SCHEME OF STUDIES

DIPLOMA IN CIVIL ENGINEERING

(C-20)

Vth Semester Scheme of Studies - Diploma in Civil Engineering [C-20]

Pathway	Course Category / Teaching Department	Course Code	Pathway Title	Hours per Semester			Total contact hrs /Semester	Credits	CIE Marks		SEE-1 Marks (Theory)		SEE-2 Mark (Practical)		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min	Max	Min					
Programme Specialization Pathway																			Both SGPA & CGPA
1	**CE** Specialization pathways in emerging areas Student may select any one of the specializations	20CE51 I	Structural Engineering	104	52	312	468	24	240	96	60	24	100	40	400	160			
		20CE52 I	Town Planning and Green Building	104	52	312	468	24	240	96	60	24	100	40	400	160			
		20CE53 I	Transportation Engineering	104	52	312	468	24	240	96	60	24	100	40	400	160			
		20CE54 I	Built Environment	104	52	312	468	24	240	96	60	24	100	40	400	160			
Science and Research Pathway				L	T	P	Total	Credits	CIE Marks		SEE Marks								
									Max	Min	Max	Min							
2	BS/SC Specialization pathway in Science and Research **(Student need to take all four papers in this pathway)**	2OSC51T	Paper 1-Applied Mathematics	52	26	0	78	6	50	20	50	20			100	40			
		2OSC52T	Paper 2 – Applied Science	52	0	52	104	6	50	20	50	20			100	40			
		2ORM53T	Paper 3 – Research Methodology	52	0	52	104	6	50	20	50	20			100	40			
		2OTW54P	Paper 4 – Technical Writing	39	13	52	104	6	60	24	40	16			100	40			
			Total	195	39	156	390	24	210	84	190	76			400	160			
Entrepreneurship Pathway																			
3	ES/CE	20ET51I	Entrepreneurship and Start up	104	52	312	468	24	240	96	160	64			400	160			

L:- Lecture T:- Tutorial P:- Practical BS- Basic Science:: ES-Engineering Science:: SC: Science

Note : In 5th Semester student need to select any one of the pathways consisting of 24 credits

VI Semester Scheme of Studies - Diploma in Civil Engineering [C-20]

Pathway	Course Category / Teaching Department	Course Code	Course	Hours per Semester			Total contact hrs	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min					
Internship/Project																	**Both SGPA & CGPA**
Internshi	ES/CE	20CE61P	Internship / Project	40 Hours / week Total 16 Weeks			640	16	240	96	160	64	400	160			

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	**Civil Engineering**	**Semester**	**5th**
Course Code	**20CE51I**	**Type of Course**	**Specialization Pathway**
Course Name	**Structural Engineering**	**Contact Hours**	**36 hours per week**
L: T:P	**104: 52: 312**	**Credits**	**24**
CIE Marks	**240**	**SEE Marks**	**160**

Introduction: Welcome to the curriculum for Structural Engineering Specialization. This specialization course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur. You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn how to plan, analyse, design, drafting, estimation and costing. Additionally, it considers the technical, economic, environmental, aesthetic, and social aspects of the structures. Structural engineering is a profession that offers a great opportunity to make a real difference in the lives of people and their environment.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an internship at an organization working in Structural Engineering related industry or do a project in Structural Engineering related sectors. After the completion of your Diploma, you shall be ready to take up roles like Junior Engineer, Assistant design engineer, Draftsman, Site Engineer, Quality controller,Auditor.

This course will teach you Fundamentals of referring IS Codes, understanding details, analysis of data, design, drafting, cost estimation, transportation, erection and assembly of steel structures.

Details of the curriculum is presented in the sections below.

Instruction to course coordinator:

1. Each Pathway is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. Single faculty shall be the Cohort Owner.
3. This course shall be delivered in boot camp mode.
4. The industry session shall be addressed by industry experts only.

5. The cohort owner shall identify experts from the relevant field and organize industry sessions as per schedule.
6. Cohort owner shall plan and accompany the cohort for industrial visits.
7. Cohort owners shall maintain and document the industrial assignments and weekly assessments, practices and mini projects.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table.
9. The cohort owner along with the classroom can augment or use for supplementally teaching online courses available although reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
10. Cohort owner shall guide the cohorts for the execution of mini project.

Course outcome: At the end of the semester students will be able to,

CO1	**Collect necessary data, analyze, refer relevant IS codes, design simple indeterminate structural elements, portal frames, steel structures and masonry structures.**
CO2	**Prepare working drawings, design drawings, fabrication drawings, erection drawings, estimates, BOQ, BOM, MTO.**
CO3	**Monitor transportation, lifting, erection, connection processes of steel and PSC structures**
CO4	**Use appropriate modern tools and design software's**

Detailed course plan

Week	CO	PO	Days	1st session (9am to 1 pm)	L	T	P	2nd session (1.30pm to 4.30pm)	L	T	P
	1	1,2	1	**Introduction** • Structural Engineering as a responsible career. • Role of structural Engineer. • Need of structural analysis and design. • Introduction to analysis and design software's. • Prevailing Codes of practice. Present roles of structural engineer at site by showing videos, images. Identify the various sectors of civil engineering where structural engineers plays a role.	2	2		**Structural analysis** • Types of structure • Conditions of equilibrium, Degrees of Freedom • Determinate and indeterminate structures-examples. • Static determinacy and kinematic determinacy • Stable and Unstable structures – examples. • Degree of indeterminacy • Concept of Analysis of Indeterminate beams. Prepare models/prototypes to present determinate and indeterminate structures using any available materials	1		2
	1	1,2	2	**Analysis of Fixed beams** • Fixed beam, Degree of indeterminacy of fixed beam- Sagging and Hogging bending moments • Determination of fixed end/support moments by Area Moment method • Drawing SF and BM diagrams for Fixed beams subjected to UDL, point load- simple problems	2		2	• Determination of Slope and Deflection of fixed beams subjected to UDL, point load by area moment method. • Simple Problems.			3

1	1	1,2	3	**Analysis of Continuous beams** • Continuous beams, applications. • Introduction to Carry over factor, Stiffness factor and Distribution factor –Stiffness Ratio or Relative Stiffness. • Concept of distribution of unbalanced moments at joints - Sign conventions. • Application of Moment Distribution method to Continuous beams of two spans only (Maximum of three cycles of distribution) • Finding Support Reactions- Problems • Sketch SFD and BMD for two span beams	2		2	• Continuation			3
	1	1,2	4	**Analysis of Portal frames** • Portal Frames, Types, Bays and Storey • Sketch Single and Multi Storey Frames, Single and Multi Bay Frames • Portal Frame – Sway and Non-Sway Frames • Analysis of Non sway Symmetrical Portal Frames-single Bay and single Storey- for Joint moments by Moment Distribution Method and draw SFD and BMD.	1		3	• Continuation	1		2
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Session*		2	3	*Industry assignment*			
	4	4,7	1	*Peer review on industry class.*		4		• Introduction to Modelling of structural elements using any *Open Source (STAAD Pro/Ansys)* analysis software. • Recall from EM & SOM	1		2

	4	4,7	2	• Model and analyze fixed beam, Continuous beam and Portal frame using any *Open Source (STAAD Pro/Ansys)* analysis software. • Compare the results with manual calculations.			4	• Continuation			3
2	1	1,2	3	**Buildings and By-laws** • Types of building and purpose • Building by-laws, floor area ratio (FAR), Set back, Height limitations of building, Fire safety. Types of Drawings. • Plan approval procedure. *Collect, Study and prepare a report on local municipal or city corporation building by-laws.*	2		2	**RCC structures** • Types of structures, structural components- Definition and their role in structural system • Tensile and compression members, Zones of tension and compression in a Beam • Role of concrete and reinforcement in RC structures, • Loads on structures, types, selection of load and load combination, • Effective span, Breadth and depth requirements of beam, thickness of slab, Column size and orientation, Footing size, depth of footing, selection of footing type. *Study IS 875-2016 and prepare a report on selection of load and load combination.*	2		1

	1	1,3	4	**Design specifications of RC structures** • Reinforcement – types, percentage of reinforcement, Spacing requirements, Selection of suitable diameter • Development length and its calculation. • Anchorage bends and hooks and their values. • Curtailment of reinforcement. • Lapping/Splicing, Spacer bars, Chairs • Cover requirements *Collect and read existing Blue Print drawings of any type of building and prepare report.*	2		2	**Ductile detailing** • Introduction to ductile detailing of RC structures as per IS 13920-2016 • Salient features of Ductile detailing • Difference between RC detailing and Ductile detailing using SP-34 and IS 13920-2016 *Read IS 456-2000, SP-34, IS 13920-2016 and prepare typical RC detailing drawings*	2		1
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Session*			5	*Weekly industry assignment.*			
3	1,4	2,7	1	*Peer review on industry class.*		4		**Planning of a Residential (2BHK)/School/Commercial building with staircase** Ask students to prepare their own • Site plan • Single line diagram • Architectural plan • Elevation (From all four directions) • Sectional elevation Using AutoCAD. Follow building by-laws.	2		1
			2	• Continuation	1		3	• Continuation			3

	1,4	2,7	3	**Design of a Residential (2BHK)/School/Commercial building with staircase** Design the structural members of the above planned building manually as per IS 456:2000 • Slab • Beam • Column • Lintel with chejja • Footing • Staircase	1		3	• Continuation			3
	1,4	7	4	• Introduction to use of Design software like STAAD Pro/ETABS and SAFE (Footing design)	2		2	• Practice of Design software like STAAD Pro/ETABS and SAFE (Footing design)	1		2
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
			6	*Industry class*	2		3	*Industry weekly assignment*			
4	1,4	7	1	*Peer review on industry class*		4		• Model, Analyze and Design the above planned building using STAAD Pro/ETABS and SAFE (Footing design) software. • Compare with manual design values.	1		2
	1,4	7	2	• Continuation	1		3	• Prepare Detailed reinforcement drawings for the above designed building using AutoCAD	1		2

	1,4	7	3	• Continuation	1		3	• Continuation			3
	1,4	7	4	Prepare drawings of • Column layout • Beam layout • Sectional details • Structural drawings • General notes Using AutoCAD	2		2	• Continuation • Print "'GOOD FOR CONSTRUCTION" drawings.			3
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry class*	3		2	*Industry weekly assignment*			
5	1,2	3	1	*Peer review on industry class*		4		• Estimate the quantities and Prepare **BOQ** making use of local Schedule of rates (SR) for the above designed 2BHK residential building	1		2
	1,2	3	2	• Continuation	1		3	• Continuation			3
	1		3	• Visit nearby construction site and expose students to different construction activities	1		3	• Visit nearby construction site and expose students to different construction activities	1		2
	1	3	4	**Design of T-beam** • Definition, where and when T-beams are provided • Structural behavior of T-beam, • Cross section of T-beam and L-beam, Effective width of flange, Neutral axis • Design of Singly reinforced T-beam for flexure. • Sketch reinforcement details.	2		2	**Design of Combined footing** • Definition, necessity, design concept • Design a combined footing to carry equal loads from two columns. • Sketch reinforcement details	1		2

			5	CIE 2– Written and practice test				Assessment Review and corrective action			3
			6	*Industry class*	2		3	*Industry weekly assignment*			
6	1,3	3	1	*Peer review on industry class*		4		**Pre-stressed concrete (PSC)** • Principle of pre-stressing • Advantages and disadvantages of PSC • Difference b/w RCC and PSC • Applications of PSC • Materials used and their characteristics, Stress-strain curve. • Methods of pre-stressing • Pre-tensioning, Post tensioning Show images and videos of pre-stressing and materials used.	2		1
	1,3	3	2	• Loss of pre-stress- Types, total loss and measures to minimize pre-stress loss • Anchoring devices • Step by step procedure of Pre-tensioning Prepare a report on stages of Pre-tensioning	1		3	• Form work for PSC at site as well as pre-casting plants – types, materials, selection of type of form work • Step by step procedure of post-tensioning Prepare a report on stages of post-tensioning	1		2
	1,3	3	3	• Concreting of PSC elements • Grouting of ducts -Definition, properties, types, materials, proportion and testing. • Curing methods- latest • Transportation of PSC members Prepare a report on grouting, curing and transportation of PSC members.	2		2	• Lifting and erection of PSC members, machineries involved, standard practice, safety precautions • Bearings- Definition, necessity, properties, types of bearings, materials, selection of bearings, installation and maintenance	2		1

								Prepare checklist for lifting and erection of PSC members			
	1,3	3	4	• Visit nearest PSC elements manufacturing plant and prepare a report. *(Accompanied by cohort owner)*			4	• Visit nearest precast concrete elements manufacturing plant and prepare a report. (Accompanied by cohort owner)			3
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Class*	1		4	*Industry weekly assignment*			
7	1	3	1	*Peer review on industry class*		4		**Introduction to Limit state design of steel structures:** • Advantages and disadvantages of Steel structures • Structural steel sections • Loads and load combinations. • Limit state design- Design considerations, Failure criteria for steel, specifications and section classifications as per IS 800-2007. Collect and Read IS 800-2007	2		1

	1,3	3	2	**Bolted Connections:**
				• Introduction
				• Advantages and disadvantages of bolted connections
				• Difference between unfinished bolts and High strength friction grip bolts (HSFG)
				• Behavior of bolted joints
				• Failure of bolted joints.
					2		2	• Simple problems on finding
								  • Shear strength
								  • Bearing strength
								  • Tensile strength of bolts (bearing type only).
								• Tensile strength of plate
								• Efficiency of joints.
								• Simple Lap joint design problems.
											3

				Prepare a report on types of bolts, behavior and suitability.							
	1,3	3	3	• For the given bolted connection snap, identify the possible joint failures. Propose an alternative type of joint to increase the connection strength. Prepare a lap joint using card board and nail. Apply the tension force and prepare a report on the failure mode.	1		3	**Welded Connections** • Introduction • Advantages and disadvantages • Types of welding • Weld symbols, specifications, effective area of weld • Design strength of fillet weld, simple problems on welded joints (fillet weld only).	1		2
	1,3	3	4	• Introduction to welding process and welding machine and accessories. • Practice welding for the above designed fillet weld.	1		3	• Visit the nearest construction site/railway station/any steel structure and identify the various types of connections used in steel structure. For the identified connections, list out the possible failure criteria and prepare a report.			3
			5	CIE 3– Written and practice test				Assessment Review and corrective action			3
			6	*Industry Class*	2		3	*Industry weekly assignment*			

8	1,3	3	1	*Weekly assignment review*		4		**Flexural Members:** • Introduction, • Lateral buckling, Web buckling and crippling • Difference between laterally restrained and unrestrained beams • Determination of the moment capacity of laterally restrained beams List different types of failures in beam sections with sketches	2		1
	1,3	3	2	• Design of laterally restrained simple beams using standard rolled steel sections only. • Problems on design of simple beam shear connection.	1		3	• Design and analyze a simply supported beam carrying UDL, point load at center, calculate the end reactions and design the fin plate connection for end reaction. • Draw respective sketches in AutoCAD.	1		2
	1,3	3	3	• Continuation			4	**Tension Members** • Introduction, types of tension members, slenderness ratio and net area. • Behavior of tension members. • Modes of failure. • Factors affecting the strength of tension member. Show images and videos of tension members and their failure modes.	2		1
	1,3	3	4	• Design strength of tension member due to yielding of gross section, due to	1		3	**Compression Members** • Columns –Classification, Boundary conditions, effective length, slenderness ratio.	1		2

				rupture of critical sections and block shear. • Design of tension members.				• Design strength of Columns. • Design of axially loaded Columns (Excluding Built up sections)			
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Class*	1		4	*Industry weekly assignment*			
9	1,3	3	1	*Peer review on industry class*		4		**Struts** • Design of Continuous and Discontinuous strut for given end conditions for axial load only.	1		2
	1,3	3	2	• Practice design of Columns and struts	1		3	**Column Bases** • Introduction • Types of Column Bases, Slab base, Gusseted Base. • Design of Slab base for axial Load.	1		2
	1,3	3	3	• Design connections and members of a steel truss for vehicle parking in your college campus	1		3	• Continuation			3
	1,3	3	4	**Introduction to steel detailing and fabrication** • Basic information on steel detailing. • Importance of detailing • Process involved in detailing • Structural drawing review, preliminary questions/ RFI's. Tutorial video to be shown to students to show sample design drawings, sample RFI's and how to find missing information's.	2		2	• Based on the tutorial video, students to review the design drawings and find out the missing information and prepare relevant RFI's (Request for Information).	1		2
			5	CIE 4– Written and practice test				Assessment Review and corrective action			3

			6	*Industry Class*	2		3	*Industry weekly assignment*			
10	1,3	3	1	*Peer review on industry class*		4		**Introduction to fabrication and erection drawings** • Basic requirement in fabrication drawings • Basic terminologies used in fabrication drawings • Title, Symbols used in fabrication drawings. • Difference between approval drawings and fabrication drawings. • Present and explain existing fabrication drawings of any steel structure, images and videos.	1		2
	1,3	3	2	• Assembly drawings, part drawings and general arrangement (GA) drawings. • Fabrication process • Importance of coordination between fabricator and detailer. • Real time problems during fabrication. • Shop queries. Present and explain existing Assembly drawings, Part drawings and General arrangement drawings.	2		2	• Erection process • Requirements in erection drawings • Co-ordination between the fabrication drawings and erection drawings • Sequence of erection • Real time problems during erection. Present and explain existing Erection drawings.	1		2
	1,3	3	3	Visit nearby steel fabrication shops and prepare a report on real time problems of fabrication.	1		3	Visit to nearby steel structures construction site and prepare a report on erection process			3

