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

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.

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)
SO1.1Recognize General Specification and Detailed Specification. SO1.2 Describe approximate method of estimate. SO1.3Prepare approximate estimates of various construction works using different methods	LE1.1Prepare 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** 2.1Units 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, 2.5Taking 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** 4.2.1Purpose of rates analysis 4.2.2 Task artisan per day 4.2.3Materials required for major items 4.2.4Labour 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)
SO5.1 Calculate the area of cross section in embankment and cutting SO5.2 Compute the earthwork for series of cross sections by using Prismoidal &Trapezoidal formulae SO5.3 Calculate the estimate of earth work for a given length of road SO5.4 Illustrate in a diagram soling coat ,inter coat and top coat and calculate their quantities	LE5.1 Estimate of earth work for different sections. LE5.2 Estimate of road of 1 K.M. length for pavement surface. W.B.M., Bitumen	**UNIT-5 Earthwork and Road Estimate** **5.1 Earthwork Estimate** 5.1.1Calculation of area of cross section for given cross sections: Fully cutting section , Partly cutting and partly embankment section, Fully embankment section 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 , Estimate of earth work for a given length of road **5.2 Road Estimate** Items of work in flexible pavement, estimation of soling coat ,inter coat and top coat in road work.	SL 5.1 Study the markets rates and SOR for earth work elements of an road SL 5.2 Prepare an detailed estimate of a identified section length of rural roads on per KM basis

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.			
LE5.2	Estimate of road of 1 K.M. length for pavement surface. W.B.M. Bitumen			

* 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 Publishers, 28, Nath Market, Nai Sarak, New Delhi	Latest Revised 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

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-3Prepare detailed estimate of buildings/structure.	2	3	2	3	2	-	-	1	1	2	-	-
CO-4Use 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	-	-

O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,58,9,10 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, 3,4,58,9,10 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-1,2,3,4,58,9,10 PSO1,2	CO-3Prepare 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-1,2,3,4,58,9,10 PSO1,2	CO-4Use SOR and analyze rates of different items in building works as er 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-1,2,3,4,58,9,10 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

A) Course Code : 2020572(020)
B) Course Title : STRUCTURAL DESIGN AND DRAFTING-I
C) Pre- requisite Course Code and Title :
ESE Hrs. : 3.00
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.

IS code 456-2000 should not be allowed only relevant tables/data should be provided in question paper or by the examination centre.

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 Study	Course Code	Course Title	Scheme of Examinations					
			Theory			Practical		Total Marks
			ESE	CT	TA	ESE	TA	
Civil Engineering	2020572 (020)	Structural Design and Drafting-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.

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 defection, Modification factor for Tensile and compressive steel ,Cover to reinforcement Vertical and horizontal, Spacing of reinforcement , Max and min reinforcement ,	SL.1 Compare the stress strain curve of mild steel ,Fe415 and Fe500 bars

Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
		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:** 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)
SO 2.1 Explain the terms related to strength, loadings and safety factors in limit state method of design. SO 2.2 Identify the stress –strain curves of concrete and steel. SO 2.3 Analyze for flexure, shear, development length. SO 2.4 Design singly	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.	**Unit 2- Limit State Method of Design & Design of Rectangular Beams** **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	SL2.1 Read and understand different types of detailed structural and working drawings of beams.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
reinforced rectangular beams, doubly reinforced rectangular beams and lintel with chajja.		and steel **2.2 Design and drafting of rectangular beams** 2.2.1 Limit state of collapse for flexure , assumptions, stress block parameters, neutral axis, analysis and design of singly and doubly 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 SO 3.4 Design and draft two way simply supported 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 design of singly reinforced Flanged beam. 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. a. Design and drafting of one way simply supported slab b. One way continuous slab – effective span, bending moment and shear force coefficient, design and drafting of three span continuous slab. c. Two way slab – design and drafting simply supported slab on for sides.	SL3.1Study design method of continuous beam and show reinforcement detail. SL3.2 Study 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.

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 4.1Draw 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.

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.			

