

## Maharashtra State Board Of Technical Education, Mumbai

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

Programme Name : Diploma In Civil Engineering / Civil & Rural Engineering / Construction Technology / Civil & Environmental Engineering

Programme Code : CE / CR / CS / LE With Effect From Academic Year : 2023-24

Duration Of Programme : 6 Semester Duration : 12 Weeks (Industry) + 10 Weeks (Institute)

Semester : Fifth NCrF Entry Level : 4.0 Scheme : K

Sr No	Course Title	Abbreviation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week			Theory	Based on LL & TL				Based on Self Learning					
						CL	TL	LL						FA-TH	SA-TH	Practical		SLA					
																Max	Min	Max	Min	Max	Min		
<b>(All Compulsory)</b>																							
1	THEORY OF STRUCTURE	TOS	DSC	315313	-	6	-	-	3	9	3	4	30	70	100	40	-	-	-	-	25	10	125
2	WATER RESOURCE ENGINEERING	WRE	DSC	315314	1	4	-	2	-	6	2	3	30	70	100	40	50	20	25@	10	-	-	175
3	EMERGING TRENDS IN CIVIL ENGINEERING	ETC	DSC	315315	-	3	-	-	-	3	1	1.5	30	70*#	100	40	-	-	-	-	-	-	100
4	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	ENDS	AEC	315002	-	1	-	2	-	3	1	-	-	-	-	50	20	25@	10	-	-	75	
5	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	315003	-	-	-	1	2	3	1	-	-	-	-	25	10	25@	10	25	10	75	
6	INTERNSHIP(12 WEEKS)	ITR	INP	315004	-	-	-	-	-	36 - 40	10	-	-	-	-	100	40	100#	40	-	-	200	
<b>ELECTIVE COURSE- I (Any - One )</b>																							
7	ENERGY CONSERVATION & GREEN BUILDING	ECG	DSE	315316	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
	PRECAST & PRESTRESSED CONCRETE STRUCTURES	PPC	DSE	315317	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
	ROAD TRAFFIC ENGINEERING	TEN	DSE	315318	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
<b>Total</b>					<b>1</b>	<b>18</b>		<b>7</b>	<b>5</b>		<b>20</b>		<b>120</b>	<b>280</b>	<b>400</b>		<b>250</b>	<b>200</b>		<b>50</b>		<b>900</b>	

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

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

**Note :**

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
- If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
- Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
- 1 credit is equivalent to 30 Notional hrs.
- \* Self learning hours shall not be reflected in the Time Table.
- \* Self learning includes micro project / assignment / other activities.

**Note:** Notional learning hours for **internship represents the student engagement hours.**

**Course Category :** Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , Ability Enhancement Course (AEC) , Skill Enhancement Course (SEC) , Generic Elective (GE)

<b>Programme Name/s</b>	<b>: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil &amp; Rural Engineering/ Construction Technology/ Computer Science &amp; Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics &amp; Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics &amp; Communication Engg./ Electronics Engineering/ Computer Hardware &amp; Maintenance/ Industrial Electronics/ Information Technology/ Computer Science &amp; Information Technology/ Civil &amp; Environmental Engineering/ Computer Science/ Electronics &amp; Computer Engg.</b>
<b>Programme Code</b>	<b>: AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ SE/ TE</b>
<b>Semester</b>	<b>: Fifth</b>
<b>Course Title</b>	<b>: ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS</b>
<b>Course Code</b>	<b>: 315002</b>

### I. RATIONALE

Entrepreneurship and Startups are introduced in this curriculum to develop the entrepreneurial traits among the students before they enter into professional life. Exposing and interacting with entrepreneurship and startup eco-system, students will develop entrepreneurial mind set. The innovative thinking with risk-taking ability along with other traits will be inculcated in the students through micro-projects and training. This exposure will be instrumental in orienting the students in transforming them to become job generators after completion of Diploma in Engineering.

### II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop project proposals for launching small scale enterprises and starts up.