	1,3	3	4	• Introduction to Pre-engineered Buildings • Advantages over Hot rolled steel structures • Light gauged members as structural and non-structural elements • Industrial Applications Study existing Pre-Engineered drawings.	2		2	• Safety precautions in erection of steel structures • Maintenance of steel structures • Inspectional tests on steel structures Prepare a report on tests on steel structures and checklist	1		2
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Class*	1		4	*Industry weekly assignment*			
	1,2	2	1	*Peer review on industry class*		4		**Pre-material take off** • Introduction to Material Take Off (MTO) • Importance and use of MTO • Information to be included in MTO extraction • Special materials and available lengths in the market. • Extraction of MTO Tutorial video to be shown to students on MTO extraction.	2		1
	1,2	2	2	• Based on the tutorial video shown, students to extract the MTO manually from existing design drawing.	1		3	• Continuation			3

11	1,2,4	2,3,4	3	Model, Analyze and Design a simple Steel Truss required for vehicle parking in your college campus using STAAD Pro.	2		2	Prepare design and fabrication drawings.			3
	1	2,3	4	**Design of Masonry structures** • **Permissible stresses**- Types of walls, permissible compressive stress, stress reduction and shape modification factors, permissible tensile stress and shear stress. • **Design Considerations**: Effective height of walls, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. • Load considerations • Design criteria Collect and read IS 1905:1987	2		2	Design of Masonry solid walls subjected to axial UDL loads supported at the ends by cross wall, and walls with piers.	1		2
			5	CIE 5– Written and practice test				Assessment Review and corrective action			3
			6	*Industry Class*	1		4	*Industry weekly assignment*			
12			1	*Peer review on industry class*		4		• Continuation of Design of Masonry solid walls.			3

	1	1,2 ,3	2	**Design of Masonry Retaining wall** • Theory of earth pressure • Calculation of earth pressure by Rankine's method with and without surcharge • Conditions of stability for no tension • Middle one third rule • Distribution of pressure at foundation • Design of masonry retaining wall	2		2	• Continuation			3
	1	2,3	3	**Earthquake engineering** • Classification of Earthquakes • Major past earthquakes and their effect • Types and characteristics of seismic waves • Magnitude and intensity of earthquakes • Local site effects • Richter Scale, Seismograph • Seismic zoning map of India Study and prepare a report on any one previous earth quake in India or outside of India.	2		2	• Typical failures of RC frame structures • Types of damages to building observed during past Earthquakes • Classification of damages to buildings • Plan irregularities, mass irregularity, stiffness irregularity • Concept of soft and weak storey. Prepare a PPT on failure and typical damages to buildings due to Earth quake.	1		2

	1,4	2,3	4	• Torsional irregularity and their consequences. • Configuration problems, continuous load path. • Architectural aspects of earthquake resistant buildings • Lateral load resistant systems. • General guidelines for earthquake resistant design Prepare models of irregularities in buildings as per IS 1893-2016 using card board and present	2		2	• Continuation			3
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Class*	2		3	*Industry weekly assignment*			
13			1	**Internship** **a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.** **Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.**				**Project** **a) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective.** **b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.** **Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**		

Note: Saturday session from 9 AM -2 PM

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 8	CIE 3– Written and practice test	4	30
Week 10	CIE 4– Written and practice test	4	30
Week 12	CIE 5– Written and practice test	4	30
Week 13	Assessment for Project or Internship	4	30
On line Course work (At least one related to the specialization)			30
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hour duration reduced to 60 marks		**3**	**60**
SEE 2 – Practical		**3**	**100**
TOTAL SEE MARKS (B)			**160**
TOTAL MARKS (A+B)			**400**

***** The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Scheme of Evaluation for CIE 6

Sl No	Description	Marks
1	Project report	10
2	Project presentation	10
3	Viva voce	10
Total		**30**

Instructions to students:

Students will have the opportunity to update their final report submission for SEE 2 post CIE 6 in order to enable them to address the feedback received during their CIE 6 assessment and also work towards achieving the desired project/case outcome.

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		**100**

Case Submission / Content Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Identification of the main issues / problem	**Identifies and understands all the main issues in the problem statement**	Identifies and understands most of the main issues in the problem statement	Identifies and understands some of the issues in the problem statement	Identifies and understands a few of the issues in the problem statement	Identifies limited issues in the problem statement	5
Analysis of the issues	Insightful and thorough analysis of all the issues	**Thorough analysis of most of the issues**	Superficial analysis of some of the issues in the problem statement	Incomplete analysis of the issues	No analysis of the issue	4
Comments on effective solutions / strategies (The solution may be in the problem statement already or proposed by you)	Well documented, reasoned and pedagogically appropriate comments on solutions, or proposals for solutions, to all issues in the problem statement	Appropriate, well thought out comments about solutions, or proposals for solutions, to most of the issues in the problem statement	Superficial and / or inappropriate solutions to some of the issues in the problem statement	**Little and/or inappropriate solutions to all of the issues in the problem statement**	No action to all issues in the problem statement	2
Links to course learning and additional research	Excellent research into the issues with clearly documented links to course learnings and beyond.	Good research and documented links to the materials read during the course	**Limited research and documented links to any readings**	Incomplete research and links to any reading.	No research or links to any reading	3
Total						**14/20**

Case Presentation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Delivery & Enthusiasm	Very clear and concise flow of ideas Demonstrates passionate interest in the topic and engagement with class / examiner	**Clear flow of ideas Demonstrates interest in the topic and engagement with class / examiner**	Most ideas flow but is lost at times Limited evidence of interest in and engagement with the topic	Hard to follow the flow of ideas Lack of enthusiasm and interest	No flow in the presentation Poor presentation skills	**4**
Visuals	Visuals augmented and extended comprehension of the issues in unique ways	Use of visuals related to the topic	Limited use of visuals loosely related to the topic	**No use of visuals**	Poor visuals used and some visuals are not easy to understand its relevance.	**2**
Staging	**Uses stage effects such as props, sound effects, and speech modulation in a unique and dramatic manner that enhances the understanding of the issues in the problem statement.**	Uses stage effects such as props, sound effects, and speech modulation in an effective manner to extend the understanding of the issues in the problem statement.	Limited use of stage effects and/or used in a manner that did not enhance the understanding of the issues in the problem statement.	No use of stage effects	Poor stage effects usage	**5**
Involvement of the class / Examiners • **Questions** • **Discussions** • **Activities**	Excellent and salient discussion points that elucidated material to develop a deep understanding Appropriate and imaginative activities used to extend	Questions and discussions addressed important information that developed understanding Appropriate	Questions and discussions addressed important superficial issues of the problem statement Limited use of activities to	Little or no attempt to engage the class / examiner in demonstrating their learning	**Did not engage the class / examiner and poor listening skills**	**1**

	understanding in a creative manner	activities used to clarify understanding	clarify understanding			
Total						**12/20**

Case Results Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Problem outcome	The topic was well researched and all information and data included are accurate and from reliable sources of information like high impact journals standards, etc. The proof was enough backed up with accurate data, analysis and reasoning beyond the class learning. Outcome achieved beyond the problem brief	**The topic was researched and most information and data were from reliable sources of information. The proof was backed up with good data and reasoning as taught in the class. Outcome achieved as per the problem brief**	The topic was researched but information and data were only partly from reliable sources of information. The proof was not fully backed up with good data or reasoning as taught in the class. Partial outcome achieved as per the problem brief	The topic was researched and data were not from reliable sources. The proof was not backed up with data, analysis or reasoning as taught in the class. Some outcome obtained as per the problem brief	Desired results not obtained, but some relevant research was done. Outcome not obtained as per the problem brief	**4**
Application of class learning in problem solving	Made effective use of class principles, models and theories. Also used creativity to find effective results appropriate to industry beyond class learning.	Made good use of class principles, models and theories Some creative ideas were explored to find desired outcome but within the framework of class learning	**Made some use of class principles, models and theories No creative ideas or models explored**	Made limited use of class principles, models and theories	Poorly applied class principals, models and theories	**3**
Response to Class /	Queries Excellent response to comments and	Good response to questions and discussions with	Satisfactory response to questions and	**Limited response to questions and**	Poor or no response to questions and	**2**

Examiners Queries	discussion with appropriate content supported by theory/research	some connection made to theory/research	discussions with limited reference to theory/research	**discussions with no reference to theory/research**	did not participate in the discussions.	
Conclusions	Provides detailed and appropriate conclusion for the problem statement	**Provides appropriate conclusion for the problem statement**	Provides adequate and mostly appropriate conclusions for the problem statement	Provides limited and somewhat appropriate conclusions for the problem statement	Has not provided appropriate conclusions for the problem statement.	**4**
Total						**13/20**

Case Innovation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Finding new processes / models / approaches	**The newly discovered processes / models / approaches are of good quality and relevant**	The newly discovered processes / models / approaches are of appropriate quality but limited relevance	The newly discovered processes / models / approaches have limited application but relevant to the problem	The newly discovered processes / models / approaches has restricted application	No new processes / models / approaches were identified	**5**
Proposing ideas and innovative solutions in terms of processes / models / approaches and how they can be applied to solve the problem on hand	Various ideas and innovative solutions have been proposed and their application have been clearly outlined	Various ideas and innovative solutions have been proposed as well as the outline of the process to apply them	**Some ideas or innovative solutions have been proposed but the process of applying them hasn't been specified**	Few ideas have been proposed	No ideas or innovative solutions have been proposed	**3**
Using creativity techniques to provide and reason good ideas which are original and unconventional	Wherever necessary creativity techniques are utilized to analyse and solve the problem	Creativity techniques are frequently utilized in more than 50% of the occasions	Creativity techniques are utilized at times in less than 50% of the occasions	**Creativity techniques are used a few times only**	Creativity technique are not utilized to analyse and solve the problem	**2**
Finding constraints and weak points in existing processes / models / approaches or methods	Constraints and weak points are understood	Constraints and weak are identified	**A critical analysis is undertaken**	Only a description of the working process and methods are provided	No constraints or weak points have been identified.	**3**
Total						**13/20**

Assessment framework for CIE (1 to 5)

Note : Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Programme	**Civil Engineering**	**Semester**	**V**
Course	**Built Environment**	**Max Marks**	**30**
Course Code		**Duration**	**4 hours**
Name of the course coordinator			

Note: Answer one full question from each section.

Qn.No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
	Section-1 (Theory) – 10 marks				
1.a)					
b)					
2.a)					
b)					
c)					
	Section-2 (Practical) - 20 marks				
3)					
4)					

Assessment framework for SEE 1 (Theory) – 100 Marks / 3 hours (Reduced to 60 marks)

Programme : Civil Engineering	**Semester: Vth**
Course : Built Environment	**Max Marks : 100**
Course Code :20CE54I	**Duration : 3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL	CO	Marks
	Section-1			
1.a)			1	
b)				
2.a)				
b)				
	Section-2			
3.a)			2	
b)				
4.a)				
b)				
	Section- 3			
5.a)			3	
b)				
6.a)				
b)				
	Section-4			
7.a)			4	
b)				
8.a)				
b)				
	Section-5			
9.a)			5	
b)				

10.a)				
b)				

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	**Civil Engineering**	**Semester**	**5th**
Course Code	**20CE52I**	**Type of Course**	**Specialization Pathway**
Course Name	**Town Planning and Green Building**	**Contact Hours**	**36 hours per week**
L:T:P	**104 : 52 : 312**	**Credits**	**24**
CIE Marks	**240**	**SEE Marks**	**160**

Introduction

Welcome to the curriculum for Town planning and Green Building Specialization. This specialization course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur. You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn how to foster innovative and responsive urban & regional development policies and practices for planned development. Leading to the successful completion of this boot camp, you shall be equipped to either do an internship at an organization working in Town planning and green building related industry or do a project in Town planning & Green building. After the completion of your Diploma, you shall be ready to take up roles like Town Planner, Green Engineer, Junior Engineer, Site Engineer.

This course will teach you Methods of data collection, data analysis, forecasting, designing, evaluating, management and maintenance of different components of City and Green Buildings.

Details of the curriculum is presented in the sections below.

Pre-requisite

Before the start of this specialization course, you would have completed the following courses;

In the 1st year of study, you would have studied Engineering Mathematics, Communication Skills, Civil Engineering Graphics, Statistics & Analysis, Basic IT Skills, Basic Surveying, Fundamentals of Electrical and Electronics Engineering, Project Management skills, Construction Materials, Environmental Sustainability.

In the 2nd year of study, you would have studied Engineering Mechanics and Strength of Materials, Modern Surveying, Construction Techniques, Building Drawing using CADD, Concrete Technology, Building Estimating and valuation, Site Management, Design and detailing of RCC structures.

In this year of study, you shall be applying your previous years learning along with specialized field of study into projects and real-world applications.

Instruction to course coordinator:

11. Each Pathway is restricted to a Cohort of 20 students which could include students from other relevant programs.
12. Single faculty shall be the Cohort Owner.
13. This course shall be delivered in boot camp mode.
14. The industry session shall be addressed by industry experts only.
15. The cohort owner shall identify experts from the relevant field and organize industry sessions as per schedule.
16. Cohort owner shall plan and accompany the cohort for industrial visits.
17. Cohort owners shall maintain and document the industrial assignments and weekly assessments, practices and mini projects.
18. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table.
19. The cohort owner along with the classroom can augment or use for supplementally teaching online courses available although reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
20. Cohort owner shall guide the cohorts for the execution of mini project.

Course outcome: At the end of the semester students will be able to,

CO1	**Identify the need for planned development by adhering to legal implications of law/standards.**
CO2	**Collect essential data from reliable sources analyze & interpret**
CO3	**Conduct various types of Survey and handle spatial data by using tools and software's**
CO4	**Identify the suitable location & apply the technology used in smart city concept**
CO5	**Apply green building rating system to evaluate the level of sustainability of a building project.**

Detailed course plan

Week	C O	P O	Days	1st session (9am to 1 pm)	L	T	P	2nd session (1.30pm to 4.30pm)	L	T	P
1	1	1	1	**Introduction** History of Town Planning, Time as a dimension of built form, Human settlements-civilization, Origin of human settlement, Society, Social stratification, Agrarian classes, Industry and labor, Tribe: profile and location, Village structure and change, Forms- caste, class, power & gender. Reference & links *1.file:///C:/Users/PC%203/Downloads/TownPlanningScheme_24-05-2020.pdf* *2. https://www.drishtiias.com/pdf/indus-valley-civilization.pdf* *3. https://dhsgsu.edu.in/images/Reading-Material/Anthropology/ANT-CC-223-UNIT-4IV.pdf* *Demonstrate using any of online sources* **Case Exercise:** City pattern Study-Short trip to city/town covering old parts as well as recently planned developments and understand how a settlement grows and driving forces behind the growth.	1	1	2	**Urban Processes** • Criteria's of location and development of towns in history, Political, economic, technological, social and cultural factors which have shaped settlements through history. • Indian city typologies and study of urban growth, decline, renewal in different cities based on function, location etc. • Town and country planning- Goals and objectives of planning; • Components of planning; • Benefits of planning; • Arguments for and against planning **Case Exercise:** Presentation on stages in the evolution of the city. Identify what has made the city unique and understand how social & economic forces (port, tourism, industries etc.) has shaped the city.	1		2

	1,2		2	**Development plan:** • Types of development plans. • Master plan. • City development plan. • Structure plan. • District plan. • Action area plan. • Subject plan. • Town planning scheme. • Regional & sub-regional plan. • Sector plans and spatial plans. Reference & links *1file:///C:/Users/PC%203/Desktop/CIVIL%20&%20Allied%20CRW/TP/research%20paper-%20developement%20plan.pdf* **Case Exercise:** Distance, Area & Space Perception-Conduct survey of college campus/any area with varying characters using Total Station/Survey instruments.	1	1	2	**Case Exercise:** • Prepare a plan indicating plot sizes, FAR, building height and open space using CADD SOFTWARE using the data obtained from field. • Prepare contour map for the data obtained from field	1		2
	1,2	1,4, 5	3	**Physical and Socio-Economic Surveys:** • Preparation of Base maps at different scales, • Contents of base maps, • Techniques for conducting surveys for land use, • Building use, density planning and other surveys	2		2	**Case Exercise:** Prepare base plan using QGIS (for the data obtained from field) https://www.youtube.com/watch?v=x-rNnlAiCFY https://youtu.be/lj7JS_Vu6Uc	1	1	1

				Case Exercise: • QGIS –Introduction to QGIS, Applications, Installation & Demonstration.							
	1,2	1,4	4	**QGIS Case Exercise Continued..**			4	**QGIS Case Exercise Continued.**			3
			5	Developmental Assessment				Assessment Review and corrective action			3
	1,2		6	*Industry Session- Demonstration of Maps, survey Formats/Checklists, Base maps etc.*	1	1	3	*Industry class and assignment*			
2	1,2	1,2	1	*Peer review on industry class.*		4		**Types of Data and Sources**: • Difference between data, information and knowledge. • Distinction between facts and opinions. • Data requirements for urban and regional planning. • Sources of primary and secondary data-e.g. Census, NSSO etc. • Problems on Moving Average Method in Time Series	2		1