* 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

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

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-2Design 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

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, theisen 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)
SO 2.1 Explain necessity, advantages, ill effects of irrigation. SO 2.2 Compute duty and delta for various crops. SO 2.3 Evaluate frequency of irrigation on the basis of soil moisture regime concept. SO 2.4 Explain water logging, cause and control		**Unit-2 Water requirements of crops** 2.1 IRRIGATION: Definition, necessity, advantages, disadvantages, types of irrigation, methods of irrigation – surface, sub surface, sprinkler and drip irrigation. 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. 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. 2.4 Water logging: cause and control.	SL 2.1 Describe lift irrigation.

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-3.0Reservoir Planning** 3.1Purposes 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.		**Unit- 5** **Diversion Headworks and Canal Irrigation System** 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. **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 linining –necessity and advantages, **5.2.2 Canal Outlets** – requirements of canal outlets, types of outlets, non-modular pipe 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.	SL 5.1 Study of types of canal linining.

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.

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
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			

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

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.	SO.3.1 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

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, Determination of liquid limit,	SL 1.1 Determination of water content by pycnometer method . SL 1.2 Explain field identification of soil

Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
		plastic limit and shrinkage limit. 1.2.3Particle 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)
SO 2.1 Describe permeability and factors affecting permeability. SO 2.2 Demonstrate constant head permeability and falling head permeability test. SO2.3 Determine discharge from well in confined and unconfined aquifer. SO 2.3 Explain seepage through soil and properties of flow net.	LE 2.1 Determination of coefficient of permeability by constant head test LE 2.2 Determination of coefficient of permeability by falling head test.	**Unit 2-Permeability,Well Hydraulics and Seepage** **2.1 Permeability** 2.1.1Definition of permeability, Darcy's law of permeability, coefficient of permeability, Factors affecting permeability. 2.1.2Determination of coefficient of permeability by constant head and falling head permeability tests. **2.2 Well Hydraulics** 2.2.1Aquifer,aquiclude, aquifuge, coefficient of transmissibility 2.2.2Formulae for discharge through unconfined and confined aquifer for steady radial	SL 2.1 Enlist typical values of coefficient of permeability for different soil.

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

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)
SO3.1 Recognize shear strength of soil SO3.2 Explain components of shearing resistance of soil. SO3.3 Explain Mohr-Coulomb failure theory	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	**Unit 3- Shear Strength of Soil** 3.1 Shear failure of soil, concept of shear strength of soil, components of shearing resistance of soil – cohesion, internal friction	SL 3.1 Determine total pressure and effective pressure for different soil water

Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
and strength envelop. SO3.4 Determine shear strength parameters of soil.	strength of soil using laboratory tri-axial test. LE 3.4 Determination of shear strength of soil using unconfined compressive strength test.	3.2 Mohr-Coulomb failure theory, Strength envelope, strength equation 3.3Effective 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,.	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)
SO4.1Explains compaction, factors affecting compaction and test on compaction. SO4.2Recognize field methods of compaction field compaction control. SO4.3 Explain earth	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	**Unit 4- Compaction of Soil and Earth Pressure** **4.1Compaction of Soil** 4.1 Concept of compaction, purpose of compaction field situations where compaction is required. 4.2 Standard proctor test – test procedure as per IS code, compaction curve, optimum	SL 4.1 Effect of compaction on various soil properties. SL 4.2 California bearing ratio, CBR test, significance of CBR value

pressure on structure. SO 4.4 Calculate active and passive earth pressure of soil on structure.		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. 4.6Difference 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).	

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. Procter test and modified Procter 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 assumption. SO5.1 Apply Field methods for determination of bearing	--	**Unit 5-Bearing Capacity of Soils , Stabilization of soil and Site Investigation And Sub Soil Exploration** **5.1 Bearing Capacity of Soils** 5.1.1 Concept of bearing	SL 5.1 Explain types of bearing capcity failures. SL5.2Depth of exploration for various structure.

Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning (SL)
capacity of soil. SO5.3 Explain methods of soil stabilization SO5.4 Explain Methods of site exploration & boring.		capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure 5.1.2 Terzaghi's analysis and assumptions made. 5.1.3 Effect of water table on bearing capacity 5.1.4 IS code method for computing bearing capacity. 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 5.1.6 Typical values of bearing capacity from building code IS:1904 5.1.6 Liquefaction(in brief) **5.2 Stabilization of soil** 5.2.1Concept of soil stabilization, necessity of soil stabilization, 5.2.2Different methods of soil stabilization – Mechanical soil stabilization, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization **5.3 Site Investigation And Sub Soil Exploration** 5.3.1 Necessity of site investigation & sub-soil exploration. 5.3.2 Method of site exploration open excavation & boring 5.3.3 Criteria for deciding the location and number of test pits and bores 5.3.4Methods 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 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 Publsher	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
3. https://nptel.ac.in

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	a) sand pouring cylinder of about 3litre capacity, mounted above a pouring cone and separated by	LE1.4

	Capacity	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	
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 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	LE1.7
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	LE3.1

		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.	
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 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.	LE3.2

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 & Teamwork 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

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.	SO.2.1 SO.2.2 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.	SO.3.1 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

A) Course Code : 2020581(020)
B) Course Title : ADVANCED CONSTRUCTION TECHNOLGY
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)
SO1.1Identify Use and properties of steel, polypropylene, carbon and glass fibers. SO1.2Explain use and properties of PVC, RPVC, HDPE, FRP, GRP. SO1.3Explain Properties and uses of acoustics materials, wall claddings, plaster boards, micro-silica, SO1.4Describe Use of waste products and industrial by products in bricks, blocks, concrete and mortar.	--	**Unit 1- Advanced Construction Materials** 1.1Fibres: Use and properties of steel, polypropylene, carbon and glass fibers. 1.2 Plastics: Use and properties of PVC, RPVC, HDPE, FRP, GRP. 1.3Miscellaneous 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)
SO2.1Explain necessity and use of ready mix concrete. SO2.2Describe 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** 2.1Ready 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. 2.3Vibrators 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. 2.5Special 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 fowabilty 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.

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. SO3.3Describe prefabricated building elements. SO3.4Identify components of reinforced soil.	--	**Unit 3 - Advanced Technology in Constructions** 3.1Construction 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 lazer, 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 lazer, 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.

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)
SO4.1Identfy 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 4.2Hoisting 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. 4.3Conveying 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)
SO5.1Describe scrapers and graders. SO5.2State uses of power shovel and dragline. SO5.3 Identify different	--	**Unit 5– Miscellaneous Machineries and Equipments** 5.1Excavation Equipments: Use, working and output of following machinery – bull dozers, scrapers, graders, Clam Shell, trenching	SL5.1State the equipment used for site clearance.

Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning (SL)
compacting equipments for earth work. SO5.4Recognise 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. 5.2Compacting 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:

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

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

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	
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.	

	Vol. I to II,			
4	Construction Planning Equipment and Methods,	Peurifoy, R. L.	McGraw Hill Co. Ltd. NewYork.	
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

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

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

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:

CO-1: Analyze road traffic characteristics.

CO-2: Undertake various types of road traffic studies.

CO-3: Use relevant road traffic signs, signal and markings and describe intersection design.

CO-4: Describe intersection control.

CO-5: 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.

CO-1: 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. SO1.5Explain various factors affecting reaction time.	--	**Unit 1– Road Traffic Characteristics** 1.1Traffic engineering-Definition, objects, scope 1.2 Relationship between speed, volume and density of traffic 1.3Road user's characteristics-physical, mental, emotional factors. 1.4Vehicular characteristics-width, length, height, weight, speed, efficiency of breaks. 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.

CO-2: 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. SO2.4Describe journey speed and travel time survey. SO2.5 Identify Methods of Origin and Destination study	--	**Unit 2- Traffic Studies** 2.1Traffic volume study – manual count, automatic count, intrusive methods, non intrusive methods, types of volume counts, representation and analysis of data. 2.2Necessity of Origin and Destination study and its methods. 2.3Speed studies - Spot speed studies, and its presentation ,time mean speed, space mean speed, journey speed and travel time survey, delay/queuing survey.	SL2.1Need 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?