### III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify one's entrepreneurial traits.
- CO2 - Use information collected from stakeholder for establishing/setting up/founding starts up
- CO3 - Use support systems available for Starts up
- CO4 - Prepare project plans to manage the enterprise effectively

### IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SL	LH			Theory	Based on LL & TL				Based on SL					
				CL	TL	LL						Practical				SLA					
				Max	Max	Max	Min	Max			Min	Max	Min	Max	Min						
315002	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	ENDS	AEC	1	-	2	-	3	1	-	-	-	-	-	50	20	25@	10	-	-	75

**Total IKS Hrs for Sem. : Hrs**

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

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

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

**V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare advantages and disadvantages of Entrepreneurship TLO 1.2 Identify entrepreneurial traits through self-analysis TLO 1.3 Compare risk associated with different type of enterprise	<b>Unit - I Introduction to Entrepreneurship Development</b> 1.1 Entrepreneurship as a career – charms, advantages, disadvantages , scope- local and global 1.2 Traits of successful entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking, learning from failure 1.3 Types of enterprises and their features : manufacturing, service and trading	Presentations Lecture Using Chalk-Board
2	TLO 2.1 Explain Important factors essential for selection of product/service and selection of process TLO 2.2 Suggest suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. TLO 2.3 Suggest steps for the selection process of an enterprise for the specified product or service with justification. TLO 2.4 Plan a market study /survey for the specified enterprise	<b>Unit - II Startup Selection Process</b> 2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Instries Commission[KVIC]	Presentations Lecture Using Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	<p>TLO 3.1 Explain categorization of MSME on the basis of turnover and investment</p> <p>TLO 3.2 Describe support system provided by central and state government agencies</p> <p>TLO 3.3 State various schemes of government agencies for promotion of entrepreneurship</p> <p>TLO 3.4 Describe help provided by the non governmental agencies for the specified product/service</p> <p>TLO 3.5 Compute breakeven point, ROI and ROS for the specified business enterprise, stating the assumptions made</p>	<p><b>Unit - III Support System for Startup</b></p> <p>3.1 Categorization of MSME, ancillary industries</p> <p>3.2 Support systems- government agencies: MCED, NI MSME, PMEGP, DI, KVIC</p> <p>3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance.</p> <p>3.4 Breakeven point, return on investment (ROI) and return on sales (ROS).</p>	<p>Presentations</p> <p>Lecture Using Chalk-Board</p>
4	<p>TLO 4.1 Explain key elements for the given business plan with respect to their purpose/size</p> <p>TLO 4.2 Justify USP of the given product/ service from marketing point of view.</p> <p>TLO 4.3 Formulate business policy for the given product/service.</p> <p>TLO 4.4 Choose relevant negotiation techniques for the given product/ service with justification</p> <p>TLO 4.5 Identify risks that you may encounter for the given type of business/enterprise with justification.</p> <p>TLO 4.6 Describe role of the incubation centre and accelerators for the given product/service.</p>	<p><b>Unit - IV Managing Enterprise</b></p> <p>4.1 Techno commercial Feasibility study, feasibility report preparation and evaluation criteria</p> <p>4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project</p> <p>4.3 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan.</p> <p>4.4 Preparing strategies of handling business: policy making, negotiation and bargaining techniques</p> <p>4.5 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, definition of startup cycle, ecosystem, angel investors, venture capitalist</p> <p>4.6 Incubation centers and accelerators : Role and procedure</p>	<p>Presentations</p> <p>Lecture Using Chalk-Board</p>