	1,2	1,4, 5	2	**Data Presentation:** **case exercise 1.** • Collect population data (5 decades) from census records and perform trend analysis by moving average method manually and using spreadsheet. • Present the results in the form of tables and charts using spreadsheet • Preparation of tables and charts, interpreting statistical, qualitative and spatial data to identify trends, patterns and processes.	2		2	**Case Exercise 2.** • Introduction to KGIS, Extraction of cadastral data from KGIS • Collect demographic details of an area from Spatial data and perform trend analysis by using spreadsheet. • Present the results in the form of tables and charts using spreadsheet. • Preparation of tables and charts, interpreting statistical, qualitative and spatial data to identify trends, patterns and processes https://kgis.ksrsac.in/kgis/home.aspx			3
				Development and development control: • Regulations. • Types of development control. • Implications of violations of development control regulations. • Conforming and Nonconforming land uses.				**Governance of Planning** • District Planning Committees, • Metropolitan Planning Committees, • Objects & Principles of town planning. **Case Exercise:**			

	1,2		3	• Compatible and non-compatible land uses. • Concept of Locally Unwanted Land Use(LULU) and Not in my Backyard (NIMBY) Case studies on Above topics.	2		2	Collect data from local government body & Prepare a presentation on organization structure of Town & Country Planning Authority and the activities performed by it. http://www.dtcp.gov.in/en	1		2
	1,2	1,3, 4	4	**Planning Legislation and Regulations** • Town Planning Legislation 73rd and 74th amendment • **Outlining KTCP Act 1961 and KUDA Act** 1.Laws related to Change of Land Use: 2.Laws related with Zoning, 3.Planning Permissions and Building Permission. 4.Identification of land use conflict and methods of resolution- 1.http://www.dtcp.gov.in/en 2.https://prsindia.org/files/bills_acts/acts_states/karnataka/1963/1963KR11.pdf 3.Karnataka_Urban_Development_Authorities_Act_1987.pdf (dtcp.gov.in) Examples and Case Studies	1		3	**Case Exercise:** 1. Refer to KTCP act 1961and KUDA Act Collect data on Common Zonal regulations w.r.t • Hierarchy of Land use • Change of Land use- Procedure, check list and documents required. 2. Collect/obtain the masterplan of the city /village map (Visit nearest TPA)/town and outline the features. http://www.dtcp.gov.in/en			3
	1,2	1,2	5	Developmental Assessment				Assessment Review and corrective action			3
			6	*Industry Session- Land conversion Process and Documentation.*			5	*Weekly industry assignment.*			

Week	C O	P O	D a ys	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
3	3	1,4, 5	1	*Peer review on industry class.*		4		**Topographical Surveying: Concepts and Techniques and GPS** • Procedure for topographic surveying. • Applications of topographical maps. • Relief-methods of representing relief • Maps – Types of Maps. https://www.youtube.com/watch?v=EnbWVDM4JeM	1		2
	2,3	1,4, 5	2	• **Case Exercise:** Collect study and Demonstrate features like terrain, natural resources, Transportation networks etc from the Topo sheet.	1		3	• **Case exercise Continuation**			3
	2,3	1,4, 5	3	**GPS**-Global Positioning System • Application of GPS in Urban planning • Various Satellites used by GPS • GPS Receivers- Pictorial Representation of working principle. • Hand held GPS Receiver • Demonstration, • Functions. Field procedure- Accuracy, Errors	2		2	Case Exercise: Using handheld GPS instrument • Establish co-ordinates of important station points of a given boundary and perform survey. 1. Obtain length between two station points. Calculate area of the boundary using GPS instrument.	1		2
	3	1,3, 5	4	**Spatial Data Infrastructure** • Introduction • Roles of NNRMS, NUIS, National Urban Observatory, • Introduction to GIS	2		2	Case Exercise: Demonstrate the collection of cadastral information of a sample			3

				• Concept, Components and Functions of GIS Case Exercise: Exposure to Spatial data handling tools. Prepare a report on uses and applications of GIS in Urban Planning **Spatial data handling tools:** • BHUVAN, KGIS etc., • DISHANK, BHOOMI etc.,				(neighborhood/residence) by using any of the tools.			
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	3		6	*Industry class- Case study on spatial data handling tools.*	1		4				
4	2,3	1,4 ,5	1	*Peer review on industry class*		4		**Aerial survey:** • Limitations of Traditional Surveys for Planning • Type of aerial Survey-Introduction to UAV survey. • Merits & demerits of UAV(drones) survey, • Application of drones in civil engineering. • Video demonstration of drones in urban planning; • ORI Images- QGIS software- conversion procedure from ORI sheets to maps- Swamitva central govt scheme –	1		2

								Commissioner survey settlement and land records, KR circle			
	3	1,4 ,5	2	Purpose of 3D animation & visualization system. System architecture (Process of drone survey)	2	1	1	Video Demonstration on 3D animation. Types of drone used for civil engineering field.		2	1
	2,3	1,4 ,5	3	Process of terrain creation & building model distribution. Video demonstration	2		2	Integration of 3D modeling from UAV survey in BIM.(can use video demonstration)	1		2
	2,3	1,3 ,5	4	Introduction to remote sensing. Objectives of remote sensing, working process of remote sensing , Types of remote sensing system.	2	2		Application of remote sensing. Remote sensing platforms .	1		2
		1,4 ,5	5	Developmental Assessment				Assessment Review and corrective action			3
	3		6	*Industry class-Drone Survey*	2		3				
5	1,2,3	1,4 ,5	1	*Peer review on industry class*		4		**INFRASTRUCTURE PLANNING** • Role of physical planner in planning of utilities and services, • Objectives of utilities and services Case Exercise: List the various utilities and services required for a Town.	1		2

	1,2,3	1,2 ,5	2	**Provisions of Utilities & Services** • Transportation Systems- Hierarchy of roads and its legal policies in planning	3		1	• Water supply systems- Location and space requirements for water distribution systems, Legal and government policy for urban and rural water supply, Familiarizing to CPHEEO manual and guidance-	1		2
	1,2,3	1,4 ,5	3	• Sanitation and sewer systems Location criteria. • Innovative approaches in waste management	1		3	• Social Infrastructure-Education, health, safety, security and other public services. • Telecommunication services Location criteria for mobile phone towers			3
	1,2,3	1,4 ,5	4	• Recreation- Play grounds, Parks, Religious centers, Club house, Theaters, Stadiums, Spa's, Swimming polls etc	1		3	• Other Underground Services (Provision of gas and oil pipelines).			3
		1,4 ,5	5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	1,2,3		6	*Industry class*	1		4	*Industry weekly assignment*			
Learning Outcomes: At the end of the week 6, students will be able to,											
6	1,2,3	1,2 ,5	1	*Peer review on industry class*		4		Case Exercise: Mini Project • Select a suitable site for a residential/commercial/ Industrial layout. • Conduct Boundary Survey Continued-	2		1

								Conduct Boundary Survey			
	1,2,3	1,4 ,5	2	Prepare layout plan of Infrastructure required as per the Town planning norm's.	2		2	Continued-			3
	1,2,3	1,4 ,5	3	Make provision for services and other utilities as per town planning norm's.	1		3	Continued-			3
	1,2,3	1,2 ,3	4	Prepare a master plan for the above using AutoCAD	1		3	Continued-			3
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	1,2,3		6	*Industry class*	2		3	*Industry weekly assignment*			
7		1,4 ,5	1	*Peer review on industry class*		4		**Concept of Smart City:** **https://mohua.gov.in/** **https://smartcities.gov.in/** • What is smart city • Why is a Smart city. • How is a Smart city. **https://smartnet.niua.org/sites/default/files/resources/making_a_city_smart_mar2021.pdf**			3
	4	1,4 ,5	2	**What is smart city** Case Exercise: Study the Smart city concept by GOI and using **https://smartcities.gov.in/** **Why is a Smart city.**	3		1	Prepare & present benefits of smart city. Field visit			3

				Case Exercise: Concept of Area based development(three model), core element of smart city infrastructure, component of area based development.							
	4	1,4,5	3	**How is a Smart city.** Case Exercise: Smart city selection process, Process of smart city proposal(SCP). Process of implementation & financing. Citizen collaboration. Challenges in smart city.	2		2	Field visit			3
	4	1,4,5	4	**Assessment/Evaluation:** Introduction about smart city technologies. Smart city component, Importance of smart city. Smart city thematic areas. Strategic roadmap assessment. Fostering sustainability with smart cities. Features of a smart city.			4	Concept of DPR. Download a DPR prepared and sample DPR report. considering other city.	2		1
			5	Developmental Assessment				Assessment Review and corrective action			3
	4		6	*Industry Class*	2		3	*Industry weekly assignment*			

Week	**C O**	**P O**	**D a y s**	**1st session (9am to 1 pm)**	**L**	**T**	**P**	**2ND session (1.30pm to 4.30pm)**	**L**	**T**	**P**
8	4	1,4.5	1	Weekly Assignment review		4		Field visit and mini Project:	1		2

								• List out the recognized smart cities in Karnataka state. • Selection criteria for Smart Cities.			
	4	1,4 ,5	2	Select a nearby Smart city. Identify the Smart works planned and implemented.	2	2		Case Exercise : Field site/Video demonstration			3
	4		3	Architecture Conceptualization Smart City Sensors Monitoring in smart city	2	2		Smart City Challenges. Presentation on steps involve to make a normal city into smart city	1		2
	4	1,4 ,5	4	Concept of IOT models used in smart city.(video demonstration)	2		2	Case excises : Present how smart city secured & Trusted			3
			5	Developmental Assessment				Assessment Review and corrective action			3
	4	1,4 ,5	6	*Industry Class*	2	1	2	*Industry weekly assignment*			
9	5	1,4 ,5	1	Weekly Assignment review		4		**Green Building:** Introduction, Need & Scope for green building and sustainable development. Reference YouTube video links: 1:*https://www.youtube.com/watch?v=YkfpYeVQXxA* 2: *https://youtu.be/lJ9qvOKEQ9A* *Case exercise:*	1		2

								1. Conduct a local survey to identify an ecofriendly home in a nearby locality and prepare a report. 2.http://www.asiabusinesscouncil.org/docs/BEE/GBCS/GBCS_CII.pdf 3.https://nzeb.in/case-studies/nzebs-in-india/nzebs-in-india-case-studies-list/ipb-case-study/ 3. Prepare a presentation on need for Green building? (Considering Global warming, energy crunch, resource crunch, global economy) *(Note: Conclusions and recommendations are must)*			
	5	1,4,5	2	• Principles • Features • Tangible and intangible benefits towards sustainable development. *Case exercise:* 3. Conduct a comparative study on green building over other conventional building. *(Note: Prepare a presentation and present)* 4. Prepare a report on effects of population density on biodiversity. *(Note: Conclusions and recommendations are must)*	2		2	**Sustainable site selection and Planning:** • Criteria for site selection. • Storm water management. • Effects of the building on light pollution. • Heat island effect **Location and transportation:** • Sensitive land protection, • Neighborhood density, • Green transportation. Promotion of MRTS. *Case exercise:*	2		1

								5. Select a site for construction of Green building and analyze the possibility of fulfilling the site selection criteria. 6. Prepare selected site key plan using Auto CAD. *(Note: Conclusions and recommendations are must)*			
	5	1,4 ,5	3	**Shape of building:** • Orientation of the building on the site relative to sun and wind, • Size and compactness of building (e.g., occupants per square foot/meter), • Door and window locations, • Concept of SBC. *Case exercise:* 7. Indicate the Orientation of building & water source location in key Plan using Auto CAD.	1		3	8. Measure and compare solar gain through windows that face various cardinal directions using Revit. 9. Determine the SBC of selected Site. *(Note: Conclusions and recommendations are must)* **Energy and atmosphere:** • Fundamentals of Energy, • Primary Energy use in Buildings, energy efficiency, Energy reduction, • Energy from Wind Turbines. 10. Measure kilowatt hours and determine energy-saving solutions & compare with solar panel energy production.	1		2
	5	1,4 ,5	4	Carbon Foot Print: • The carbon footprint and its significance, • Carbon footprints that results from the building construction and operations.	1		3	*Case exercise:* 12. Calculate Carbon Footprints of various construction materials and Prioritize ecofriendly materials.			3

				• Reducing carbon footprint. *Case exercise:* 11. Calculate carbon footprint of an individual person per day. *(Write your recommendations to reduce carbon footprint)* *(Write your recommendations on replacing solar panels as alternative*							
		1,4 ,5	5	Developmental Assessment				Assessment Review and corrective action			3
	5		6	*Industry Class*			5	*Industry weekly assignment*			
10	5	1,4 ,5	1	Weekly Assignment review		4		**Introduction to Autodesk Green Studio:** Demonstration and practice of Energy analysis and arriving for an energy efficiency check. Prepare a 3D model of 1BHK Residential building using Revit/AutoCAD.	2		1
	5	1,4 ,5	2	Hands-on- Analyze energy efficiency of selected building using Autodesk Green Studio. Reference video links: https://www.linkedin.com/learning/green-building-studio-energy-analysis/welcome-to-green-building-	2		2	Continuation			3

				studio?autoplay=true&trk=course_preview&upsellOrderOrigin=default_guest_learning							
	5	1,4,5	3	**Water:** • Water efficient plumbing systems, • Water metering, • Reclaimed water, • Water treatment, • Recycle and reuse systems. *https://youtu.be/UcyprU5ZrHE* *Case exercise:* 21. Identify naturally available sustainable water sources in and around the site. *(Note: Conclusions and recommendations are must)* 12. How do you make use of reclaimed water efficiently in your household? 13. Conduct a market survey on water-saving plumbing fixtures.	1		3	**Water:** • Rainwater harvesting & recharging methods for roof & non-roof, • Water issues in the landscape. • Waste water treatment and disposal. *Case exercise:* 14. Prepare a Presentation showing the methodology applied to implement grey recycled water for an individual home and community building. *(Note: Conclusions and recommendations are must)* 15. Estimate quantity of Rain water can be harvested for a selected building for available rainfall data.	1		2
	5	1,4,5	4	**Materials and waste management:** • Identification of Eco-friendly Building material. • Recyclable, Rapidly renewable, sustainable wood products.	1		3	Waste Management- Segregation of waste, 3R concept. • Bio methanation, • Plastic waste recycling technology, • Recycling technology for C&D waste. *Case exercise:*	1		2

				• Local materials, re-purposed materials; overall reduction in material. *Case exercise:* 15. Conduct a survey to identify materials that can be reclaimed and used. 16. Prepare a comparative estimate in excel showing the cost difference between any of the ecofriendly method of flooring with Vitrified or Granite flooring and prepare a report on it.				18. Conduct market survey for cost analysis and compare it with CC block and table moulded bricks using excel. *(Note: Conclusions and recommendations are must)*			
			5	Developmental Assessment				Assessment Review and corrective action			3
	5		6	*Industry Class*1.			5				
Week	**C O**	**P O**	**D a ys**	**1st session (9am to 1 pm)**	**L**	**T**	**P**	**2ND session (1.30pm to 4.30pm)**	**L**	**T**	**P**
11	5	1.4 .5	1	*Peer review on industry class*		4		**Indoor environment quality** • Indoor air quality, • Moisture and temperature control, • Connect occupants to nature via daylight, views and biophilic design. *Case exercise:* 17. Visit nearby Pollution control board /Municipal office/ Corporation/ Gram panchayat & Collect data to Control environmental toxins such as mold and radon.	1		2

								18. Prepare a report on Study of psychological impact of daylight. *(Note: Conclusions and recommendations are must)*			
	5	1,3,5	2	**Social justice:** • Affordability, • Accessibility, • Positive or negative impacts to communities locally and globally due to green building design choices. *Case exercise:* 19. Prepare a BOQ with Rate analysis for Green building components (at least 5no's) and compare it with same Conventional building components.	2		2	**Life cycle assessment:** • Ecological impacts across the life of building materials from creation to use to end-of-life. • Embodied energy in furniture and building materials. *Case exercise:* 20. Follow a building product from "cradle to grave" or "cradle to cradle". 21. Compare old and new building practice.	1		2
	5	1,4,5	3	**Economics:** • Cost-saving features, • Long-term budgeting, • Trade-offs between cost and performance. *Case exercise:* 22. Calculate amount of energy savings by adopting use of reclaimed water, solar panels & wind turbines. 23.Compare costs of green building materials.	2		2	**Operations and metrics:** • Green cleaning, occupant education and training. • Building information modeling (BIM). • Performance monitoring. 24. Differentiate and compare environmental effects of various cleaning products on air and water quality. 25. Prepare a checklist to monitor Electronics Appliances in a green building.	2		1

	5	1,4 ,5	4	**Site Visit:** 25. Conduct survey to identify the nearest existing building which complies at least any 5 green building concepts incorporated and make a detailed report showing comparative study with conventional method.			4	**Site Visit:** 26. Prepare a detailed AutoCAD drawing for a residential building showing Green building components and also prepare detailed BOQ incorporating Green Infrastructure.			3
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	5		6	*Industry Class*			5	*Industry weekly assignment*			
12	5		1	*Peer review on industry class*		4		**Green building certification:** • Building assessment and eco labels – ISO-14001 & ISO- 14064. • GHG removal & Verification process of GHG. Case exercise: 27. List the standards of code of practice related to above ISO's	1		2
	5	1,3 ,5		Assessment structure and process- GRIHA- Implementation of PMAY Scheme. GRIHA Online Registration process.	3		1	Case exercise: 26. Collect schedule of Ratings for Green building from agencies like GRIHA and Compare the collected ratings for the nearest Green project. *(Note: Conclusions and recommendations are must)*			3

	5	1,4 ,5		Assessment structure and process- IGBC IGBC- Online Registration process, Levels of Certification,	2		2	Case exercise: 27. Prepare a mock presentation showing the Green measures adopted for IGBC Certification of a nearest public building. *(Note: Conclusions and recommendations are must*			3
	5	1,4 ,5		Assessment structure and process- LEED-INDIA- Requirements to get LEED-INDIA certificate for a school building.	1		3	Case exercise: 28. Collect schedule of Ratings for Eco friendly home ratings from different agencies like LEED-INDIA and Compare the collected ratings schedule and prepare a schedule for the nearest school building project. *(Note: Conclusions and recommendations are must)*	1		2
			5	Developmental Assessment				Assessment Review and corrective action			3
	5		6	*Industry Class*			5	*Industry weekly assignment*			
13			1	**Internship** **c) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **d) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.**				**Project** **c) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective.** **d) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.**			

				Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.	**Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**

Note: Saturday session from 9 AM -2 PM

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 8	CIE 3– Written and practice test	4	30
Week 10	CIE 4– Written and practice test	4	30
Week 12	CIE 5– Written and practice test	4	30
Week 13	Assessment for Project or Internship	4	30
On line Course work (At least one related to the specialization)			30
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hour duration reduced to 60 marks		**3**	**60**
SEE 2 – Practical		**3**	**100**
TOTAL SEE MARKS (B)			**160**
TOTAL MARKS (A+B)			**400**

***** The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note : Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Programme	**Civil Engineering**	**Semester**	**V**
Course	**Town Planning & Green building**	**Max Marks**	**30**
Course Code		**Duration**	**4 hours**
Name of the course coordinator			

Note: Answer one full question from each section.