CO-3: 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.

CO-4: 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** 4.1Properties 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.	SL4.1Study 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.

CO-5 : Suggest measures for highway safety.

(Approx. Hrs: CI+LI = 9)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1Explain 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. 5.2Steps in highway safety management, Network Screening Process, Diagnosis, Select Counter Measures, Economic Appraisal, Prioritize Project, Safety Effective ness Evaluation, Effectiveness of safety design features, safety effectiveness of some commonly used highway design features. 5.3Traffic 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	SL5.1Study 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
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

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 & Teamwork 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

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.**	SO.3.1 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

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 1.3.1Design 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 modulii 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 2.5State Westergaard's stress equation. SO 2.6 Explain the design of joints in concrete pavement.	--	**Unit -2 Design of Pavement** 2.1Methods 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- 2.2.1Critical load positions, Equivalent radius of resisting section, Wheel load stresses - Westergaard's stress equation, Temperature stresses, Warping stress, Frictional stresses, Combination of stresses 2.2.2Design 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)
SO3.1State the characteristics of GSB. SO3.2Describe construction of WMM. SO3.3Identify 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. 3.2Binders for Bituminous Construction- Bitumen, Bitumen Emulsions, Cutback Bitumen and Modified Bitumen, Quality control tests of binders. 3.3Bituminous 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. SO4.5Identify 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 4.4Quality Control and Quality Assurance, Various tests.	SL4.1 Study IRC 15-2017 guidelines for construction of rigid pavement.

SW-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,

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 Learning (SL)
SO5.1Classify pavement maintenance. SO5.2Identify types and causes of damages in flexible pavements. SO5.3Describe Benkelman Beam deflection method. SO5.4 Types of damages in rigid pavement. SO5.5Describe repair of spalled joints, full depth reconstruction, and replacement of dowel bars. SO5.6Explain Falling Weight Deflectometer method.	--	**Unit -5 Pavement Evaluation and Maintenance** 5.1 Definition and purpose of pavement evaluation, types of pavement maintenance - routine, periodic, and special. Need for inspection and maintenance schedule. 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. 5.2.2Methods of Pavement evaluation –Visual rating, Pavement serviceability index, Roughness measurements, Benkelman Beam deflection method . 5.3.1 Types of damages in rigid pavement - cracking, spalling, slab rocking, settlement, joint sealant failure. 5.3.2 Methods of repair - repair of spalled joints, full depth reconstruction, and replacement of dowel bars. Strengthening and Rehabilitation of rigid pavement. 5.3.3 Evaluation of rigid pavement by Falling Weight Deflectometer.	SL5.1 IRC SP:83-2018 guidelines for maintenance, repair and rehabilitation of concrete pavement.

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
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

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 & Teamwork 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

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

A) Course Code : 2020564(020)

B) Course Title : Summer Internship

C) Pre- requisite Course Code and Title :

D) Rationale :

With the advancement in technology and industry, we need to prepare our young Indian technical talent to meet the present demand. Our diploma pass outs are either supposed to work as supervisor in the industries or start their own enterprise, hence upon the completion of diploma programme, they need to be adequately equipped with knowledge, skills and attitude required by the world of work in their relevant field. To attain this, students need to be sent for industrial visit and industrial training during the course of study. With these provision of industrial exposures relevant practical and professional skills are developed in the students and as a result of this students are readily employed and widely accepted by cross section of the industries, even sometimes during such training itself.

Series of continues interactions with the industry personnel are required to be done for planning and arranging and also effectively implementing such exposures.

E) Course Outcomes: After undergoing the industrial visit, industrial training and internship the students will be able to -

CO-1 Appreciate the importance of industrial visit, industrial training and internship for gaining direct practical skills on their relevant domain area.

CO-2 Comprehend the comprehensive view of industry or world of work in terms of its layout, management, culture, hierarchy, discipline, safety norms, different department/sections, quality control/assurance in processes, services and products, demonstration and operation of specific equipment/machinery, rules and procedures etc.