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Collect information of successful entrepreneurial traits	1	*Preparation of report on entrepreneurship as	2	CO1
LLO 2.1 Identify different traits as an entrepreneur from various field LLO 2.2 Suggest different traits from identified problem	2	Case study on 'Traits of Entrepreneur'	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Explore probable risks for identified enterprise.	3	*Case study on 'Risks associated with enterprise	2	CO1
LLO 4.1 Identify new product for development LLO 4.2 Prepare a newly developed product	4	*Preparation of report on 'Development of new Product	2	CO1 CO2
LLO 5.1 Identify Process for development of product for new startup	5	Preparation of Report on ' Process selection 'for new startup	2	CO1 CO2 CO3
LLO 6.1 Develop questioner for market survey	6	*Market survey for setting up new Start up	2	CO2 CO3
LLO 7.1 Interpret the use of Technology Life Cycle	7	A Case study on ' Technology life cycle' of any successful entrepreneur.	2	CO3
LLO 8.1 Use information related to support of startups from Government and non-government agencies' LLO 8.2 Prepare report for setting up startup	8	*Preparation of report on 'Information for setting up new startup' from MCED/MSME/KVIC etc	2	CO3 CO4
LLO 9.1 Compute ROI of successful enterprise.	9	Case study on 'Return on Investment (ROI)' of any successful startup	2	CO3
LLO 10.1 Calculate of ROS of any successful enterprise	10	Case study on 'Return on sales (ROS)' of any successful startup	2	CO3
LLO 11.1 Calculate Brake even point of any enterprise	11	Preparation of report on 'Brake even point calculation' of any enterprise.	2	CO3 CO4
LLO 12.1 Prepare feasibility report of given business	12	*Preparation of report on 'feasibility of any Techno-commercial business"	2	CO4
LLO 13.1 Plan a USP of any enterprise.	13	*A case study based on 'Unique selling Proposition (USP) of any successful enterprise	2	CO4
LLO 14.1 Prepare a project report using facilities of Atal Incubation center.	14	*Prepare project report for starting new startup using 'Atal incubation center (AIC)	2	CO1 CO2 CO3 CO4

**Note : Out of above suggestive LLOs -**

- '\*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

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

- Prepare a 'Pitch- desk' for your start up
- Prepare a business plan for a. Market research b. Advertisement agency c. Placement Agency d. Repair and Maintenance agency e. Tour and Travel agency
- Prepare a 'Social entrepreneurship business plan, plan for CSR funding.
- Prepare a ' Women entrepreneurship business plan ' Choose relevant government scheme for the product/service

- Prepare a business plan for identified projects by using entrepreneurial eco system for the same (Schemes, incentives, incubators etc.)

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computers with internet and printer facility	All

**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Entrepreneurship Development	CO1	4	0	0	0	0
2	II	Startup Selection Process	CO2	2	0	0	0	0
3	III	Support System for Startup	CO3	2	0	0	0	0
4	IV	Managing Enterprise	CO4	2	0	0	0	0
<b>Grand Total</b>				<b>10</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- Assessment during practicals

**Summative Assessment (Assessment of Learning)**

- End of term examination

**XI. SUGGESTED COS - POS MATRIX FORM**

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

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

## XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr. Nishith Dubey, Aditya Vyas , Annu Soman , Anupam Singh	Un- boxing Entrepreneurship your self help guide to setup a successful business	Indira Publishing House ISBN 2023,978-93-93577-70-2
2	Gujral, Raman	Reading Material of Entrepreneurship Awareness Camp	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad
3	Chitale, A K	Product Design and Manufacturing	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
4	Charantimath, Poornima	Entrepreneurship Development Small Business Entrepreneurship	Pearson Education India, New Delhi; ISBN: 9788131762264
5	Khanka, S.S.	Entrepreneurship and Small Business Management	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6

## XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	<a href="http://www.mced.nic.in/allproduct.aspx">http://www.mced.nic.in/allproduct.aspx</a>	MCED Product and Plan Details
2	<a href="http://niesbud.nic.in/Publication.html">http://niesbud.nic.in/Publication.html</a>	The National Institute for Entrepreneurship and Small Business Development Publications
3	<a href="http://niesbud.nic.in/docs/1standardized.pdf">http://niesbud.nic.in/docs/1standardized.pdf</a>	Courses : The National Institute for Entrepreneurship and Small Business Development
4	<a href="https://www.nabard.org/Tenders.aspx?cid=501andid=24">https://www.nabard.org/Tenders.aspx?cid=501andid=24</a>	NABARD - Information Centre
5	<a href="http://www.startupindia.gov.in/pdf/file.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action">http://www.startupindia.gov.in/pdf/file.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action</a>	Start Up India
6	<a href="http://www.ediindia.org/institute.html">http://www.ediindia.org/institute.html</a>	About - Entrepreneurship Development Institute of India (EDII)
7	<a href="http://www.nstedb.com/training/training.htm">http://www.nstedb.com/training/training.htm</a>	NSTEDB - Training

<b>Sr.No</b>	<b>Link / Portal</b>	<b>Description</b>
<b>Note :</b> <ul style="list-style-type: none"><li>Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students</li></ul>		