Qn.No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
	Section-1 (Theory) – 10 marks				
1.a)					
b)					
2.a)					
b)					
c)					
	Section-2 (Practical) - 20 marks				
3)					
4)					

Scheme of Evaluation for CIE 6

Sl No	Description	Marks
1	Project report	20
2	Project presentation	20
3	Viva voce	20
Total		**60**

Assessment framework for SEE 1 (Theory)

Programme	**:**	**Civil Engineering**			
Semester	**:**	**Vth**			
Course	**:**	**Town Planning & Green building**	**Max Marks**	**:**	**100**
Course Code	**:**		**Duration**	**:**	**3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL	CO	Marks
	Section-1			
1.a)			1	
b)				
2.a)				
b)				
	Section-2			
3.a)			2	
b)				
4.a)				
b)				
	Section- 3			
5.a)			3	
b)				
6.a)				
b)				
	Section-4			
7.a)			4	
b)				
8.a)				
b)				
	Section-5			
9.a)			5	
b)				

10.a)				
b)				

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		**100**

Case Submission / Content Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Identification of the main issues / problem	**Identifies and understands all the main issues in the problem statemen**	Identifies and understands most of the main issues in the problem statement	Identifies and understands some of the issues in the problem statement	Identifies and understands a few of the issues in the problem statement	Identifies limited issues in the problem statement	5
Analysis of the issues	Insightful and thorough analysis of all the issues	**Thorough analysis of most of the issues**	Superficial analysis of some of the issues in the problem statement	Incomplete analysis of the issues	No analysis of the issue	4
Comments on effective solutions / strategies (The solution may be in the problem statement already or proposed by you)	Well documented, reasoned and pedagogically appropriate comments on solutions, or proposals for solutions, to all issues in the problem statement	Appropriate, well thought out comments about solutions, or proposals for solutions, to most of the issues in the problem statement	Superficial and / or inappropriate solutions to some of the issues in the problem statement	**Little and/or inappropriate solutions to all of the issues in the problem statement**	No action to all issues in the problem statement	2
Links to course learning and additional research	Excellent research into the issues with clearly documented links to course learnings and beyond.	Good research and documented links to the materials read during the course	**Limited research and documented links to any readings**	Incomplete research and links to any reading.	No research or links to any reading	3

Case Presentation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Delivery & Enthusiasm	Very clear and concise flow of ideas Demonstrates passionate interest in the topic and engagement with class / examiner	**Clear flow of ideas Demonstrates interest in the topic and engagement with class / examiner**	Most ideas flow but is lost at times Limited evidence of interest in and engagement with the topic	Hard to follow the flow of ideas Lack of enthusiasm and interest	No flow in the presentation Poor presentation skills	**4**
Visuals	Visuals augmented and extended comprehension of the issues in unique ways	Use of visuals related to the topic	Limited use of visuals loosely related to the topic	**No use of visuals**	Poor visuals used and some visuals are not easy to understand its relevance.	**2**
Staging	**Uses stage effects such as props, sound effects, and speech modulation in a unique and dramatic manner that enhances the understanding of the issues in the problem statement.**	Uses stage effects such as props, sound effects, and speech modulation in an effective manner to extend the understanding of the issues in the problem statement.	Limited use of stage effects and/or used in a manner that did not enhance the understanding of the issues in the problem statement.	No use of stage effects	Poor stage effects usage	**5**

Involvement of the class / Examiners • **Questions** • **Discussions** • **Activities**	Excellent and salient discussion points that elucidated material to develop a deep understanding Appropriate and imaginative activities used to extend understanding in a creative manner	Questions and discussions addressed important information that developed understanding Appropriate activities used to clarify understanding	Questions and discussions addressed important superficial issues of the problem statement Limited use of activities to clarify understanding	Little or no attempt to engage the class / examiner in demonstrating their learning	**Did not engage the class / examiner and poor listening skills**	**1**
Total						**12**

Case Results Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Problem outcome	The topic was well researched and all information and data included are accurate and from reliable sources of information like high impact journals standards, etc. The proof was enough backed up with accurate data, analysis and reasoning beyond the class learning. Outcome achieved beyond the problem brief	**The topic was researched and most information and data were from reliable sources of information. The proof was backed up with good data and reasoning as taught in the class. Outcome achieved as per the problem brief**	The topic was researched but information and data were only partly from reliable sources of information. The proof was not fully backed up with good data or reasoning as taught in the class. Partial outcome achieved as per the problem brief	The topic was researched and data were not from reliable sources. The proof was not backed up with data, analysis or reasoning as taught in the class. Some outcome obtained as per the problem brief	Desired results not obtained, but some relevant research was done. Outcome not obtained as per the problem brief	**4**
Application of class learning in problem solving	Made effective use of class principles, models and theories. Also used creativity to find effective results appropriate to industry beyond class learning.	Made good use of class principles, models and theories Some creative ideas were explored to find desired outcome but within the framework of class learning	**Made some use of class principles, models and theories No creative ideas or models explored**	Made limited use of class principles, models and theories	Poorly applied class principals, models and theories	**3**
Response to Class / Examiners Queries	Queries Excellent response to comments and discussion with appropriate content supported by theory/research	Good response to questions and discussions with some connection made to theory/research	Satisfactory response to questions and discussions with limited reference to theory/research	**Limited response to questions and discussions with no reference to theory/research**	Poor or no response to questions and did not participate in the discussions.	**2**

Conclusions	Provides detailed and appropriate conclusion for the problem statement	**Provides appropriate conclusion for the problem statement**	Provides adequate and mostly appropriate conclusions for the problem statement	Provides limited and somewhat appropriate conclusions for the problem statement	Has not provided appropriate conclusions for the problem statement.	**4**
Total						**13/20**

Case Innovation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Finding new processes / models / approaches	**The newly discovered processes / models / approaches are of good quality and relevant**	The newly discovered processes / models / approaches are of appropriate quality but limited relevance	The newly discovered processes / models / approaches have limited application but relevant to the problem	The newly discovered processes / models / approaches has restricted application	No new processes / models / approaches were identified	**5**
Proposing ideas and innovative solutions in terms of processes / models / approaches and how they can be applied to solve the problem on hand	Various ideas and innovative solutions have been proposed and their application have been clearly outlined	Various ideas and innovative solutions have been proposed as well as the outline of the process to apply them	**Some ideas or innovative solutions have been proposed but the process of applying them hasn't been specified**	Few ideas have been proposed	No ideas or innovative solutions have been proposed	**3**
Using creativity techniques to provide and reason good ideas which are original and unconventional	Wherever necessary creativity techniques are utilized to analyse and solve the problem	Creativity techniques are frequently utilized in more than 50% of the occasions	Creativity techniques are utilized at times in less than 50% of the occasions	**Creativity techniques are used a few times only**	Creativity technique are not utilized to analyse and solve the problem	**2**
Finding constraints and weak points in existing processes / models / approaches or methods	Constraints and weak points are understood	Constraints and weak are identified	**A critical analysis is undertaken**	Only a description of the working process and methods are provided	No constraints or weak points have been identified.	**3**
Total						**13/20**

Sl no	References
1	*History of Human Settlements, Sengupta, B.K., New Delhi, Institute of Town Planners, India 2002*
2	*Introduction to Settlement Geography, Sumita Ghosh , Orient BlackSwan , 1998*
3	*Fundamentals of Town Planning, G.K. Hiraskar, Dhanpat Rai Publications, 2012*
4	*Architecture and town planning- by, Sajjan V Wagh & pravin R Minde. Tech-Neo Publications.*
5	*Principles of Town planning and Architecture- by Hirannay Biswas.*
6	
4	*URDPFI Guidelines (Volume I and II), Ministry of Urban Development, Government of India, 2015*
5	*Cities, Urbanization& Urban Systems (Settlement Systems), K.Siddhartha and S.Mukherjee, Kitab Mahal, 2016*
6	*How to Conduct Survey, Arlene Fink, Sage, 2013*
7	*The Survey Methods Workbook, A. Buckingham and Peter Saunders, Rawat, 2014*
8	*Fundamentals of Statistics, S.C. Gupta, Himalaya Publishing House, 2013*
9	*Surveying Vol. I &II, B.C.Punmia, Standard Book House, New Delhi,1983*
10	*Surveying (Volume I), S. K. Duggal, TMH*

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	**Civil Engineering**	**Semester**	**5th**
Course Code	**20CE53I**	**Type of Course**	**Specialization Pathway**
Course Name	**Transportation Engineering**	**Contact Hours**	**36 hours per week**
L:T:P	**104 : 52 : 312**	**Credits**	**24**
CIE Marks	**240**	**SEE Marks**	**160**

Introduction: Welcome to the curriculum for Transportation Engineering Specialization. This specialization course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur. You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn investigate, plan, analyze, design, execute, maintain Transpiration systems.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an internship at an organization working in Built Environment related industry or do a project in Built Environment. After the completion of your Diploma, you shall be ready to take up roles like Junior Engineer, Entrepreneur, consultancy services, Auditor.

This course will teach you Fundamentals of data collection, data analysis, forecasting, design, drafting, evaluation, estimating and costing, management and maintenance of different components of Transpiration System. Details of the curriculum is presented in the sections below.

Transportation engineering is the application of technology and scientific principles to the planning, functional design, construction, operation, maintenance and management of facilities for any mode of transportation in order to provide safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods transport. The facilities support air, highway, rail, road, pipeline, water transportation. The design aspects of transportation engineering include the sizing of transportation facilities how many lanes or how much capacity the facility has, determining the materials and thickness used in pavement, designing the geometry (vertical and horizontal alignment) of the roadway or track. Operations and

management involve traffic engineering, so that vehicles move smoothly on the road or track. Transportation engineering emphasizes on Road safety and assess environmental and health impacts.

Pre-requisites: Pre-requisite

Before the start of this specialization course, you would have completed the following courses;

In the 1st year of study, you would have studied Engineering Mathematics, Communication Skills, Civil Engineering Graphics, Statistics & Analysis, Basic IT Skills, Basic Surveying, Fundamentals of Electrical and Electronics Engineering, Project Management skills, Construction Materials, Environmental Sustainability.

In the 2nd year of study, you would have studied Engineering Mechanics and Strength of Materials, Modern Surveying, Construction Techniques, Building Drawing using CADD, Concrete Technology, Building Estimating and valuation, Site Management, Design and detailing of RCC structures.

In this year of study, you shall be applying your previous years learning along with specialized field of study into projects and real-world applications.

Instruction to course coordinator:

22. Each Pathway is restricted to a Cohort of 20 students which could include students from other relevant programs.
23. Single faculty shall be the Cohort Owner.
24. This course shall be delivered in boot camp mode.
25. The industry session shall be addressed by industry experts only.
26. The cohort owner shall identify experts from the relevant field and organize industry sessions as per schedule.
27. Cohort owner shall plan and accompany the cohort for industrial visits.
28. Cohort owners shall maintain and document the industrial assignments and weekly assessments, practices and mini projects.
29. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table.
30. The cohort owner along with the classroom can augment or use for supplementally teaching online courses available although reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM , etc.
31. Cohort owner shall guide the cohorts for the execution of mini project.

Course outcome: At the end of the semester students will be able to,

CO1	Conduct Survey, investigate subgrade soil and test pavement material for its suitability and Prepare Geometric design, required for the alignment of road construction.

CO2	Suggest suitable pavement construction methodology , Prepare Pavement design ,mix design , surface drainage system design , select suitable equipment/ machinery for road construction and take required safety precautions during road construction and Estimate the operational and annual cost of highway project with skills of highway financing and recommend suitable maintenance method
CO3	Study the traffic flow and behavior of vehicular movement at intersection, Signals and importance of signs and markings, conduct accident analysis ,road safety auditing and Assess environmental and health impact
CO4	Compare between different types of railway systems with Local Bus transport system and differentiate between different modes of transportation system(surface, water and air) and suggest suitable transportation structure for the transportation project
CO5	Select the appropriate tools, production environment and deploy the model.

Detailed course plan

Week	C O	P O	Days	1st session (9am to 1 pm)	L	T	P	2nd session (1.30pm to 4.30pm)	L	T	P
1	1	1,2	1	**Introduction to Specialization :** 1. Importance of transportation Engineering 2. Role of Transportation in national development- Economic, Social, Spatial, Cultural and Political Development 3. Audio-Visual Presentation on Different modes of transportation –Surface, water and air transportation	2		2	**Road Transportation – Surface Transportation** 1. Formation of Jayakar Committee and its recommendations and Implementations 2. Importance of Indian Road Congress (IRC) Committees and Sub committees, Importance of IRC Codal Provisions - Law resources IRC codal provisions **Case Exercise :** 1. Study and prepare report on Ongoing National Level highway Development Plan (NHDP) and Improvement of Riding Quality Programme(IRQP) 2. Study and prepare report on Present Scenario of Road Development in India 3. Refer Law resources IRC codal Provisions : https://law.resource.org/pub/in/bis/irc	2	1	
	1	1,2	2	1. Characteristics of Road Transportation , Comparison of Road Transportation with other modes of Transportation	1	1	2	1. Highway alignment, Major ideal requirements of highway alignment 2. Factors affecting Highway alignment, Steps to be followed in new highway alignment	2	1	

				2. Introduction to highway Planning and Surveys - Economical Studies, Financial Studies, Engineering Surveys and Traffic and Road User studies 3. Saturation system, its advantages and limitations, Road Construction Phase **Case Exercise:** 1. Study of Different Road Patterns- Rectangular , Radial or Star and Block , Radial or Star and Circular, Hexagonal Pattern				3. Realignment of highways, Objectives of Realignment, Steps to be followed in highway realignment **Case Exercise** 1.Study on Highway planning and Surveys- Detailed report preparation 2. Study Different Class of roads- National Highway (NH), State Highway(SH), Major District Roads(MDR), Other District Roads(ODR) and Village roads(VR)			
	1	3	3	1. Importance of Curves in Road and Railway alignment, Curves- Elements of Curves, relation between Radius and Degree of a curve 2. Types of curves – Horizontal and vertical curves. 3. Types of horizontal curves- simple, compound, reverse and transition curves	2		2	1. Elements of Simple curve. Procedure for Setting out Simple curve by Rankine's method using Total Station (Deflection Angle Method) 2. Elements of Compound Curve. Procedure for Setting out Compound curve by Rankine's method using Total Station (Deflection Angle Method) 3. Elements of a reverse curve. Procedure for Setting out Reverse Curve between Two Parallel Lines by Deflection Angle Method using Total Station	1		2
	1	4	4	**Field Practice**			4	**Field Practice**			3

				1. Set out simple curve by Rankine's method using Total Station in field 2. Set out Compound curve by Rankine's method using Total Station in field				1. Set out Reverse Curve between Two Parallel Lines by Deflection Angle Method using Total Station in field 2.Setting out Curves- Review of results and corrective action			
	1		5	Developmental Assessment				Assessment Review and corrective action			3
	1	7	6	*Industry Session:* *1.Importance and Applications of transportation engineering studies in Industry* *2. Importance of IRC codal provisions and in Industry*		1	4	*Industry assignment*			
2	1	3,7	1	*1.Peer review on industry class.* *2. Review of Case exercises*		4		**Geometric Design – IRC 38** 1. Importance of highway geometrics 2. Factors influencing good geometrics: Design Speed, Topography or terrain, Traffic factors, Design hourly Volume and Capacity, Environmental and other factors 3. **Highway Cross Section Characteristics** : Pavement Surface Characteristics, Friction, Pavement unevenness, Light Reflecting Characteristics	2		1

	1	3	2	1. **Cross Sectional elements** –Cross slope or Camber, Width of carriage way, Medians, Kerb, 2. Road Margins : Shoulders, guard rail, Foot path, drive way, cycle track, parking lane, bus bay, frontage roads and embankment slopes, cut slopes 3. Right of Way or Width of Formation: Factors affecting Right of way **Case Exercise**: Refer the following 1. IRC recommendations of Right of Way Width for different types of roads 2. IRC 38 - Guidelines for Design of Horizontal Curves for Highways and Design Tables	1		3	1.Drawing and detailing of typical Cross section of roads • Cross Section in Embankment • Cross Section in Cutting • Cross section of VR or ODR in embankment in rural area • Cross section of MDR in cutting in Rural area • Cross section of two lanes in city in Urban area 2. **Types of Sight Distance:** Stopping Sight Distance(SSD), Over Taking distance(OSD), Intermediate Sight Distance			3
	1	3	3	1.. Factors affecting SSD and OSD, Standard values of SSD and OSD for different design speed as per IRC ,Expressions for calculating SSD and OSD, Overtaking zones 2.**Elements of Horizontal Alignment** – Objectives and Expressions for the following • Design speed • Type of Curve provided • Super elevation	1		3	1.Numerical problems on cross sectional elements, types of sight distances and elements of horizontal alignment 2. Numerical Problems on design of elements of horizontal alignment as per IRC 38			3