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	2020564 (020)	Summer Internship	-	-	-	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	2020564 (020)	Summer Internship	-	-	-	-	100	100

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) Guidelines to Teachers for arranging Industrial Visit :

1. Rationale :

During implementation of the curriculum, industrial exposure in the form of industrial visit is very important for developing and reinforcing many concepts and principles and also to get an idea to understand the industrial environment, working culture and latest developments in relevant field and many other aspects of the industries, where diploma holders are going to be absorbed. Students also get exposed to the different kinds of problems which can be brought into the institutional laboratories or workshop. Planning before industrial visit and Industrial tour is essentially required to be done or effective implementation of the same.

2. Planning for industrial visit :

During industrial visit of students to develop certain expected outcomes, many dimensions or aspects of industries need to be understood. The major dimensions or aspects of industry's visit which may be taken care of during the industrial visit are as below –

- Layout of different Departments, Sections of Industry, stores, entry and exit etc.

S.N	Major Dimensions /Aspects of Industrial Visit
I.	Layout of different Departments, Sections of Industry, stores, entry and exit etc.
II.	Display of Quotations in the Industry
III.	Display of Charts on - • Systems of Industry • Procedures/Rules/standards • Hierarchy at Industries • Products & Services • Targets • Safety Precautions/Norms • Flow diagrams of different process • Other Aspects
IV.	Demonstration of Specific Equipment, not available in the Institute or Department or even the Demonstration of Performance of Specific Experiment.
V.	Demonstration of latest Engineering Tools or Techniques or Software's or Procedures

Assessment rubric may be prepared by the implementing teachers in advance for assessing the students on various dimensions of industrial visit.

3. Major outcomes expected to be attained and assessed :

Outcomes expected from the industrial visit should be clearly defined and briefed to the students. Evaluation criteria for assessing students, need to be prepared for different outcomes set, during the planning stage. The list of major outcomes expected to be attained are –

- Development and reinforcement of Basic knowledge
- Development and reinforcement of Engineering knowledge through reinforcement of concepts or principles

- Outcome attainment through content beyond syllabus
- Engineering and Society
- Environment & Sustainability
- Communication ability
- Industrial System and its development
- Safety Awareness
- Systematic Operations and Productions
- Quality control
- Management of work place and work force
- Development of positive attitude
- Work culture/Quality Culture
- Development of Professional Ethics
- Industrial Management
- Systematic planning, Implementation & Evaluation
- Use of engineering tools, techniques, softwares and Procedures
- Development of Lifelong learning skills

It is important to note that outcomes attained during industrial visit are at the awareness level only.

I) Guidelines to Teachers for arranging Industrial Training :

1. Rationale :

Apart from arranging industrial visit, organizing industrial training of students is essentially required to be done during implementation of the curriculum to improve the quality of our young diploma engineering students and to enhance the prospects of employability, After undergoing industrial training, students get the direct exposure to the world of work in their relevant field. They get hands on experience in the industries. The need to be given opportunity to undergo training in relevant industry for minimum two weeks and it is recommended that it should be mandatory for all the programmes running in the institute. The industrial training period may vary from 2 weeks to 6 months depending upon the requirement of that programme.

The programmes, where there is provision of industrial training during the semester are termed as sandwich programmes. Many of the programmes have industrial training at the end of last semester or sometimes a full semester is dedicated for industrial training.

2. Planning for Industrial Training :

Following points need to be planned and briefed by the teachers to the students before proceeding for industrial training. Student should take into consideration these points and carry the relevant format/data/log book with them.