<b>Programme Name/s</b>	: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering/ Computer Science/ Electronics & Computer Engg.
<b>Programme Code</b>	: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ PG/ SE/ TE
<b>Semester</b>	: Fifth
<b>Course Title</b>	: SEMINAR AND PROJECT INITIATION COURSE
<b>Course Code</b>	: 315003

### I. RATIONALE

Most of the diploma graduates lack the confidence and fluency while presenting papers or interacting verbally and expressing themselves with a large gathering. Seminar presentation boosts the confidence of the students and prepares them precisely for facing the audience, interviews and group discussions. The course on seminar is to enhance student's ability in the art of academic writing and to present it. It also helps broaden the minds of the participants. Through this course on Seminar, students will develop new ideas and perspectives of the subject /themes of emerging technologies and services of their area of studies. Project initiation enhances project planning skill which establishes measurable objectives and interaction skills.

### II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Present a seminar on the selected theme/area of study effectively and confidently to the specific audience and stakeholders. Plan innovative solutions independently or collaboratively to the identified problem statement.

### III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify topics of seminar presenting to the large gathering at the institute/conference.
- CO2 - Collect relevant and updated research-based data and information to prepare a paper of seminar presentation.
- CO3 - Apply presentation skills.
- CO4 - Create conducive environment for learning and discussion through seminar presentation.
- CO5 - Identify a problem statement and establish the action plan for the successful completion of the project.

### IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TL		Based on SL					
				CL	TL	LL					FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA					
				Max	Max	Max	Min	Max			Min	Max	Min	Max	Min						
315003	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	-	-	1	2	3	1	-	-	-	-	-	25	10	25@	10	25	10	75

### V. General guidelines for SEMINAR and Project Initiation

- The seminar must be related to emerging trends in engineering / technology programme or may be inter/ multi-disciplinary, based on the industry expected outcomes of the programme.
- The individual students have different aptitudes and strengths. Therefore, SEMINAR should match the strengths of students. For this purpose, students shall be asked to select the TITLE (Theme)of SEMINAR they would like to prepare and present.
- Seminar titles are to be finalized in consultation with the faculty mentor.
- Seminar must involve logic development of applications of various technologies/ processes applicable in industry.

- Seminar must be assigned to the single student. However, support of other students may be sorted while presenting the seminar
- Students are required to prepare using relevant software tools, write ups for presentation
- Students shall submit One Hard copy and one Soft copy each of the presentation and may be encouraged to keep a recorded copy of the presentation made during the seminar.
- Batch of 3-4 students shall be formed for project initiation.
- Projects give a platform for the students to showcase an attitude of inquiry to identify the problem statement related to the programme. Students shall Identify the information suggesting the cause of the problem and possible solutions
- Students shall study and assess the feasibility of different solutions and the financial implications.
- Students should collect relevant data from different sources (books/internet/market/suppliers/experts through surveys/interviews).
- Students shall prepare required drawings/ designs and detailed plan for the successful execution of the work.
- Students may visit the organisation pertaining to the problem statement as part of initial study.

#### VI.Guidelines for Seminar preparation and presentation :

Once the title/topic of a seminar has been finalized and allotted to the student, the teacher's role is important as guide, mentor and motivator, to promote learning and sustain the interest of the students.

Following should be kept in mind while preparing and presenting the seminar:

- **Seminar Orientation cum -briefing:** the seminar topics/themes should be innovative, novel and relevant to the curriculum of the programme, and also aligned to the expectations of industry.
- **Seminar Literature survey:** Information search and data collection: the information and data should be authentic, realistic and relevant to the curriculum of the programme.
- **Seminar Preparation, and presentation:** The seminar shall be present with suitable software tools and supporting handout/notes. The presentation of seminar should not be more than 20 minutes including Q-A session.

The following guidelines may be followed for Project Initiation

- **Establishing project scope:** Determine the boundaries of the project.
- **Defining project objectives:** Set clear and measurable objectives that align with the project's purpose.
- **Stakeholder identification and analysis:** Perform an exercise in identifying all stakeholders involved in the project and analyzing their needs and expectations.
- **Team Formation:** Carefully build a team with the necessary skills and expertise to execute the project successfully.
- **Documentation.** Create a project planner showcasing the action plan, define the project's scope, outline the project definition, and design of the project. The document has to be made available to all stakeholders

#### VII. Criteria of Assessment /Evaluation of Seminar

##### A. Formative Assessment (FA) criteria

The assessment of the students in the fifth semester Progressive Assessment (PA) for 50 marks is to be done based on following criteria.