				• Extra width at curve • Setback distances and Curve resistance							
	1	3	4	**Vertical alignment**- 1. Types of gradient : Ruling gradient, Limiting gradient, Exceptional gradient and minimum gradient 2.Grade Compensation at curves 3. Types of Vertical curves: Summit Curves or crest curves, Valley curves or Sag curves 4.Length of Summit curves and Valley curves, and its expressions	1		3	1. Design criteria for summit curve and Valley curves 2. Numerical Problems on design of elements of Vertical alignment Reference : IRC SP 23			3
	1		5	Developmental Assessment				Assessment Review and corrective action			3
	1	7	6	*Industry session-* Introduction to highway geometric design softwares and its application • KENPAVE • IIPAVE	1		4	*Weekly industry assignment.*			
3	1	1	1	*1. Peer review on industry class.* *2. Review of Case exercises*		4		**Types of Pavements- Audio Visual Presentation** 1. Need for highway pavement 2. Structure of flexible pavement and Rigid Pavement and Construction Methodology	1		2

								3. Components of pavements and their functions in flexible and rigid pavements 4. Basic Difference between rigid and flexible pavement			
	1	4	2	**FLEXIBLE PAVEMENT**: Demonstrate the following 1. Flexible Pavement layers – Subgrade, Sub base, Base course, Surface course, Wearing course 2. Soil as Subgrade layer - Application of Soil Mechanics in Road Construction 3. Three Phase system of Soil, Water Content, Density, Unit weights, Specific Gravity, Void Ratio, Porosity and Degree of Saturation, its functional relationships 4. Introduction to Index properties and engineering properties of soil.	2		2	**1. Laboratory procedure to determine following Index properties :** • Water content • Specific gravity • Particle Size distribution • Consistency limits • Insitu Density 2.Soil Classification Systems: IS classification system and HRB classification 3. Numericals on determining index properties and soil classification by IS system and HRB systems	1		2
	1	4	3	**LAB EXPERIMENTS** 1. Conduction of experiment to determine water content in the given sample of soil by oven drying method and Pycnometer method			4	**LAB EXPERIMENTS** 1. Conduction of experiment to determine liquid limit by Casagrande's apparatus 2. Conduction of experiment to determine Plastic limit by method of rolling			3

				2. Conduction of experiment to determine Specific Gravity in the given sample of soil 3. Conduction of experiment to determine Particle Size Distribution in the given sample of soil by Dry Sieve analysis				3. Conduction of field experiment on determination of In-situ Density of soil by Core Cutter method / sand replacement method **Case Exercise :** Importance of soil testing for Index properties in determining type and behavior of soil for road construction			
	1	4	4	1. Importance and factors affecting the Engineering properties of soil : Shear strength , Compaction and Permeability of soil 2. Procedure for determining the Optimum moisture content and Maximum Dry density of Soil by Modified Proctor Compaction test 3. Procedure for determining Strength of soil by California Bearing Ratio test (CBR)	1		3	**LAB EXPERIMENTS** 1.Conduction of Dynamic Compaction test for the given sample of soil by Modified Proctor test method 2. Conduction of CBR test for the given sample of soil 3.Laboratory Experiments on Soil - Review of results and corrective action **Case Exercise :** Importance of soil testing for Engineering properties in determining type and behavior of soil for road construction			3
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	1	4	6	*Industry class- Consultancy Services- Soil testing*	1		4				

4	1	4	1	*1.Peer review on industry class* *2.Review of Case exercises*		4		**Introduction to Pavement Materials: Aggregates** 1. Origin, Classification and Properties of aggregates to be considered for road construction 2. Laboratory Test procedure on aggregate to be considered for road construction as per IS codes and **MORTH** specifications • Impact test • Abrasion test • Polished stone Value test(Only for Demonstration) • Crushing test • Flakiness and Elongation Index test and angularity Number • Specific gravity and Water Absorption test	1		2
	1	4	2	**LAB EXPERIMENTS** 1. Conduction of Experiment for determining the toughness / resistance to Impact of aggregates by Aggregate Impact Test 2. Conduction of Experiment for determining the Hardness / Resistance to Abrasion of aggregates by Los Angeles Abrasion test			4	**LAB EXPERIMENTS** 1. Conduction of Experiment for determine the Specific Gravity and Water absorption of aggregates 2. Conduction of Experiment for determining the shape of aggregates by Flakiness and Elongation test 3. Conduction of Experiment for determining the shape of aggregates by Angularity Number			3

				3. Conduction of Experiment for determining the resistance to crushing of aggregates by Aggregate Crushing Test				**Case Exercise :** MORTH Specifications on the results of each tests for inference of its application in road construction			
	1	4	3	**Introduction to Pavement Materials-Binder** Audio – Visual Presentation 1. Origin of Asphalt , Bitumen and Tar and its types 2. Chemical Composition of Bitumen and Tar, Differences between Bitumen and Tar and its grades 3. Introduction and Applications of following bitumen used in road Construction • Cut back Bitumen • Bitumen Emulsion • Modified Bitumen	2		2	1. Functions of binder as Pavement Material and desirable properties 2. Laboratory Test procedure on bitumen to be considered for road construction as per IS codes and MORTH specifications • Penetration test • Ductility test • Softening point test • Specific gravity test • Viscosity test • Flash and Fire point test • Float test • Water content test • Loss on heating test • Stripping Value test (Adhesion between Bitumen- aggregate)	1		2
	1	4	4	**LAB EXPERIMENTS** 1. Conduction of Experiment for determining the consistency of			4	**LAB EXPERIMENTS**			3

				bituminous material by Penetration test 2. Conduction of Experiment for determining the Ductility or malleability of bituminous material by Ductility test 3. Conduction of Experiment for determining the Temperature at which bituminous material softens by Softening point test 4. Conduction of Experiment for determining the Specific Gravity of bituminous material softens by Pycnometer Method				1. Conduction of Experiment to determine the rate of flow of bituminous material by viscosity test using Orifice Viscometer 2. Conduction of Experiment for determining the Temperature at which bituminous material catches flash and fire (Safety)by Flash POINT TEST 3. Conduction of Experiment for determining the adhesion of bituminous material on the surface of aggregate by Stripping value test of aggregates **Case exercise** : IRC and MORTH Specifications on the results of each tests for inference of its application in road construction			
	1		5	Developmental Assessment Laboratory tests on pavement material-Soil, Aggregate and Bitumen - Review of results and corrective action				Assessment Review and corrective action			3
	1	4	6	*Industry class – Consultancy Services – Material Testing*	1		4				
5	2	2,3	1	*1. Peer review on industry class* *2. Review of Case exercises*				**Bituminous Paving mix** :	1		2

								1.Gradation and proportioning of aggregates by Rothfutch method 2. Step wise Procedure for preparation of Bituminous trial mix 3. Procedure to determine the Stability, Flow Value and Optimum Binder Content of Bitumen trial mix by Marshal Stability test 4. Demonstration of the experiment to check the Marshal Stability for the Bituminous mix prepared from Mix design			
	2	4,5	2	**Flexible Pavement Construction: Audio – Visual Presentation** 1.Introduction , Components of Highway in embankment and cutting 2.Embankment and Subgrade: Functions and Design elements of highway Embankment and Subgrade 3. Construction methodology of highway embankment and Subgrade- Material	2		2	**Construction of Flexible Pavement: Audio – Visual Presentation** 1. Material Specifications, Construction Methodology and Quality Control checks for the following Components of flexible pavement • Granular sub base drainage layer, • Granular Base course – Wet Mix Macadam(WMM), Water Bound Macadam(WBM)	1		2

				Specifications, Construction Methodology and Quality Control checks 4. Compaction of soil for the construction of Embankment and Subgrade **Case Exercise :** Equipments and Machineries used for Compacting soils and Excavation of earth for road construction							
	2	4,5	3	**Construction of Flexible Pavement: Audio – Visual Presentation** 1. Material Specifications, Construction Methodology and Quality Control checks for the following Components of flexible pavements • Prime Coat and Tack coat • Bitumen Base Course- Bituminous Macadam (BM), Bituminous Penetration Macadam(BPM), Built-up Spray Grout(BUSG) • Bitumen Surface Course	1		3	**Construction of Flexible Pavement: Audio – Visual Presentation** 1. Material Specifications, Construction Methodology and Quality Control checks for the following Components of flexible pavements • Dense Graded Bituminous Mixes • Bitumen Mastic Wearing course • Stone Mastic Asphalt (SMA) **Case Exercise :** Bitumen Paver Machines and Equipments used in road construction	1		2
	2	3,4,5	4	**Rigid Pavements**	2		2	1.Prepare a Cement Concrete mix design for Pavement as per IRC standards			3

				1.Types of Rigid pavements, .Components of Cement Concrete Pavements and their functions 2.Material Specifications, Construction Methodology and Quality Control checks for the construction of Cement Concrete Pavements 3. Different Types of Joints, their functions and their Construction procedure				2.Conduct experiment to determine the Compressive and Flexural strength of concrete mix prepared from the mix design as per IRC 44 2017			
			5	CIE 2– Written and practice test				Assessment Review and corrective action			3
	2	4,5	6	*Industry class-* *1.Subgrade Soil Stabilization techniques and its importance* *2.Machineries and Equipments used in road construction*	1		4	*Industry weekly assignment*	12	6	18
6	2	1,3	1	*1.Peer review on industry class* *2. Review of Case exercises*		4		**Design of Flexible Pavement**: (IRC 37 2018) Factors governing the design of flexible pavement • Wheel loads of heavy vehicles or traffic loads • Sub grade soil • Climatic factors • Pavement Component material • Environmental Factors	2		1

								Special factors in the design of different types of pavements			
	2	2,3	2	Design approach and criteria • Estimation of design traffic • Design life • Vehicle Damage Factor (VDF) • Distribution of Commercial Vehicle Traffic • GROWTH RATE	1		3	1. Numerical problems on determination of design factors 2. Numerical problems on IRC method of Design of Flexible Pavement			3
	2	2,3	3	**Design of Rigid Pavement**: **IRC 58 2015** Factors governing the design of rigid pavement and its Standard values and expressions as per • Wheel load • Design period • Design traffic • Temperature differential • Characteristics of Subgrade and Sub base • Drainage layer • Characteristic strength and Fatigue behavior of Concrete • Calculation of stresses	1		3	3. Numerical problems on determination of design factors 4. Numerical problems on IRC method of Design of Rigid Pavement			3
	2	2,3	4	**Introduction to Road Drainage works- IRC – SP- 42** 1. Objectives of road drainage	1		3	1. Numerical Problems on Design of Surface drainage for roads 2. Methods of Subsurface Drainage			3

				2. Requirement of highway drainage 3. Design procedure of surface drainage 4. Standard values and expressions as per IRC				3. Cross Drainage works- Culverts			
			5	Developmental Assessment				Assessment Review and corrective action			3
	2	2,5	6	*Industry Class* • *Pavement Maintenance* • *Highway Finance* • *Economic Evaluation*	1		4	*Industry weekly assignment*			
7	2	2,5	1	*Peer review on industry class*				1. Numerical Problems on Estimation of Operational Cost of highway project 2. Numerical Problems on Estimation of Annual cost of Highway project 3. Numerical Problems on Economical Evaluation of Highway projects			3
	1,2	7	2	**Project 1 : Pavement Construction Site visit** • Observe and Study about Constructional aspects and methodology for sub grade, sub base, base, bituminous coarse / concrete pavements • Observe and Study different types of Equipments, Machineries and Rollers used • Observe and Study the Safety precautions taken during Pavement Construction • Collect the data about Project details like Type of Soil and its investigations, Pavement materials used and tests conducted , Preparation of pavement layers, setting / curing period and special techniques if any Preparation of Report on Site visit (LATEST TECHNOLOGIES)-PROJECT STUDY							21
	1,2	7	3								
	1,2	7	4								

			5	CIE 3– Written and practice test				Assessment Review and corrective action				3
	1,2	7	6	*Industry Class* Introduction to Highway Design Softwares and its application • MX ROAD • CIVIL 3D PAVEMENT DESIGN • KJPBACK- PAVEMENT DESIGN AND EVALUATION	1		4					
									L	**T**	**P**	
8	3	1,2	1	1. *Peer review on industry class* 2.Progress review of **Project 1**				**Traffic Engineering** Audio – Visual Presentation on • Introduction to Scope of Traffic Engineering • Road User Characteristics • Human and Vehicular Characteristics • Fundamental Parameters and Relations of Traffic Flow, Speed, Density, Volume, Travel Time • Simple Numerical Problems on Fundamental Traffic Parameters	2		1
	3	1,2	2	Audio – Visual Presentation on **Introduction to Following** 1. Origin and destination Studies 2. Volume Counts 3. Speed, Travel time and delay studies 4. Accidental studies	2		2	Audio – Visual Presentation on Introduction to Traffic Intersections 1.Levels of Intersection Control				3

				5. Parking Characteristics 6. Pedestrian behavior and use of streets 7. Capacity studies Economic loss caused by Inferior traffic facilities				• Passive control – Traffic Rules, Signs and Marking • Semi Control – Channelization by traffic Islands and rotaries • Active control- Traffic Signals, Grade separators 2.Traffic signs • Requirements of traffic control devices • Communication tools • Types of traffic signs – Regulatory, Warning and Informative signs 3.Traffic Markings • Longitudinal marking : Centre line, Traffic Lane, No passing line, Warning line, Edge line • Transverse marking : Stop line, pedestrian crossing, directional arrows • Object Marking : Within and adjacent to carriage way • Word messages, Parking and Hazardous location			
	3	7	3	**Project 2 : Field visit:** Visit Passive Control. Semi control and Active Control Intersections. –traffic survey						14	
	3	7	4	Observe and Study the following and prepare a report • Flow of traffic • Traffic rules followed by people using different modes of vehicles • Different types of signs used and their characteristics							

				• Movement of vehicles in channelized islands and rotaries • Movement of vehicles in Signalized intersections and study about the signals • Movement of Vehicles in grade separated intersections if any Different types of markings and the meaning of that marking							
			5	Developmental Assessment				Assessment Review and corrective action			3
	3	7	6	*Industry Class-* Introduction to Traffic Engineering Softwares and its application • VISSIM Software	1		4	*Industry weekly assignment*			

	1,2,3	7	1	1. *Peer review on industry class* 2.Progress review of **Project 2**		**4**		**Project 3 : Proposal of New Highway Alignment Project** – Survey, Drawings and Report **Field Survey** - Terrain to be chosen for survey such that it should include vertical & Horizontal curve • Reconnaissance of the area			
9	1,2,3	7	2	1.**Field Survey** - Terrain to be chosen for survey such that it should include vertical & Horizontal curve • Align a new road between two obligatory points. • Conduct Longitudinal and cross-sectioning surveys • Projecting a road of given gradient. • Blockleveling at the lowest level or valley curve • Connecting to new road alignment, surveying existing road 90m and exploring possibility of widening. 2.**Graded Exercise** : Preparation of AUTOCAD Drawings					28		
	1,2,3	7	3								
	1,2,3	7	4								

				• Index plan
				• Plan showing alignment with Horizontal Curves of road
				• L.S & C.S of Road at different chainages as per IRC standards (Report should justify the selected alignment with details of all geometric designs for horizontal curve and Vertical curves proposed, traffic and design speed assumed.)
				• Typical Cross Section of Road as per Pavement Design
				• Block leveling @ the lowest level or valley curve placing Culvert – Cross Drainage works
				  ○ Half plan at top & half plan at foundation.
				  ○ Half sectional elevation, half front elevation.
				  ○ Half Cross section @centre half Cross section @ abutment
				
				3.**Quantity surveying**
				• Earthwork Calculation from the cross-section area at different chainages.
				• Estimation of Cost of Construction and Maintenance of Proposed Project
				
				4.**Experiments**
				• Field sample of soil to be collected and laboratory and insitu experiments to be conducted to determine the Index and engineering properties of soil- Subgrade and results to be reported
				• Based on Pavement design for type of pavement proposed – Pavement materials to be laboratory tested and results to be reported
				5. **REPORT**
				• AUTOCAD Drawings
				• Geometric Design geometric designs for horizontal curve and Vertical curves proposed
				• Pavement design for type of pavement proposed
				• Details of Cross Drainage work proposed
				• Soil Investigation Report
				• Pavement Material Testing Report	

				• Quantity Surveying – Earthwork Calculation, Estimation of Cost of Construction and Maintenance of Proposed Project							
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	1,2,3	7	6	*Industry Class- Real time projects*	1		4	*Industry weekly assignment*			
10	4	1,2	1	*1.Peer review on industry class* 2.Progress review of **Project 3**		4		Audio Visual Presentation on **Introduction to Railway Engineering (Surface Transportation)** 1. Role and Features of Indian Railways 2. Various components and requirements of a good track 3. Factors to be considered while selecting a good alignment 4. Forces acting on the track 5. Concept of coning of wheels and tilting of rails, Gradient and its types	1		2
	4	1,2	2	Audio Visual Presentation on Functions, Types and requirements of Track Components • Rails • Sleepers • Ballast	2		2	Audio Visual Presentation on Importance and Features of • Track fittings and Fastening • Rail Joints and Welding of Rails • Railway Stations and Yards	1		2