- Objectives /Purposes of the industrial training
- Outcomes targeted before proceeding to industrial training.
- Pre-requisite knowledge or skills required to be developed in the students in the form of demonstration or classroom sessions.
- Identification and planning for demonstration of any equipment or experiments, concepts, under the content beyond syllabus.
- Preparation of database of nearby relevant industries.
- Good rapport need to be developed and maintained with the industries by the teachers, so that the students are ultimately benefitted by the industrial training.
- Industrial policy of the state also need to be taken care of while planning of industrial training

- For assessing the students on various dimensions of industrial training, assessment rubric may be prepared by the implementing teachers in advance.
- Following formats need to be developed by the teachers and briefed to the students before proceeding to industrial training –
  - Formats of observations on layout, ambience, and work culture to be developed, and briefed to the students.
  - Formats of outcome attainment, related to observation on relevant technical area also need to be developed by the teachers and briefed to the students.
  - Formats and contents of report writing and presentation.
  - Formats and contents on assessment of industrial training.
  - Continuous observation formats on many points such as behavioral aspects related to soft skills development such as initiativeness, observation, notes taking skills, inquisitiveness, obedience, sincerity, follow the instructions, positive attitude and many other aspects.
  - Formats of Assessment Rubric on different parameters of both behavioral aspects and technical aspects of the programme.

3. Actions to be taken by the Students and Teachers :

Students are sent to Industrial training after briefing on various aspects. During industrial training, observational skills in students are required to a great extent -

- Students need to be alert, meticulous and record the data, as briefed to them before the industrial training.
- Record of observations on safety precaution to be followed, any special point during performance and handling of equipment, performance on technical aspects and other related aspects need to be taken care of.
- Continuous observation, monitoring and assessment on various behavioral and performance of technical aspects of each student need to be critically observed and recorded by the teachers using different assessment tools.

4. Post Training Assessment :

The students need to be assessed on report writing, presentation and interpretation of data recorded, on various dimensions, planned and performed, after the industrial training. The actions are required to be taken for assessment during report writing, analysis, interpretation, presentation of data and its assessment.

5. Major outcomes expected to be attained and assessed :

The following learning outcomes are expected to be developed during the industrial training. This will lead to attainment of COs, POS and PSOs.

- Development and Reinforcement of Basic Knowledge/concepts
- Development and Reinforcement & Engineering Knowledge i.e operations, performance, maintenance, demonstrations of specific skills relevant to the content of the programme.
- Experiment and practice – Development of experimental practical skills and technical skills relevant to the course programme.
- Development of learning to learn skills and life long teaching skills for latest advancement in technology.
- Development of positive attitude, professional ethics and etiquettes.
- Development of skills for individual and team work during performance and otherwise.
- Maintaining Business Secrecy
- Development of Communication Skills
- Ability to follow the instructions
- Ability to follow the safety precautions

- Ability to supervise the task
- Ability to coordinate with subordinates and higher ups
- Development of Interpersonal skills
- Environmental Consciousness and Sustainability
- Development of Observational Skills
- Time Management
- Self discipline
- Integrity
- Development of generic skills such as pro-activeness, commitment
- Development of Problem Solving abilities
- Achievement of target

J) Guidelines to Teachers for arranging Internship :

1. Rationale :

The concepts of internship is the need for the development of outcomes based in the students. It encourages on the job-training, practice, feedback and reinforcement of concepts and principles. During internship students are exposed to variety of task/problems/assignments which enhances the exposure of students to cross section of different real situations. Continuous feedback on the job helps in sharpening of the outcomes to be attained in the relevant field.

2. Planning for Internship :

The advantages of providing internshala platform to the students are enormous. Some of these are :

- Free access to 4th Lakhs internships (both part-time and full time).
- A chance to earn a certificate and a stipend.
- Additional 10% discount on all Internshala training to students.
- The T&P official of every college will who receive a monthly performance report of their students on Internshala.
- Once the institutions are registered with the Internshala. Registration is done through the website internshala.com/i/register-rgpv. Details of students (name, e-mail & phone no.) are uploaded in an excel sheet. Internshala will create an account for all the students so that they can apply for internship. The registration is free of cost.

For assessing the students on various dimensions of internship, assessment rubric may be prepared by the implementing teachers in advance

3. Major outcomes expected to be attained and assessed :

The following learning outcomes/skills are expected to be developed through internship. This will lead to attainment of COs, POS and PSOS.

- Development and Reinforcement of Basic Knowledge/concepts
- Development and Reinforcement & Engineering Knowledge i.e operations, performance, maintenance, demonstrations of specific skills relevant to the content of the programme.
- Experiment and practice – Development of experimental practical skills and technical skills relevant to the course programme.
- Development of learning to learn skills and lifelong teaching skills for latest advancement in technology.