##### A. Suggestive RUBRICS for assessment

Sr. No.	Criteria	Marks
1	Selection Topic/Theme of seminar	05
2	Literature review and data presentation	05
3	Quality of Preparation and innovativeness	05
4	Q-A handling	05
5	Time Management	05
6	Seminar Presentation report	10

##### Rubrics for assessment of Project Initiation

Sr. No.	Criteria	Marks
1	Selection of Theme of Problem Statement and its innovativeness	05
2	Stages of development of Action plan	05
3	Prototyping	05

The total marks as per above out of 50, shall be converted in proportion of 25 marks.

**B. Summative Assessment criteria/**

The summative assessment of the students in the fifth semester End-Semester-Examination (ESE) for 50 marks is to be done based on following criteria.  
This assessment shall be done by the Faculty.

Suggestive **RUBRICS** may be developed by the faculty

Sr. No.	Criteria	Marks
1	Quality of information/Knowledge presented in SEMINAR	10
2	Creativity, Innovation in SEMINAR presentation	10
3	Response to the question during seminar presentation	10
4	Establishment of Innovative Problem Statement and its presentation	10
5	Objectives of the project and action plan	10

The total obtained marks shall be converted in proportion of 25 marks.

**VIII. Suggestive CO-PO Mapping**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	1	0	-	2	2	3		
CO-2	2		2	-	2	1	3		
CO-3	3	1	1	2	1	2	3		
CO-4	2	0	0	2	1	2	3		
CO-5	3	3	3	2	2	3	3		

**VIII. Typographical instructions/guidelines for seminar preparation & presentation**

- The seminar PPT shall be computer typed (English- British)
- Text Font -Times New Roman (TNR), Size-12 point
- Subsection heading TNR- 12 point bold normal
- Section heading TNR- 12 capital bold
- Chapter Name/ Topic Name – TNR- 14 Capital
- All text should be justified. (Settings in the Paragraph)
- Different colors text/diagrams /tables may used
- The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the first slide of PPT.

**IX. Seminar and Project Initiation Report**

On completion and presentation of Seminar, every student will submit a brief report which should contain the following:

- Cover Page (as per annexure 1)
- Title page (as per annexure 2)
- Certificate by the Guide (as per annexure 3)
- Acknowledgment (The candidate may thank all those who helped in the execution of the project).
- Abstract of Paper presented in the seminar (It should be in one page and include the purpose of the seminar & methodology if any .)
- Index
- List of Figures
- Introduction

- Literature Review
- Information/Chapters related to Seminar topic
- Advantages and Disadvantages
- Conclusion
- Project Initiation : a) Description of problem statement. b) Scope and objectives. c) State holder d) Platform/ Equipment/ Resources identification.
- Bibliography
- References

NOTE: Seminar report must contain only relevant – technology or platform or OS or tools used and shall not exceed 25-30 pages.

Details of Softcopy to be submitted:

The soft copy of seminar presentation is required to be provided on the back cover of the seminar report in clear packet, which should include the following folders and contents:

- 1.Presentation (should include a PPT about project in not more than 15 slides)
- 2.Documentation (should include a word file of the project report)

NOTE: Soft copy must be checked for any harmful viruses before submission.

---

## **X. Sample Formats**

- 1) Cover Page - Annexure-I
- 2) Index - Annexure-II
- 3) Assessment - Annexure-III

Annexure - I

MSBTE  
LOGO

# SEMINAR Report

Institute  
Logo

“SEMINAR Title \_\_\_\_\_”

as a partial fulfilment of requirement of the

THIRD YEAR DIPLOMA IN

\_\_\_\_\_

Submitted by

Name of Student

Enrollment Number

(H.O.D)

(Principal)

(Internal Guide)

(External Examiner)

## Annexure - II

**Institute Name****(An Affiliated Institute of Maharashtra State Board of Technical Education)****Table of Contents**

Title Page	i
Certificate of the Guide	ii
Acknowledgement	iii
Index	iv
Abstract	v
List of Figures	vi
List of Tables (optional)	vii