	4	1,2	3	Audio Visual Presentation on Importance and Features of Points and Crossings • Turnouts • Track Junctions • Track Maintenance	2		2	Audio Visual Presentation on Types of Rail Transportation • Sub urban Rails • Rapid Rail Transit • Light Rail Transit • Monorail	1		2
	4	1,2	4	Audio Visual Presentation on **Harbour - Water Transportation** **1.** Introduction to Harbour, Purpose of providing Harbour 2. Terminology - Dock, Port, Sea works for transportation Breakwater, Jetties, Quays, Dredging, Light house, Buoys and Beacons. 3. Types of Harbor- Natural Harbor, Artificial Harbor, Ice-Free Harbors	2		2	Audio Visual Presentation on **Airport- Air Transportation** 1. Terminology- Aerodrome, Apron, Hanger, Runway, Taxiway, Terminal area, Wind rose 2. Factors affecting selection of site for airport 3. Advantages and Disadvantages of Airport 4. Importance of Airport Lighting			3
			5	Developmental Assessment				Assessment Review and corrective action			3
	4	1,2	6	*Industry Class- Railways and Airport Engineering*	1		4	*Industry weekly assignment*			

11	4	1,2	1	*1.Peer review on industry class* 2.Progress review of **Project 3**		4		**Audio – Visual Presentation on Introduction to Transportation Structures** 1. Bridges – Rail Bridge, Road Bridge and Pedestrian bridge			3

								2. Tunnels and Culverts 3. Grade Separators - Flyovers (Overpass and Underpass) and Interchange 4. Retaining Walls in highways			
	4	1,2	2	Audio Visual Presentation on **Introduction to Bridges** 1. Component parts of a bridge 2. Terminologies - Water way, afflux, economic span of a bridge, scouring, free board, approach 3. Selection of site for bridges 4. Bridge Sub structure and Super structure	1		3	Audio Visual Presentation on 1. Types of Bridges based on Material • Temporary bridges – Timber bridges • Permanent bridges - Masonry, Steel or R.C.C / Pre stressed bridges 2. Types of Bridges based on Structure • Arch bridges and Tied Arch bridges • Beam Bridges • Truss Bridges • Cantilever Bridges • Cable stayed bridges • Suspension bridges	1		2
	4	2,6	3	Audio Visual Presentation on **Tunnels**: 1. Terminology 2. Advantages of tunnels 3. Size and shapes of tunnels- horse shoe, egg shape, segmental roof section 4. Transferring alignment inside the tunnel, mucking, concept of shafts	2		2	**Assignment 1** : 1. Compare the Local Bus transport system with the Metro Rails and Sub urban Railway systems (Completed)available in different cities of India 2. Compare the following and report which transportation system is most economical in those cities of India • Population of the cities		3	

				5. Objects of tunnel lining and Ventilation 6. Drainage in tunnels				• Project Completion Cost • Annual returns (Income) • Ridership per annum			
	4	6	4	**Assignment 2** : Report the following 1. Cities/ Places in India where Harbours and Airports are situated 2. Important features ,Purpose and benifits of those harbours and airports situated in different cities of India 3. Project Completion Cost of those Harbours and Airports situated in different cities of India 4. Types of Airports and Harbours situated in India		4		**CASE STUDY 1** : Conduct a case study on the construction procedure of the following and prepare a report 1. Grade separators • Flyover – Underpass • Flyover – Overpass • Interchange 2. Retaining wall in highways			3
			5	CIE 1– Written and practice test				Assessment Review and corrective action			3
	4	7	6	*Industry Class- Bridges and Tunnels*	1		4	*Industry weekly assignment*			
12	4	2	1	*1.Peer review on industry class* *2.Review of Assignment 1 and 2*		4		Audio Visual Presentation on Introduction to Multi Modal Transportation system • Public Transport • Services and Freight	1		2

								• Intermediate Para Transit • Multi Occupancy Cars (Car Pool) • Single Occupancy Cars			
	3,4	5	2	**Audio- Visual Presentation** on 1. Accidental Studies • Objectives of accident studies • Causes of Road accidents • Accidental black spots • Study of accidental statistics 2.Accidental Analysis • Accident Data collection • Accident Investigation • Accident Data Analysis	1		3	Audio- Visual Presentation on **Road Safety** 1. Pedestrian Safety and Security 2. Risk factors for Pedestrian Traffic Injury 3. Road Crashes/ Accidents- Factors influencing crashes 4. Safety Precautions to be considered for Road safety	1		2
	3,4	5		**Road Safety Auditing – IRC SP 88** 1. Different Types of auditing 2. Introduction to road safety auditing 3. Need of road safety auditing 4. Objectives of road safety auditing 5. Benefits of road safety auditing	2		2	Audio- Visual Presentation on Stages of Road safety auditing 1. Auditing of Roads before opening to traffic • Feasibility stage • Preliminary design stage • Detailed design Stage • Pre –opening stage 2. Auditing of Existing roads • Accidental data collection • Inspection at Road Construction at accident black spot • Inspection of Designs • Assessment and Reviews			3

	3,4	5,6		Audio- Visual Presentation on 1. Step wise procedure followed in the road safety auditing 2. General and Formal requirements 3. Importance of Monitoring and Evaluation of road safety by auditing 4. Environmental Impact assessment and Health Impact Assessment of transportation system	2		2	**CASE STUDY 2 :** Conduct a case study on the following and prepare a report • Accident analysis • Road safety auditing • Environmental and Health Impact assessments of transportation systems • Sustainability – Reclaimed Asphalt Pavement , Usage of alternative materials in road construction			3
			5	Developmental Assessment				Assessment Review and corrective action			3
	3,4	7	6	*Industry Class – Road Safety Auditing*	1		4	*Industry weekly assignment*			

13		6		**Internship** **e) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **f) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.** **Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.**				**Project** **e) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective.** **f) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.** **Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**			

Note: Saturday session from 9 AM -2 PM

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 8	CIE 3– Written and practice test	4	30
Week 10	CIE 4– Written and practice test	4	30
Week 12	CIE 5– Written and practice test	4	30
Week 13	Assessment for Project or Internship	4	30
On line Course work (At least one related to the specialization)			30
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hour duration reduced to 60 marks		**3**	**60**
SEE 2 – Practical		**3**	**100**
TOTAL SEE MARKS (B)			**160**
TOTAL MARKS (A+B)			**400**

***** The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Scheme of Evaluation for CIE 6

Sl No	Description	Marks
1	Project report	10
2	Project presentation	10
3	Viva voce	10
Total		**30**

Instructions to students:

Students will have the opportunity to update their final report submission for SEE 2 post CIE 6 in order to enable them to address the feedback received during their CIE 6 assessment and also work towards achieving the desired project/case outcome.

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		**100**

Case Submission / Content Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Identification of the main issues / problem	**Identifies and understands all the main issues in the problem statement**	Identifies and understands most of the main issues in the problem statement	Identifies and understands some of the issues in the problem statement	Identifies and understands a few of the issues in the problem statement	Identifies limited issues in the problem statement	5
Analysis of the issues	Insightful and thorough analysis of all the issues	**Thorough analysis of most of the issues**	Superficial analysis of some of the issues in the problem statement	Incomplete analysis of the issues	No analysis of the issue	4
Comments on effective solutions / strategies (The solution may be in the problem statement already or proposed by you)	Well documented, reasoned and pedagogically appropriate comments on solutions, or proposals for solutions, to all issues in the problem statement	Appropriate, well thought out comments about solutions, or proposals for solutions, to most of the issues in the problem statement	Superficial and / or inappropriate solutions to some of the issues in the problem statement	**Little and/or inappropriate solutions to all of the issues in the problem statement**	No action to all issues in the problem statement	2
Links to course learning and additional research	Excellent research into the issues with clearly documented links to course learnings and beyond.	Good research and documented links to the materials read during the course	**Limited research and documented links to any readings**	Incomplete research and links to any reading.	No research or links to any reading	3
Total						**14/20**

Case Presentation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Delivery & Enthusiasm	Very clear and concise flow of ideas Demonstrates passionate interest in the topic and engagement with class / examiner	**Clear flow of ideas Demonstrates interest in the topic and engagement with class / examiner**	Most ideas flow but is lost at times Limited evidence of interest in and engagement with the topic	Hard to follow the flow of ideas Lack of enthusiasm and interest	No flow in the presentation Poor presentation skills	**4**
Visuals	Visuals augmented and extended comprehension of the issues in unique ways	Use of visuals related to the topic	Limited use of visuals loosely related to the topic	**No use of visuals**	Poor visuals used and some visuals are not easy to understand its relevance.	**2**
Staging	**Uses stage effects such as props, sound effects, and speech modulation in a unique and dramatic manner that enhances the understanding of the issues in the problem statement.**	Uses stage effects such as props, sound effects, and speech modulation in an effective manner to extend the understanding of the issues in the problem statement.	Limited use of stage effects and/or used in a manner that did not enhance the understanding of the issues in the problem statement.	No use of stage effects	Poor stage effects usage	**5**

Involvement of the class / Examiners • **Questions** • **Discussions** • **Activities**	Excellent and salient discussion points that elucidated material to develop a deep understanding Appropriate and imaginative activities used to extend understanding in a creative manner	Questions and discussions addressed important information that developed understanding Appropriate activities used to clarify understanding	Questions and discussions addressed important superficial issues of the problem statement Limited use of activities to clarify understanding	Little or no attempt to engage the class / examiner in demonstrating their learning	**Did not engage the class / examiner and poor listening skills**	**1**
Total						**12/20**

Case Results Evaluation Rubrics

Evaluation Parameters	**5**	**4**	**3**	**2**	**1**	**Student Score**
Problem outcome	The topic was well researched and all information and data included are accurate and from reliable sources of information like high impact journals standards, etc. The proof was enough backed up with accurate data, analysis and reasoning beyond the class learning. Outcome achieved beyond the problem brief	**The topic was researched and most information and data were from reliable sources of information. The proof was backed up with good data and reasoning as taught in the class. Outcome achieved as per the problem brief**	The topic was researched but information and data were only partly from reliable sources of information. The proof was not fully backed up with good data or reasoning as taught in the class. Partial outcome achieved as per the problem brief	The topic was researched and data were not from reliable sources. The proof was not backed up with data, analysis or reasoning as taught in the class. Some outcome obtained as per the problem brief	Desired results not obtained, but some relevant research was done. Outcome not obtained as per the problem brief	**4**
Application of class learning in problem solving	Made effective use of class principles, models and theories. Also used creativity to find effective results appropriate to industry beyond class learning.	Made good use of class principles, models and theories Some creative ideas were explored to find desired outcome but within the framework of class learning	**Made some use of class principles, models and theories No creative ideas or models explored**	Made limited use of class principles, models and theories	Poorly applied class principals, models and theories	**3**
Response to Class / Examiners Queries	Queries Excellent response to comments and discussion with appropriate content supported by theory/research	Good response to questions and discussions with some connection made to theory/research	Satisfactory response to questions and discussions with limited reference to theory/research	**Limited response to questions and discussions with no reference to theory/research**	Poor or no response to questions and did not participate in the discussions.	**2**

Conclusions	Provides detailed and appropriate conclusion for the problem statement	**Provides appropriate conclusion for the problem statement**	Provides adequate and mostly appropriate conclusions for the problem statement	Provides limited and somewhat appropriate conclusions for the problem statement	Has not provided appropriate conclusions for the problem statement.	**4**
Total						**13/20**

Case Innovation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Finding new processes / models / approaches	**The newly discovered processes / models / approaches are of good quality and relevant**	The newly discovered processes / models / approaches are of appropriate quality but limited relevance	The newly discovered processes / models / approaches have limited application but relevant to the problem	The newly discovered processes / models / approaches has restricted application	No new processes / models / approaches were identified	**5**
Proposing ideas and innovative solutions in terms of processes / models / approaches and how they can be applied to solve the problem on hand	Various ideas and innovative solutions have been proposed and their application have been clearly outlined	Various ideas and innovative solutions have been proposed as well as the outline of the process to apply them	**Some ideas or innovative solutions have been proposed but the process of applying them hasn't been specified**	Few ideas have been proposed	No ideas or innovative solutions have been proposed	**3**
Using creativity techniques to provide and reason good ideas which are original and unconventional	Wherever necessary creativity techniques are utilized to analyse and solve the problem	Creativity techniques are frequently utilized in more than 50% of the occasions	Creativity techniques are utilized at times in less than 50% of the occasions	**Creativity techniques are used a few times only**	Creativity technique are not utilized to analyse and solve the problem	**2**
Finding constraints and weak points in existing processes / models / approaches or methods	Constraints and weak points are understood	Constraints and weak are identified	**A critical analysis is undertaken**	Only a description of the working process and methods are provided	No constraints or weak points have been identified.	**3**
Total						**13/20**

Assessment framework for CIE (1 to 5)

Note : Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Programme	**Civil Engineering**	**Semester**	**V**
Course	**Transportation Engineering**	**Max Marks**	**30**
Course Code		**Duration**	**4 hours**
Name of the course coordinator			

Note: Answer one full question from each section.

Qn.No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
	Section-1 (Theory) – 10 marks				
1.a)					
b)					
2.a)					
b)					
c)					
	Section-2 (Practical) - 20 marks				
3)					
4)					

Assessment framework for SEE 1 (Theory) – 100 Marks / 3 hours (Reduced to 60 marks)

Programme : Civil Engineering	**Semester: Vth**
Course : Transportation Engineering	**Max Marks: 100**
Course Code :	**Duration : 3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL	CO	Marks
	Section-1			
1.a)			1	
b)				
2.a)				
b)				
	Section-2			
3.a)			2	
b)				
4.a)				
b)				
	Section- 3			
5.a)			3	
b)				
6.a)				
b)				
	Section-4			
7.a)			4	
b)				
8.a)				
b)				
	Section-5			
9.a)			5	
b)				

10.a)				
b)				

References:

Sl. No.	Description
1	" Highway Engineering " by Khanna S.K. and Justo C.E.G, , Nemchand and Bros, Roorkee
2	" Highway Material Testing Laboratory Manual" by Khanna SK and Justo CEG, Nemchand and Bros. Roorkee
3	" Highway Engineering " by Kadiyali L.R, , Khanna Publishers, New Delhi
4	" Traffic Engineering and Transport Planning " by Kadiyali L R
5	"Railway Engineering "by Satish Chandra and Agarwal M M, Oxford university press.
6	IRC Codal Provisions
7	Transportation Engineering and related courses in NPTEL , Swayam
8	Industry Consultation

Government of Karnataka
DEPARTMENT OF COLLEGIATE and TECHNICAL EDUCATION

Program	**Civil Engineering**	**Semester**	**5th**
Course Code	**20CE54I**	**Type of Course**	**Carrier Pathway**
Course Name	**Built Environment**	**Contact Hours**	**36 hr/week**
L: T:P	**104: 52: 312**	**Credits**	**24**
CIE Marks	**240**	**SEE Marks**	**160**

Introduction: Welcome to the curriculum for Built Environment Specialization. This specialization course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur. You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn how to build, operate, assess, monitor the human-made facilities/surroundings that provide the setting for public health.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an internship at an organization working in Built Environment related industry or do a project in Built Environment. After the completion of your Diploma, you shall be ready to take up roles like Junior Engineer, Facility Manager, Environmental Engineer, Water Analyst, Green Engineer.

This course will teach you Fundamentals of data collection, data analysis, forecasting, design, evaluation, estimating and costing, management and maintenance of different components of Water supply, Waste water and Solid waste Management System. Details of the curriculum is presented in the sections below.

Pre-requisite

Before the start of this specialization course, you would have completed the following courses;

In the 1st year of study, you would have studied Engineering Mathematics, Communication Skills, Civil Engineering Graphics, Statistics & Analysis, Basic IT Skills, Basic Surveying, Fundamentals of Electrical and Electronics Engineering, Project Management skills, Construction Materials, Environmental Sustainability.

In the 2nd year of study, you would have studied Engineering Mechanics and Strength of Materials, Modern Surveying, Construction Techniques, Building Drawing using CADD, Concrete

Technology, Building Estimating and valuation, Site Management, Design and detailing of RCC structures.

In this year of study, you shall be applying your previous years learning along with specialized field of study into projects and real-world applications.

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialized field of study and the cohort of students who have chosen to study that specialized field of study.

Guidelines for Cohort Owner

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The industry session shall be addressed by industry subject experts in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for any industrial visits.
7. Cohort owner shall maintain and document industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom sessions can augment or use supplementally teaching and learning opportunities including good quality online courses available on platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM , etc.

Course outcome: At the end of the semester students will be able to,

1. Interpret Built Environment and evaluate the need for efficient built environment to achieve Sustainable Development.
2. Asses the quality of water, waste water, solid waste as per BIS, WHO and interpret their relation to public health.

3. Analyze, design and optimize the components of Water Supply system, Waste water and Solid waste Management system.
4. Work with appropriate tools, software's and technology for the design, operation, maintenance and management of built Environment.