- Development of positive attitude ethics values and etiquettes.
- Development of skills for Individual and Team work during performance and otherwise.
- Maintaining Business Secrecy
- Development of Communication Skills
- Ability to follow the instructions
- Ability to follow the safety precaution
- Ability to supervise the task
- Ability to coordinate with subordinates and higher ups
- Development of Interpersonal skills
- Environmental Consciousness and Sustainability
- Development of Observational Skills
- Time Management
- Self discipline
- Integrity
- Development of generic skills such as pro-activeness, commitment
- Development of Problem Solving abilities
- Achievement of target

K) Initiatives by Govt. of India and other Agencies :

1. Initiatives by Govt. of India, GOI

a. Initiatives by Ministry of Skills Development and Entrepreneurship

Many efforts are initiated by different agencies in this direction as per our Prime Minister's Skills Development Mission. Make in India, Skills India etc are such initiatives taken by ministry for the benefit of the students.

b. Initiatives by Ministry of HRD, Govt. of India

I. Ministry of HRD, Government of India is providing students a platform to inculcate a culture of product innovation and a mindset of problem solving to solve some of pressing problems solving to solve some of pressing problems we face in our daily lives through Smart India Hackathon (SIH) 2019.

In SIH-2019, the students would also have the opportunity to work on challenges faced within the private sector organizations and create world class solutions for some of the top companies in the world, thus helping the private sector hire the best minds from across the nation. The team size for participation in one team will be 8 (6 Students + 2 Mentors). 50 Teams will be selected for the final Hackathon. The prize will be a cash prize for each rank with following distribution criteria for the top three teams ranging from Rs. 50,000 to 1,00,000/-.

II. **Internshala :** Internshala is India's largest internship and training platform where more than 80,000 companies look for interns in various profiles (Engineering, management, media, arts etc.) AICTE has also partnered with Internshala for providing internship opportunities to every students in AICTE approved colleges. This facility is created to provide a platform for hands on experience to the our future technicians on the relevant industries. With this experience, they are updated with the latest advances in their field of work.

Government of India through, AICTE is engaged in promoting the concept of industrial training through its various scheme, such as Internshala. The teachers now have the responsibility to understand in depth and implement such schemes in the institution for the benefit of students.

At institute level also, there is need to develop policy for sending the students for industrial training.

c. Initiatives by Ministry of Labour and Employment, Govt. of India

Ministry of Labour and Employment, Government of India launched a National ICT based job portal known as National Career Service (NCS) portal to connect the opportunities with the aspirations of youth. This portal facilitates registration of job seekers, job providers, skill providers. Career counselors, etc. The portal provides job matching services in a highly transparent and user friendly manner. These facilities along with career counseling content are delivered by the portal through multiple channels like career centres, mobile devices, CSCs, etc.

The portal provides information on over 3000 career options from 53 key industry sectors. Job seekers also have access to industry trends in a user friendly way. The NCS portal links job-seekers, employers, counselors and training providers all through Aadhaar-based authentication. Registration to NCS portal is online and free of charge. The salient feature of NCS portal includes the following :

- Career counseling and Guidance
- Enabling Skill Development
- Empowering Job seekers to find the right Job
- Enabling employers to pick the right talent
- Enhancing capabilities of students through training

Information's related to Job Fairs/Placements

d. Initiatives by Telecom Sector Skill Council (TSSC)

TSSC has taken a step towards fulfilling the emerging requirements of the industry by partnering with key stakeholders in order to bring the latest content to the forefront. TSSC have got into partnership with All India Council for Technical Education (AICTE) for summer internship programme and various other MNCs to impart Skilling in new emerging technologies. Some of the prime courses in new emerging technologies being offered by TSSC in addition to TSSC Qualification packs are as under :

- Artificial Intelligence & Data Science
- Cyber Security
- Internet of Things
- Android
- AR/VR

In addition to this certain courses on life skills/soft skills, employability related skills are also planned for the students such as

- Problem solving and analytic
- Communication skills
- Lifelong learning
- Behavioral Skills
- Professional Behavioral etc.