**INDEX**

<b>Sr. No.</b>	<b>Chapter</b>	<b>Page No.</b>
<b>1.</b>	Chapter-1 Introduction (background of the seminar)	<b>1</b>
<b>2.</b>	Chapter-2 Literature review for the seminar topic/theme	<b>5</b>
<b>3.</b>	Chapter-3 -	
-	-	
-	Seminar Report	
-	<b>Bibliography</b>	
-	<b>Referances</b>	

\*Students can add/remove/edit chapter names as per the discussion with their guide

## Annexure - III

## Format for SEMINAR and PROJECT INITIATION Assessment /Evaluation

## Formative Assessment

## CRITERIA AND WEIGHTAGE

Enrollment No	1 Selection Topic/Theme of seminar (5)	2 Literature review and data presentation (5)	3. Quality of Preparation and innovativeness (5)	4 Q-A handling (5)	5 Time Management (5)	6. Seminar Presentation report (10)	7 Selection of Theme of Problem Statement and its innovativeness (5)	8 Stages of development of Action plan (5)	9. Prototyping (5)	10. Total (50)	Scaled to (25)

## Summative Assessment

## CRITERIA AND WEIGHTAGE

Enrollment No	1. Quality of information/Knowledge presented in SEMINAR  10	2 Creativity, Innovation in SEMINAR presentation  10	3. Response to the question during seminar presentation  10	4 Establishment of Innovative Problem Statement and its presentation  10	5 Objectives of the project and action plan  10	Total  (50)	Scaled to  (25)

<b>Sign:</b> <b>Name: -----</b> <b>(Course Expert/s)</b>	<b>Sign:</b> <b>Name: -----</b> <b>(Program Head )</b> <b>(Information Technology)</b>

<b>Programme Name/s</b>	: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering/ Computer Science/ Electronics & Computer Engg.
<b>Programme Code</b>	: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ PG/ SE/ TE
<b>Semester</b>	: Fifth
<b>Course Title</b>	: INTERNSHIP(12 WEEKS)
<b>Course Code</b>	: 315004

**I. RATIONALE**

Globalization has prompted organizations to encourage skilled and innovative workforce. Internships are educational and career development opportunities, providing practical/ hands-on experience in a field or discipline. Summer internship is an opportunity for students to get accustomed to modern industry practices, apply the knowledge and skills they've acquired in the classroom to real-world situations and become familiar with industry environments before they enter the professional world. Keeping this in mind, industrial training is incorporated to all diploma programmes as it enables the student to get equipped with practical skills, soft skills and life skills

**II. INDUSTRY / EMPLOYER EXPECTED OUTCOME**

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Apply skills and practices to industrial processes.

**III. COURSE LEVEL LEARNING OUTCOMES (COS)**

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

- CO1 - Observe time/resource management and industrial safety aspects.
- CO2 - Acquire professional experience of industry environment .
- CO3 - Establish effective communication in working environment.
- CO4 - Prepare report of assigned activities and accomplishments.

**IV. TEACHING-LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										
				Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TL				Based on SL		Total Marks	
				CL	TL	LL					FA-TH	SA-TH	Total	Practical		SLA					
							Max	Min						Max	Min	Max	Min	Max	Min		
315004	INTERNSHIP(12 WEEKS)	ITR	INP	-	-	-	-	36 - 40	10	-	-	-	-	-	100	40	100#	40	-	-	200

Legends: # External Assessment

**Note: Credits for Industrial Training are in-line of guidelines of NCrF : The industrial training is of 12 weeks considering 36-40 hours per week engagement of students (as per Guidelines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mentor**

### V General guidelines for organizing Industrial training

The Industry/organization selected for Industrial training/ internships shall be Government/Public Limited/ Private limited / Startup /Centre of Excellence/Skill Centers/Skill Parks etc.

1. Duration of Training - 12 weeks students engagement time
2. Period of Time slot - Between 4th and 5th semester (12 weeks) i.e. commencement of internships will be immediately following the 4th semester exams.
3. Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

### VI Role(s) of Department at the Institute:

Following activities are expected to be performed by the concerned department at the Polytechnics.