Week	CO	PO	Day	1st Session (9am to 1pm)	L	T	P	2nd Session (1.30pm to 4.30pm)	L	T	P
1	1,3	1,2	1	**Built Environment:** Introduction, need, types, public health and sustainable built environment. Sustainable Development Goal's (SDG's). Audio - Video Presentation. **Case Exercise:** 1.Conduct a Survey of nearby locality and prepare a report on: (A) Different types of Built Environment. (B) Prioritize types of built environment based on public health and justify. (Note: Conclusions and recommendations are must) References: SDG's: THE 17 GOALS | Sustainable Development (un.org)	1	1	2	**Water Supply system:** Need, Objectives Scenario on Water Deficits in India. Water and SDG's. Water supply schemes, Roles and Responsibilities of Engineers, Job Opportunities. Water measurement units and conversion. Simple problems on conversion of water quantities. **Case Exercise:** 2. Conduct a Survey of nearby locality and prepare a report on: (A) Existing water supply scheme and quantity of water supplying. (Note: Conclusions and recommendations are must) 3.Outline the highlights of JalaAmruth Water Supply Scheme-Karnataka. References: 1. Central Public Health and Environmental Engineering organization: Manual on Water Supply and Treatment - 1999:Central Public Health & Environmental Engineering Organization (CPHEEO), Govt of India	1		2
	1,3	1,2	2	**Sources of Water:** World water distribution, Natural and artificial Sources of water their availability, characteristics and Selection of sources, Uses of Water, Water supply key issues. THE RAINWATER (HARVESTING AND STORAGE) BILL, 2016 **Case Exercise:**	2		2	**Sizing-the challenge:** Water demand. • Components. • Factors affecting. • Fluctuations. Design period and design population, population forecasting methods, percapita demand, Demand forecasting and Design Capacities. Accurate population forecasting.	1		2

				4.Conduct a Survey of nearby locality to identify sources of fresh water. 5.Prepare a report on Rain water harvesting and Desalination. 6.Estimate the quantity of rain water can be harvested from building roof top. (Note: Conclusions and recommendations are must) References: 1.Desalination: IVRCL 2.Rainwater Harvesting: RWH starting page.pmd (iricen.gov.in)				**Case Exercise:** 7.Collect water demand and supply data of your district for a period of 10 years and analyse. 8. Identify the factors affecting the variation between the actual population and forecasted population. (Note: Conclusions and recommendations are must) References: 1. An Analysis of Demand and Supply of Water in India | Bhat | Journal of Environment and Earth Science (iiste.org)			
	2	2	3	Practice problems on population forecasting. **Case Exercise:** 9.Using population data of nearby locality find. (Specify the nature of locality) (A)Forecasted population. (B)Forecasted total demand. (C)Allocation of water for various demands as per codal provisions. (Note: Conclusions and recommendations are must)		1	3	**Conveyance from the source:** Collection of water from sources. Surface water Intake system, Intake Structures-Function and location criteria. Subsurface water intake system. Well interferences, well losses and Efficiency. **Case Exercise:** 10.Suggest a suitable intake structures for various types of surface water sources.	2		1
	3	1,3	4	**Water Conveyance:** **Pipes and conduits for water supply** Pipe materials and selection, Hydraulics of flow in pipes-Causes of pressure drop in pipe lines and remedial measures. Darcy-Weisbach equation in design of pipe lines.	1		3	Design of pipe lines, Losses in pipes and factors affecting losses. Laying, jointing and testing of pipes, appurtenances, Defects in pipes and remedial measures			3

	1,3	1,3	5	Developmental assessment: (Suggested assessment-200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Commitment. Followed by Q & A session on each presentation) Submission of week-1 case exercises.				Assessment Review and corrective action			3
	1,3	1,3	6	Industry class: Per capita demand and factors affecting it. Estimation of total quantity of water required for a town.		2	3	Industry assignment			
2	1,3	2,3	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		**Pumps**: Types and capacity of pumps, Energy efficient pumps, Selection of pumps, pumping stations, Booster pumping stations. **Case Exercise:** 11.Conduct a market survey and prepare a report on types of pipes, pipe fixtures and its applications and suitability. 12.Conduct a market survey and prepare a report on types of pumps available and its applications and suitability.	1		2
	1,2,4	4	2	**Water Storage:** Raw water storage, Treated water storage, Location, Geometrical design and Construction of storage Reservoirs. Practice problems on Reservoir capacity Estimation. **Case Exercise:**	1		3	**Water Sampling and Analysis:** Types, Sampling location, Sampling frequency, Sample collection, Automatic sampler, On spot analysis, Sample preservation, Analytical methods and Instrumental techniques, Data handling and reporting.	1		2

				13.Design the size of raw and treated water storage Reservoirs. (Note: Conclusions and recommendations are must)				Demonstrate Collection of Water Samples: Surface, Running and Ground water samples. (Collect sufficient amount of water for Physical, Chemical and biological examination.)			
	1,2,4	3,4	3	Physical, Chemical and biological examination of water. Preparation of standard chemical solutions required for physical and chemical analysis in the laboratory.			4	Analyse the collected water sample for Physical and Chemical parameters. **Physical Parameters:** Colour, Taste and Odour, pH, Turbidity, Total Dissolved solids. Reference: IS 10500 (2012): Drinking water (cgwb.gov.in) Compare the result with BIS and interpret the result. Virtual Lab: Virtual Labs (vlab.co.in)			3
	1,2,4	3,4	4	**Chemical Parameters:** Total Hardness, Calcium hardness, Magnesium Hardness, Chlorides, Nitrates, Fluoride, Sulphates, Iron, Residual chlorine and chlorine demand, Calcium, Acidity, Alkalinity and other relevant chemical parameters. Reference: IS 10500 (2012): Drinking water (cgwb.gov.in) Virtual Lab: Virtual Labs (vlab.co.in) Compare the result with BIS and interpret the result.			4	Continuation of chemical analysis… Virtual Lab: Virtual Labs (vlab.co.in) Compare the result with BIS and interpret the result.			3
	1,2,4	3,4	5	200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Capacity to Learn, Commitment. Followed by Q & A session on each presentation. Submission of week-2 case exercises.				Allocation of grades. Assessment Review and corrective action			3

	1,2,4	3,4	6	Industry Class-Biological analysis of water. Virtual lab: Virtual Labs (vlab.co.in)			5	Weekly industry assignment.			
3	1,2	2,3	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		**Water Treatment units:** **Screening and aeration:** Introduction, Selection, Application, Operation and Process control. **Sedimentation:** Introduction, Selection, Application, Design of sedimentation tank, Operation and Process control. Practice Problems on Sedimentation. Demonstrate relevant videos.	2		1
	1,2	2	2	**Coagulation and Flocculation:** Introduction, Selection, Application, Estimation of optimum dosage of coagulant, Operation and Process control. Practice Problems on Estimation of optimum dosage of coagulant. Demonstrate relevant videos.	1		3	**Filtration process:** Introduction, Filtration theory and principle and Selection criteria. • Slow sand filters. • Rapid sand filter. • Filter media and components. • Pressure filters. Demonstrate relevant videos.	2		1
	1,2,3	2,4	3	**Disinfection.** • Chlorination • Ozone and UV disinfection. • Advanced and alternate treatment systems. • Advanced oxidation processes and Membrane process. • Water softeners. • Sludge management. Practice problems on chlorine demand. **Case Exercise:**	2		2	**Design of Water Distribution network:** • Systems of Water distribution networks. • Methods of water supply. • Analysis of Water Distribution Networks. • Types of layouts and their suitability. Practice Problems on Pipe flow. **Case Exercise:**			3

				14. Suggest appropriate treatment for the water sample if needed. (Refer Data from Week 2,Day 4)				15. For a selected locality Suggest a suitable water supply system and design water distribution network.			
	1,3,4	5,7	4	• Water Losses in the Water Distribution System. • Water balance for water loss Assessment and performance Indicators. • Water loss Detection and control. • Continuous (24/7) water supply systems. Case study on 24/7 water supply system:Karnataka: Three Towns Pilot 24/7 Water Supply (worldbank.org) Practice problems on water audit and water loss Estimation.	2		2	Software for water distribution networks design and analysis (Hydraulic Simulation) • Necessity of Hydraulic Simulation • Challenges of Hydraulic simulation Demonstrate EPANET/ WaterGEMS/LOOP4/FLOW and other software's.			3
	1,3,4		5	CIE 1– Written and practice test Submission of week-3 case exercise reports.				Assessment Review and corrective action			3
	1,2,4	2	6	Industry class-Importance of water quality analysis and monitoring. Possible outbreaks of waterborne and induced diseases.			5	Industry weekly assignment			
4	4	4,7	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		Get familiar with the commands and step by step procedure. (Assumed data) • Project Set up. • Drawing the network. • Setting the properties of the object in the model. • Save the project.			3
	4	4,7	2	**Smart water Supply and monitoring system:**	2		2		1		2

				Need, Concept, Objectives. • Automation in Water supply systems and case study.				• Modern smart water systems: IoT and Sensing devices. • Smart water metering and monitoring systems.			
	1,4	4,7	3	• SCADA in water supply network monitoring: Concept, HMI. Case study on SCADA: Study tour Navi Mumbai Nagpur for 24x7 SCADA 16 Aug 2013.pdf (pas.org.in) **Case Exercise:** 16. Comparative analysis of conventional and smart water management.	2		2	Economics of water supply systems. Capital and Operational cost of water supply system, Water Pricing. Case study and Practice problems on water pricing. Water reuse for multipurpose usages (3R concept) with different modes and strategies.			3
	2,3	2	4	Field Visit to Water Treatment Plant and distribution network system.			4	Field Visit to Water Treatment Plant and distribution network system.			3
	2		5	200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Capacity to Learn, Commitment. Followed by Q & A session on each presentation. Submission of week-4 case exercises.				Assessment Review and corrective action			3
	4	4,7	6	Industry class: Software's for water distribution network design. Smart water supply and monitoring system.	3		2	Weekly Assignment			
5	1	1,5	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		**Waste Water Management System:** Need, Waste water impact on environment and ecosystem, SDG's and	1		2

								Waste water. Wastewater treatment new directions and concerns. Job opportunity, Role of Engineer. Audio Video presentation on • Need of waste water management system. • Waste water treatment process. Reference: CPHEEO Manual Manual on Sewerage and Sewage Treatment Systems - 2013:Central Public Health & Environmental Engineering Organisation (CPHEEO), Govt of India			
	1,3	1,2	2	**Introduction:** Technical Terms used, Sources of waste water generation, Types of waste water. **Case Exercise:** 17.Visit nearby locality to identify and prepare a report on. • Sources and types of waste water and their characteristics. • Waste water management system. (Note: Conclusions and recommendations are must)	2		2	**Sewer appurtenances:** • Types • Suitability • Location. • Materials. • Construction. **Case Exercise:** 18. For a residential building Suggest suitable type of sewer appurtenances required and specify location.	2		1
	1,3	3	3	**Design and construction of sewers:** Estimation of quantity of sewage, Population forecast, Design period, Per capita sewage generation, Appropriate peak factor. **Case Exercise:** 19. Estimate quantity of sewage generated for a selected locality.	2		2	**Hydraulics of sewers:** Depth of flow, Variability of flow, limiting velocity, Self-cleansing and Maximum velocities of sewer. Determination of velocity and discharge. Simple problems on design of sewers. **Case Exercise:**	2		1

								20. Design a sewer for a selected nearest ongoing project.			
	1,3	2	4	**Surface and storm water drainage**: Determination of Storm Water Flow, Run-Off Co-Efficient, Time of Concentration, Empirical Formulae for Run-Off. Problems on Design of Storm Water Sewers Systems. **Case Exercise:** 21. Estimate quantity of storm water run-off flow for a selected locality and design storm water sewer.	1		3	**Collection, Conveyance, Treatment and Disposal of waste water.** **Sewerage system:** • Types: Separate, Combined and Partially Separate Systems. • Working principle. • Suitability • Types of sewers. Method of Conveyance: Gravity, Low Pressure and Vacuum. **Case Exercise:** 22.Suggest suitable type of sewerage system and sewers for a selected locality. Reference: (1007) Wastewater Collection | Method of conveyance - YouTube			3
	1,3		5	CIE 2– Written and practice test Submission of week-5 case exercise reports.				Assessment Review and corrective action			3
	1,3	2	6	Industry class-Repairs and maintenance of sewerage systems.	3		2	Industry weekly assignment			
6	2,5	4	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		**Waste water characteristics:** Physical, Chemical and Biological characteristics. Source specific wastewater characteristics. • Sampling technique. • Sample preservation • Analytical methods and Instrumental techniques • Data handling and reporting.	2		1

								Collect and Read IS code for waste water analysis. Demonstrate Collection of waste Water Samples.			
	2,5	4	2	Preparation of standard chemical solutions required for physical and chemical analysis in the laboratory.	1		3	Analyse the collected wastewater sample for Physical and Chemical parameters. **Analysis of physical Parameters:** Colour, Temperature and Odour, pH, Turbidity, Total solids, Suspended Solids, Dissolved Solids, volatile solids, fixed solids, Settleable Solids. Virtual Lab: Virtual Labs (vlab.co.in) Compare the result with BIS and interpret the result.	1		2
	3	4	3	**Analysis of Chemical Parameters:** Chlorides, Nitrogen, phosphorus, Acidity, Alkalinity, Residual chlorine and chlorine demand, DO, COD, BOD and other relevant chemical parameters. Reference: Virtual Lab: Virtual Labs (vlab.co.in) Compare the result with BIS and interpret the result.	1		3	Continuation of Chemical Analysis of waste water. Virtual Lab: Virtual Labs (vlab.co.in)	1		2
	1,3	4	4	Continuation of Chemical Analysis of waste water. Virtual Lab: Virtual Labs (vlab.co.in)	1		3	**Wastewater treatment:** Objectives, Unit Operations and Processes, Selection of treatment processes, Onsite sanitation, grey water harvesting. Reference: LIQUID WASTE MANAGEMENT SYSTEMS IN RURAL TAMIL NADU (swachhbharatmission.gov.in)	2		1

	1,3		5	200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Capacity to Learn, Commitment. Followed by Q & A session on each presentation. Submission of week-6 case exercise reports.				Assessment Review and corrective action			3
	1,3	2	6	Maintenance of sewers, safety precautions and Hazards. Wastewater pumping.	2		3	Industry weekly assignment			
7	1,3	2	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		**Primary treatment of Sewage:** Principles, functions and design of sewage treatment units-screens, grit chamber, Skimming tank, Sedimentation tanks. Construction, Operation and Maintenance aspects.	2		1
	3	2	2	**Secondary treatment of sewage:** Objectives, Selection of Treatment Methods, Principles, Functions. (i)Activated sludge process: Conventional, completely mixed, extended aeration. (ii)Aerobic attached growth system: Trickling filters, Rotating biological contactor, waste stabilization pond.	3		1	Anaerobic Treatment. Sludge treatment and disposal: Objectives, Sludge characterization, Thickening, Sludge digestion, Biogas recovery, Sludge Conditioning and Dewatering, Sludge drying beds, ultimate residue disposal.	2		1
	3		3	**Tertiary treatment:** Sand and activated carbon filter and chlorination. Explore reuse of tertiary treated waste water. **Case Exercise:**	2		2	**Effluent Disposal:** Dilution, Self-purification of streams, factors affecting self-purification. Disposal in Sea water, Disposal on Lands. Recycle of wastewater. **Case exercise:**	2		1

				23.Estimate quantity of fresh water consumption can be reduced by reusing treated waste water.				24.Identify the disposal method/system of treated wastewater in your locality.			
	3	5	4	**Rural Sanitation:** Low-cost treatment process, working principle and geometric design of septic tank for small communities in rural and urban areas, two pit latrines, eco-toilet and soak pits.	2		2	Continuation. Case exercise: Explore innovative methods of converting waste to beneficial.	1		2
	3		5	CIE 3– Written and practice test Submission of week-7 case exercise reports.				Assessment Review and corrective action			3
	1,3	2	6	Operation and maintenance of wastewater treatment plant.	3		2	Industry weekly assignment			
8	4	4,7	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics)		4		Application of SCADA in waste water treatment.	2		1
	4	3	2	**Project 1**							7
	3,4	3	3	**Water supply and waste water Management Project.**							7
	3,4	3	4	1.Examination of sources of water supply and water quality analysis. 2.Calculation of quantity of water required based on existing and future projected population for a village. 3.Preparation of village map and location of sites for ground level 4.Longitudinal section along proposed pipe line. 5.Block levelling for overhead tanks 6.Underground drainage system surveys for laying the sewers. 7. Block levelling for Water Treatment plant. **Drawings to be prepared** 1.Plan of water supply line, sewer lines in village map 2.L/S of water supply and sewer lines							7

				3.Block levelling placing overhead tanks 4.Block levelling Placing WTP Instructions: 1. At least one of the above should be done by using TOTAL STATION 2. The **Project-1** Report should be attached with field book, calculation sheets, all plans/drawings, estimates of earth work and structure in spread sheet and should be submitted in the form of Hardcopy and softcopy.							
	3,4		5	200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Capacity to Learn, Commitment. Followed by Q & A session on each presentation. Submission of week-8 case exercise reports.				Assessment Review and corrective action			3
	1,3	2	6	Wastewater Treatment Plant Visit			5	Industry weekly assignment			
9	1	5	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics) **Review progress of Project-1**		4		**Solid Waste Management System:** Introduction, Need, Impact, early waste disposal. Solid waste Management Hierarchy. Video demonstration on 1.Impact of solid waste. 2.Solid waste management system. Reference: Solid Waste Management Rules 2016 — Vikaspedia	1		2
	3	5	2	Sources, Classification, Characteristics and composition of solid waste. **Case Exercise:** 23. Identify types and sources of waste generation in your locality/Institution. (Note: Conclusions and recommendations are must) Reference: Swachh Bharat Mission - Gramin, Ministry of Drinking Water and Sanitation	2		2	Factors affecting waste generation. Units of quantity measurement and method of Quantity estimation. (Note: Conclusions and recommendations are must) **Case Exercise:** 24. Estimate the quantity of solid waste generated at your institution based on	1		2