The main objectives of TSSC are as follows

- Bridge the gap and enhance employability of our students
- Training young minds towards 21st Century skills assisting industry cross-sector
- Meet the needs of school leavers and graduates, employers, government educational institutions and society.
- Address the need for quality, skill training for human resources to complement the large goal of accomplishing the include growth.
- Address the limited capacity of skills development facilities in India
- To develop extensive placement linkages with employers in all sectors to provide gainful entry-level employment opportunities to youth undergoing the skill training.

- Industry participation in developing the skill training solutions to address critical skill gaps by standardization of training content, delivery and assessment process o improve overall competitiveness of the industry.

2. Initiatives by other agencies

a. Initiatives by Engineering Council of India (ECI)

(ECI has also taken initiatives to organize series of interactive workshops to update and apprise the students about the products and services being offered by respective corporate house. This interaction will definitely bring the institute and industry closer and help in planning for effective implementation of industrial training.

b. Others

Many public sector and private organizations are also contributing to the course of quality improvement in technical education system by way of arranging industrial visit of providing industrial training to the students as a part of their corporate social responsibility and also for the growth of technical education system of the country.

L) Initiatives to be taken by State Technical University/Board/Institutions.

- State Technical University/Board have to sign MOU with Internshala, partner of AICTE, with the aim of providing students with professional experience in the form of internship. For registration of students at college level for Internshala platform, visit of website address internshala.com/i/register-rgpv is suggested for uploading the details (Name, e-mail address & phone number compulsory) in an excel sheet. Internshala will create an account for all the students so that they can apply for internship. The registration is free of cost.
- Programme wise Industries Bank of nearby industries at state level and national level need to be created for useful interaction with details of content e-mail addresses phone numbers and areas of expertise.
- Institute may take initiative to facilitate the registration of students at National Career service (www.ncs.gov.in) portal and ensure the compliance of above directive in your institute.
- Institute should encourage and facilitate the registration of team of students for Smart India Hackathon-2019 at www.sih.gov.in portal and other similar websites.
- After careful curriculum analysis and also identifying the learning gaps, an action plan for effective implementation of the course need to be prepared based on the area of industries. This would help the teachers to decide the particular industry to be visited for exposing to specific content area or specific outcomes to be attained.
- Frequent Industry – Institute meet may be arranged on different topics for mutual benefit.
- List of a directory of industrial experts may be prepared for inviting them for seeking their expertise.
- Guidelines/policy for sending students to industrial training/internship must be prepared by the university for effective implementation of the industrial training/internship.
- TOT programmes on orientation of arranging industrial visit, training should be arranged for teachers implementing the same.
- MOU between University and Industry need to be signed for -
  - Industry collaboration for student/faculty empowerment
  - Partnership with industry on curriculum implementation.
  - Demonstrating and performing practical performances to students.
  - Providing technical work force for industrial production.
  - Corporate support to Academia through various resources.
- Establishment of training and placement cell at each institute level.

- Employability Enhancement initiatives need to be taken by CSVTU for arranging campus placement at CSVTU level/institute level or through open campus.

M) References:

- **What is Industrial Visit & Benefit's of Industrial's Visit**
  http://education.osrvacation.com/what-is-industrial-visit-benefits-of-industrials-visit/
- **Importance of Industrial visit**
  http://industrialtour.com/importance-of-industrial-visit/
- **Difference Between Training and Internship**
  https://keydifferences.com/difference-between-training-and-internship.html
- **INTERNSHIP VS INDUSTRIAL TRAINING – ANY DIFFERENCE?**
  http://www.careerhubafrica.com/blog/internship-vs-industrial-training-any-difference/
- **What is an Internship?**
  https://www.wikijob.co.uk/content/internships/advice/what-internship
- **5 Elements to Include in any Post Training Evaluation Questionnaire**
  https://www.efrontlearning.com/blog/2017/12/element-post-evaluation-training-questionnaire.html