#### Table of activities to be completed for Internship

S.No	Activity	Suggested Schedule
1	Collection of information about industry available and ready for extending training with its offered capacity of students ( <b>Sample Format 1</b> )	1 <sup>st</sup> to 3 <sup>rd</sup> week of 4 <sup>th</sup> Semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15))	4 <sup>th</sup> to 6 <sup>th</sup> week of 4 <sup>th</sup> semester
3	Communication with Industry and obtaining its confirmation Sample letter Format	6 <sup>th</sup> to 8 <sup>th</sup> week of 4 <sup>th</sup> semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	Before 10 <sup>th</sup> week of 4 <sup>th</sup> semester
5	Enrollment of Students for industrial training (Format 3)	Before 12 <sup>th</sup> week of 4 <sup>th</sup> semester

6	Issue of letter to industry for training along with details of students and mentor (Format 4)	Before 14 <sup>th</sup> week of 4 <sup>th</sup> Semester
7	Organize Internship Orientation session for students	Before end of 4 <sup>th</sup> Semester
8	Progressive Assessment of industry training by Mentor	Each week during training period
9	Assessment of training by institutional mentor and Industry mentor	5 <sup>th</sup> Semester ESE

### Suggestions-

1. Department can take help of alumina or parents of students having contact in different industries for securing placement.
2. Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
3. Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.
4. The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

### VII Roles and Responsibilities of students:

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives then the same may be utilized for securing placement for themselves and their peers.
2. Students have to fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non-disciplinary action will be taken .
7. Students must maintain a weekly diary (**Format 6**) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.

8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to the mentor at the institute.
9. Prepare a final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from a mentor as well as industry training in charge.
10. Students must submit the undertaking as provided in **Format 5**.

**VIII Typographical guidelines for Industry Training report**

**Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following**

1. The training report shall be computer typed (English- British) and printed on A4 size paper.
2. Text Font -Times New Roman (TNR), Size-12 point
3. Subsection heading TNR- 12 point bold normal
4. Section heading TNR- 12 capital bold
5. Chapter Name/ Topic Name – TNR- 14 Capital
6. All text should be justified. (Settings in the Paragraph)
7. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
8. The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.
9. The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

**IX Suggestive format of industrial training report**

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- Title Page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1	Organization structure of Industry and general layout.
Chapter 2	Introduction to Industry / Organization (history, type of products and services, turn over and number of employees etc.)
Chapter 3	Types of Major Equipments/raw materials/ instruments/machines/ hardware/software used in industry with their specifications, approximate cost, specific use and routine maintenance done
Chapter 4	Processes/ Manufacturing Manufacturing techniques and methodologies and material handling procedures

Chapter 5	Testing of Hardware/Software/ Raw materials/ Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 6	Safety procedures followed and safety gears used by industry.
Chapter 7	Particulars of Practical Experiences in Industry/Organization if any in Production/Assembly/Testing/Maintenance
Chapter 8	Detailed report of the tasks undertaken (during the training).
Chapter 9	Special/challenging experiences encountered during training if any (may include students liking & disliking of workplaces).
Chapter 10	Conclusion
Chapter 11	References / sources of information

**X Suggested learning strategies during training at Industry**

- Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
- They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.
- Students may also visit websites related to other industries wherein similar products are being manufactured.

**XI Tentative week wise schedule of Industry Training**

Industrial training is a common course to all Diploma programmes , therefore the industry selection will depend upon the nature of the programme and its related industry. The training activity may vary according to nature and size of industry.

The following table details of activities to be completed during industrial training.

<b>Details of Activities to be completed during Industry training</b>
Introduction of Industry and departments.
Study of Layout of Industry, Specifications of Machines , raw materials, components available in the industry
Study of setup and manufacturing processes
Execute given project or work assigned to the students, study of safety and maintenance procedures
Validation from industry mentor regarding project or work allocated
Report writing

**XII CO-PO Mapping Table to be created by respective Department/faculty.**

**XIII. Formative Assessment of training : Suggested RUBRIC**

(Note : Allot the marks in proportion of presentations and outcome observed. Marks excluding component of week 11 are to be filled by Institute mentor)

Week No	Task to be assessed	Outcome Achievement - Poor	Outcome Achievement - Moderate	Outcome Achievement - High		Week-wise total Marks
		Poor	Average	Good	Excellent	
		Marks	Marks	Marks	Marks	

