal, liquid seal, fog seal, and patching, ready mix patch. Strengthening and Rehabilitation of Flexible.</p> <p>5.2.2Methods of Pavement evaluation –Visual rating, Pavement serviceability index, Roughness measurements, Benkelman Beam deflection method .</p> <p>5.3.1 Types of damages in rigid pavement - cracking, spalling, slab rocking, settlement, joint sealant failure.</p> <p>5.3.2 Methods of repair - repair of spalled joints, full depth reconstruction, and replacement of dowel bars. Strengthening and Rehabilitation of rigid pavement.</p> <p>5.3.3 Evaluation of rigid pavement by Falling Weight Deflectometer.</p>	<p>SL5.1 IRC SP:83-2018 guidelines for maintenance, repair and rehabilitation of concrete pavement.</p>

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. Classify pavement maintenance.

2. State the types and causes of damages in flexible pavements.
3. Describe remedial measures for damages in flexible pavements.
4. Describe Benkelman Beam deflection method.
5. State the types and causes of damages in rigid pavements.
6. Describe repair of spalled joints, full depth reconstruction, and replacement of dowel bars.
7. Explain evaluation of rigid pavement by Falling Weight Deflectometer.

b. Mini Project:

1. Visit nearby highway and study maintenance work.

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

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
1	Fundamentals of Pavement Design	4	6	4	14
2	Design of Pavement	4	6	4	14
3	Construction of Flexible Pavements	4	6	4	14
4	Construction of Rigid Pavements	4	6	4	14
5	Pavement Evaluation and Maintenance	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*):NA

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	

* 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 NA Marks as per assessment scheme.

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial

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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. Others

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Highway Engineering,	Kadiyali, L.R.,	Khanna Book Publishing House, New Delhi	Latest revision
2	Principles of Transportation Engineering	Chakroborty, Partha Das, Animesh	Prentice-Hall of India Pvt.Ltd	Latest revision
3	Transportation Engineering Vol. I & II,	Vazirani, V N, Chaondola, S P	Khanna Publishers. Delhi	Latest revision
4	Principles of Pavement Design	Yoder, E J	Wiley India Pvt Ltd	Latest revision
5	Highway Engineering	Martin Rogers Bernard Enright	Wiley India, New Delhi	Latest revision
6	Traffic and Highway Engineering	Nicholas J.Garber Lester A.Hoe K.ramchndra rao	Cengage Learning India, New Delhi	Latest revision

(b) Open source software and website address:

1. nptel.ac.in
2. swayam portal

M) List of Major Laboratory Equipment and Tools: NA

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
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N) Mapping of POs & 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 basics of pavement Design.	3	3	3	2	3	2	2	3	2	2	3	3
CO-2 Explain design of flexible and rigid pavements.	3	3	3	2	3	2	2	3	2	2	3	3
CO-3 Describe the construction of flexible pavements.	3	3	3	2	3	2	2	3	2	2	3	3
CO-4 Describe the construction of rigid pavements.	3	3	3	2	3	2	2	3	2	2	3	3
CO-5 Supervise the maintenance work of flexible and rigid pavements	3	3	3	2	3	2	2	3	2	2	3	3

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O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-1 Identify the basics of pavement Design.	SO1.1 SO5.4 SO1.2 SO5.5 SO1.3	--	1.1 1.2 1.3.1-1.3.3	SL1.1
PO-1,2,3,4,5,6,7,8,9,10 PSO-1,2	CO-2 Explain design of flexible and rigid pavements.	SO2.1 SO2.4 SO2.2 SO2.5 SO2.3 SO2.6	--	2.1.1-2.1.4 2.2.1-2.2.3	SL2.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-3 Describe the construction of flexible pavements.	SO3.1 SO3.4 SO3.2 SO3.5 SO3.3 SO3.6	--	3.1 3.2 3.3 3.4	SL3.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-4 Describe the construction of rigid pavements.	SO4.1 SO4.4 SO4.2 SO4.5 SO4.3	--	4.1 4.2 4.3 4.4	SL4.1
PO-1,2,3,4,5,6,7,8,10 PSO-1,2	CO-5 Supervise the maintenance work of flexible and rigid pavements	SO5.1 SO5.4 SO5.2 SO5.5 SO5.3 SO5.6	--	5.1 5.2.1-5.2.2 5.3.1-5.3.3	SL5.1

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