				CPHEEO Manual on Muncipal solid waste management: Part1(1).pdf (cpheeo.gov.in)				their characteristics and composition separately.			
	4	3	3	• Separation and reduction of solid waste at source. • Storage: Selection and function of containers. • Collection: Frequency of collection, Factors affecting collection, Segregated collection, collection methods. **Case Exercise:** 25. Prepare presentation on the method of solid waste storage facility provided at your institution and present. Suggest suitable storage facility if not available. (Note: Conclusions and recommendations are must)	2		2	• Collection routes. • Tools and equipment's. • Designing collection system: 1. Determining number of vehicles 2. Determining vehicles time on the route 3. Routing **Case Exercise:** 26. Identify the suitable vehicle to transport solid waste from source to transfer station based on the quantity estimated for a selected location. (Note: Conclusions and recommendations are must)	2		1
	3,4	2	4	Transfer and Transport: Need for transfer operation, Transportation vehicle with their capacity working. **Case Exercise:** 27. Collect the relevant technical and commercial information about tools used for collection of solid waste.	1		3	Solid waste generation rate. Material mass balance. Transfer stations: Meaning, Function, necessity, location, types. Case study: 1487853226A Case Study on Municipal Solid Waste Management in Solapur.pdf (assam.gov.in)	2		1
	3,4		5	CIE 4 – Written and practice test Submission of week-9 case exercise reports.				Assessment Review and corrective action			3
	4	3	6	Design of a new waste Collection system and collection route optimization.	1		4	Industry weekly assignment			
10	3	2	1	**PEER REVIEW:** Focused group discussion on industry class.		4		**Processing of municipal solid waste:**	1		2

				(Faculty shall evaluate student's performance using rubrics) **Review progress of Project-1**				Purpose, Methods and waste minimization, recovery, recycle and reuse (3R) of materials from solid waste, volume and size reduction, biological processing. **Case Exercise:** 28. Prepare a report on the common types of materials recovered from MSW.			
	3	2	2	**Treatment methodologies:** Various Methods of waste treatment. Biological Treatment (waste to wealth): Aerobic and anaerobic process, principle methods of aerobic composting. Factors affecting. Demonstrate Techniques of Composting: Windrow composting, aerated static pile composting, Horizontal reactor, Mechanical/in vessel system, agitated bin system, backyard composting. Case Exercise: Analyse and select suitable composting technique for treating solid waste generated at your institution (Project-2).	1		3	Visit to nearby composting unit and Understand • Estimation of degradable solid waste. • Design of composting pit • Processing of degradable solid waste. • Operation and maintenance.			3
	3,4	3	3	**Project-2 At the end of 13th week there shall be a waste to wealth/waste to energy system executed.**							7
	3,4	3	4	1.Estimation of waste quantity. 2.Design of the system. 3.Preparation of project-2 schedule (Project duration is two weeks) 4.Preapration of drawings in CADD, BOM, BOQ and Cost estimation. 5.Use reclaimed material for construction. 6.Initiation project.							7

	3,4		5	200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Capacity to Learn, Commitment. Followed by Q & A session on each presentation. Submission of week-10 case exercise reports.				Assessment Review and corrective action			3
	4	4	6	Measures to minimise production of waste at source. Importance of 3R concept in achieving sustainability.			5	Industry weekly assignment			
11	3	3	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics) **Review progress of Project-1 and Project-2**		4		Thermal Treatment (waste to energy) : Need and comparison with other methods. 1. Incineration: About process, types of incinerators, Design Consideration, products of incinerator process with their use. **Case Exercise:** 29. Prepare a PPT and Present the working principle and process of Biomethanation and Refused derived fuel (RDF).	1		2
	3	3	2	2.Pyrolysis: About process, products of pyrolysis process, advantages and disadvantages. Case Exercise: Prepare a report on the impact of thermal treatment on environment. Ultimate disposal: Land filling: Concept, necessity, Problems associated, Siting considerations, stages of landfill, Landfill types.	1		3	Land filling method and operation-Area method, Trench method and ramp method. Composition, characteristics, generation, movement and control of landfill gas. Composition, formation, movement and control of leachate in landfills. Layout and preliminary design of landfills, landfill closure and final cover	2		1

	3	2	3	**Biomedical waste management:** Introduction, sources and generation, classification, Issues, Management technologies. Collect and read: Bio medical waste management rules 2016.	1		3	**Industrial waste management:** Introduction, varieties of industrial waste, issues, control measures for industrial waste, Recycling of industrial waste.	1		2
	3	2	4	**E-Waste Management:** Introduction, Verities of E-waste, Dangers of E-waste, Recycling of E-waste, Disposal of E-waste. Collect and read: E-waste management rules 2016.	1		3	**Construction and demolition waste:** Introduction, origin, major components, issues, Onsite management, Processing and recovery, markets for C & D waste, landfill disposal. Collect and read: construction and demolition waste management rules 2016.	1		2
	3	2	5	CIE 5– Written and practice test **Review progress of Project-1 and Project-2**				Assessment Review and corrective action			3
			6	Present scenario, Legal aspects, Rules, regulations and guidelines for various waste management.	2		3	Industry weekly assignment			
12	1,3	2	1	**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics) **Review progress of Project-1 and Project-2**		4		Agricultural waste: Introduction, source, Effects, management, creating wealth from agricultural waste, disposal, Reference for creating wealth from agricultural waste: Creating-Wealth-From-Agricultural-Waste.pdf (icar.org.in)	1		2

	1,3	2,7	2	Health aspects during handling and processing. Health problems during times of segregation, recovery, recycling and reuse of solid waste. Public involvement and community participation: Strategy to community participation.	1		3	System of waste management to be adopted, measures to be taken to bring about a change in public behaviour, enforcement Reference CPHEEO chapter: Chapter XVIII - Community Participation.PDF (cpheeo.gov.in)			3
	1,3	2	3	Site visit to waste segregation and processing unit/Incineration plant/pyrolysis/ Landfill area to visualize the waste processing and disposal technique			4	Site visit to waste segregation and processing unit/Incineration plant/pyrolysis/ Landfill area to visualize the waste processing and disposal technique			3
	1,3	5	4	Conduct a public awareness program on Water, waste water and Solid waste management system.			4	Conduct a public awareness program on Water, waste water and Solid waste management system.			3
	1,3		5	200 second presentations, as video. Lecturers evaluate on Communication, Comprehension, Capacity to Learn, Commitment. Followed by Q & A session on each presentation.				Assessment Review and corrective action			
	1,3	5	6	Waste to energy: Power generation, energy recovery, blending with construction materials, governmental, non-governmental activities and roles under solid waste management.			5	Industry weekly assignment			
13				**PEER REVIEW:** Focused group discussion on industry class. (Faculty shall evaluate student's performance using rubrics) **Review progress of Project-1 and Project-2**				**Project** **g) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or**			

				Internship **g) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **h) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.** **Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.**				**as identified by the student. Document the impact the project will have from a technical, social and business perspective.** **h) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.** **Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**			

CIE 6– Comprehensive assessment based on mini project (Only practice)- Day 6

CIE and SEE Assessment Methodologies

CIE Assessment	**Assessment Mode**	**Duration** In hours	**Max Marks**
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 8	CIE 3– Written and practice test	4	30
Week 10	CIE 4– Written and practice test	4	30
Week 12	CIE 5– Written and practice test	4	30
Week 13	Assessment for Project or Internship	4	30
On line Course work (At least one related to the specialization)			30

Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *		30
TOTAL CIE MARKS (A)		**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hour duration reduced to 60 marks	**3**	**60**
SEE 2 – Practical	**3**	**100**
TOTAL SEE MARKS (B)		**160**
TOTAL MARKS (A+B)		**400**

***** The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Scheme of Evaluation for CIE 6

Sl No	Description	Marks
1	Project report	10
2	Project presentation	10
3	Viva voce	10
Total		**30**

Scheme of Evaluation for SEE 2

Sl. No	Description	Marks
1	Case submission	20
2	Case presentation	20
3	Case innovation	20
4	Result	20
5	Viva voce	20
Total		**100**

Case Submission / Content Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Identification of the main issues / problem	**Identifies and understands all the main issues in the problem statement**	Identifies and understands most of the main issues in the problem statement	Identifies and understands some of the issues in the problem statement	Identifies and understands a few of the issues in the problem statement	Identifies limited issues in the problem statement	5
Analysis of the issues	Insightful and thorough analysis of all the issues	**Thorough analysis of most of the issues**	Superficial analysis of some of the issues in the problem statement	Incomplete analysis of the issues	No analysis of the issue	4
Comments on effective solutions / strategies (The solution may be in the problem statement already or proposed by you)	Well documented, reasoned and pedagogically appropriate comments on solutions, or proposals for solutions, to all issues in the problem statement	Appropriate, well thought out comments about solutions, or proposals for solutions, to most of the issues in the problem statement	Superficial and / or inappropriate solutions to some of the issues in the problem statement	**Little and/or inappropriate solutions to all of the issues in the problem statement**	No action to all issues in the problem statement	2

Links to course learning and additional research	Excellent research into the issues with clearly documented links to course learnings and beyond.	Good research and documented links to the materials read during the course	**Limited research and documented links to any readings**	Incomplete research and links to any reading.	No research or links to any reading	3
Total						**14/20**

Case Presentation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Delivery & Enthusiasm	Very clear and concise flow of ideas Demonstrates passionate interest in the topic and engagement with class / examiner	**Clear flow of ideas Demonstrates interest in the topic and engagement with class / examiner**	Most ideas flow but is lost at times Limited evidence of interest in and engagement with the topic	Hard to follow the flow of ideas Lack of enthusiasm and interest	No flow in the presentation Poor presentation skills	**4**
Visuals	Visuals augmented and extended comprehension of the issues in unique ways	Use of visuals related to the topic	Limited use of visuals loosely related to the topic	**No use of visuals**	Poor visuals used and some visuals are not easy to understand its relevance.	**2**
Staging	**Uses stage effects such as props, sound effects, and speech modulation in a unique and dramatic manner that enhances the understanding of the issues in the problem statement.**	Uses stage effects such as props, sound effects, and speech modulation in an effective manner to extend the understanding of the issues in the problem statement.	Limited use of stage effects and/or used in a manner that did not enhance the understanding of the issues in the problem statement.	No use of stage effects	Poor stage effects usage	**5**

Involvement of the class / Examiners • **Questions** • **Discussions** • **Activities**	Excellent and salient discussion points that elucidated material to develop a deep understanding Appropriate and imaginative activities used to extend understanding in a creative manner	Questions and discussions addressed important information that developed understanding Appropriate activities used to clarify understanding	Questions and discussions addressed important superficial issues of the problem statement Limited use of activities to clarify understanding	Little or no attempt to engage the class / examiner in demonstrating their learning	**Did not engage the class / examiner and poor listening skills**	**1**
Total						**12/20**

Case Results Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Problem outcome	The topic was well researched and all information and data included are accurate and from reliable sources of information like high impact journals standards, etc. The proof was enough backed up with accurate data, analysis and reasoning beyond the class learning. Outcome achieved beyond the problem brief	**The topic was researched and most information and data were from reliable sources of information. The proof was backed up with good data and reasoning as taught in the class. Outcome achieved as per the problem brief**	The topic was researched but information and data were only partly from reliable sources of information. The proof was not fully backed up with good data or reasoning as taught in the class. Partial outcome achieved as per the problem brief	The topic was researched and data were not from reliable sources. The proof was not backed up with data, analysis or reasoning as taught in the class. Some outcome obtained as per the problem brief	Desired results not obtained, but some relevant research was done. Outcome not obtained as per the problem brief	**4**
Application of class learning in problem solving	Made effective use of class principles, models and theories. Also used creativity to find effective results appropriate to industry beyond class learning.	Made good use of class principles, models and theories Some creative ideas were explored to find desired outcome but within the framework of class learning	**Made some use of class principles, models and theories No creative ideas or models explored**	Made limited use of class principles, models and theories	Poorly applied class principals, models and theories	**3**

Response to Class / Examiners Queries	Queries Excellent response to comments and discussion with appropriate content supported by theory/research	Good response to questions and discussions with some connection made to theory/research	Satisfactory response to questions and discussions with limited reference to theory/research	**Limited response to questions and discussions with no reference to theory/research**	Poor or no response to questions and did not participate in the discussions.	**2**
Conclusions	Provides detailed and appropriate conclusion for the problem statement	**Provides appropriate conclusion for the problem statement**	Provides adequate and mostly appropriate conclusions for the problem statement	Provides limited and somewhat appropriate conclusions for the problem statement	Has not provided appropriate conclusions for the problem statement.	**4**
Total						**13/20**

Case Innovation Evaluation Rubrics

Evaluation Parameters	5	4	3	2	1	Student Score
Finding new processes / models / approaches	**The newly discovered processes / models / approaches are of good quality and relevant**	The newly discovered processes / models / approaches are of appropriate quality but limited relevance	The newly discovered processes / models / approaches have limited application but relevant to the problem	The newly discovered processes / models / approaches has restricted application	No new processes / models / approaches were identified	**5**
Proposing ideas and innovative solutions in terms of processes / models / approaches and how they can be applied to solve the problem on hand	Various ideas and innovative solutions have been proposed and their application have been clearly outlined	Various ideas and innovative solutions have been proposed as well as the outline of the process to apply them	**Some ideas or innovative solutions have been proposed but the process of applying them hasn't been specified**	Few ideas have been proposed	No ideas or innovative solutions have been proposed	**3**
Using creativity techniques to provide and reason good ideas which are original and unconventional	Wherever necessary creativity techniques are utilized to analyse and solve the problem	Creativity techniques are frequently utilized in more than 50% of the occasions	Creativity techniques are utilized at times in less than 50% of the occasions	**Creativity techniques are used a few times only**	Creativity technique are not utilized to analyse and solve the problem	**2**
Finding constraints and weak points in existing	Constraints and weak points are understood	Constraints and weak are identified	**A critical analysis is undertaken**	Only a description of the working process and	No constraints or weak points have	**3**

processes / models / approaches or methods				methods are provided	been identified.	
Total						**13/20**

Assessment framework for CIE (1 to 5)

Note : Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Programme	**Civil Engineering**	**Semester**	**V**
Course	**Built Environment**	**Max Marks**	**30**
Course Code		**Duration**	**4 hours**
Name of the course coordinator			

Note: Answer one full question from each section.

Qn.No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
Section-1 (Theory) – 10 marks					
1.a)					
b)					
2.a)					
b)					
c)					
Section-2 (Practical) - 20 marks					
3)					
4)					

Assessment framework for SEE 1 (Theory) – 100 Marks / 3 hours (Reduced to 60 marks)

Programme : Civil Engineering	**Semester: Vth**
Course : Built Environment	**Max Marks : 100**
Course Code :20CE54I	**Duration : 3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL	CO	Marks
	Section-1			
1.a)			1	
b)				
2.a)				
b)				
	Section-2			
3.a)			2	
b)				
4.a)				
b)				
	Section- 3			
5.a)			3	
b)				
6.a)				
b)				
	Section-4			
7.a)			4	
b)				
8.a)				
b)				
	Section-5			

9.a)			5	
b)				
10.a)				
b)				

References:

1. Fair, G.M., Geyer J.C and Okun, (1969) "Water and Wastewater Engineering" Vol II, John Wiley Publications.
2. Weber W.J., (1975) "Physico - Chemical Processes for Water Quality Control".
3. AWWA, (1971), "Water Quality and Treatment "McGraw Hill.
4. CPHEEO Manual, (1991), "Water Supply and Treatment", GOIPublications, New Delhi.
5. Tchobanoglous G., Theissen H., and Eliassen R.(1991), "Solid Waste Engineering Principles and Management Issues", McGraw Hill, New York.
6. Peavy, Rowe and Tchobanoglous (1985), "Environmental Engineering", McGraw Hill Co. 4th Edition
7. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.
8. Integrated Solid Waste Management - Engineering Principles and Management Issues, Tchobanoglous/Theisen/Vigil, McGraw Hill (1993)
9. Mantell C.L., (1975), "Solid Waste Management", John Wiley.
10. Wastewater Engineering (2013) by Metcalf and Eddy; Publisher - McGraw-Hill
11. Environmental Engineering (2015) by Peavy, Rowe and Tchobanoglous; Publisher - McGraw-Hill
12. Water Quality Engineering: Physical / Chemical Treatment Processes (2013) by Lawler and Benjamin; Publisher - John Wiley & Sons
13. Industrial Wastewater Treatment, Recycling and Reuse (2014) by Bhandari and Ranade; Publisher - Elsevier
14. Unit Operations and Processes in Environmental Engineering (1996) by Reynolds and Richards Publisher - CL Engineering
15. Manual on Sewerage and Sewage Treatment (2013), Publisher - CPHEEO (MoUD) Additional reference material will be provided by the course instructor
16. Peavy, Rowe and Tchobanoglous (1985), "Environmental Engineering", McGraw Hill Co. 4th Edition
17. Waste Treatment and Disposal 2nd edition Paul T Williams, Wiley, 2005
18. Mantell C.L., (1975), "Solid Waste Management", John Wiley
19. Visit websites of:

    - Rural Drinking water and Sanitation Department: Drinking Water – RDWSD Karnataka (swachhamevajayate.org)
    - Karnataka Urban Water Supply and Drainage Board: ಕುಉಸ್ಡಬ – Karnataka Urban Water Supply and Drainage Board (kuwsdb.org)
    - Bangalore Water Supply and Sewerage Board: Home - Bangalore Water Supply and Sewerage Board (karnataka.gov.in)