1	Introduction of Industry	Minimal Knowledge of Departments, processes, products and work culture of the company <b>(Marks –1)</b>	Moderate Knowledge of Departments, processes, products and work culture of the company <b>(Marks –2)</b>	Good Knowledge of Departments, processes, products and work culture of the company <b>(Marks –3/4)</b>	Extensive Knowledge of Departments, processes, products and work culture of the company <b>(Marks –5)</b>	
2	Presentation of Layout of Industry, Specifications of Machines, raw materials, components available in the industry	Minimal w.r.t. tasks <b>(Marks –1)</b>	Moderate w.r.t. tasks <b>(Marks –2)</b>	Good w.r.t. tasks <b>(Marks –3/4)</b>	Extensive w.r.t. tasks <b>(Marks –5)</b>	
3	Participation in setup and manufacturing processes/platforms	Minimal Participation with poor understanding <b>(Marks –1-8)</b>	Moderate Participation with poor understanding <b>(Marks –9-12)</b>	Good Participation with poor understanding <b>(Marks –13-17)</b>	Extensive Participation with poor understanding <b>(Marks –18-20)</b>	
4 to 10	Execution of given project or work to the students, Follow of safety and maintenance procedures	Minimal Participation with poor understanding <b>(Marks –1-8)</b>	Moderate Participation with lower level understanding <b>(Marks – 9-12)</b>	Good Participation with Good understanding <b>(Marks – 13-17)</b>	Extensive Participation with excellent understanding <b>(Marks – 18-20)</b>	
11	Validation by industry mentor regarding project or work allocated	Minimal Participation with poor performance <b>(Marks –1-10)</b>	Moderate Participation with acceptable performance <b>(Marks – 11-15)</b>	Good Participation with Good performance <b>(Marks – 16-20)</b>	Extensive Participation with excellent performance <b>(Marks – 21-25)</b>	

12	Diary writing	<ul style="list-style-type: none"> <li>• Results are not Presented properly,</li> <li>• Project work is summarized and concluded not acceptable</li> <li>• Future extensions are not specified</li> </ul> <p><b>(Marks –1-10)</b></p>	<ul style="list-style-type: none"> <li>• Results are Presented just casually</li> <li>• Project work is summarized and concluded casually</li> <li>• Future extensions are casually specified</li> </ul> <p><b>(Marks –11-15)</b></p>	<ul style="list-style-type: none"> <li>• Results are Presented well and properly,</li> <li>• Project work is summarized and concluded to a Good level</li> <li>• Future extensions are well specified</li> </ul> <p><b>(Marks –16-20)</b></p>	<ul style="list-style-type: none"> <li>• Results are Presented exhaustively</li> <li>• Project work is summarized and elaborated in excellent manner , concluded</li> <li>• Future extensions are excellently specified</li> </ul> <p><b>(Marks –21-25)</b></p>
<b>Total Out of :100</b>					

Marks for (FA) are to be awarded for each week considering the level of completeness of activity observed as per table specified in Sr.No. XIII above, from the daily diary maintained . Feedback from industry supervisor shall also be considered.

**XIV Summative Assessment (SA) of training:**

Academic year : 20 -20

**i) Suggested RUBRIC for SA**

Enrollment Number	Observations from Orals				Presentations				Diary , Report writing and / Product (10)	Total (100)
	Tasks undertaken (20)	Overall Understanding (20)	Creativity /Innovation demonstrated (10)	Knowledge acquired (10)	Speech Clarity (10)	Body Language (10)	Presentations (10)			

Name of mentor:  
Signature of Mentor

**XV FORMATS**

**Format-1: Collecting Information about Industry/Organization available for training along with capacity**

- 1) Name of the industry/organization:
- 2) Address/communication details with email :
- 3) Contact person details:
  - a) Name:
  - b) Designation:
  - c) Email
  - d) Contact number/s:
- 4) Type:
 

Govt / PSU / Pvt /

Large scale / Medium scale / Small scale .....
- 5) Products/services offered by industry:
- 6) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: **Yes / No.**  
 b) If yes, whether you offer 12 weeks training: **Yes/No**  
 c) Possible Industrial Capacity:

Students	Programme name/ Title					Total
	Civil	Mechanical	Chemical			
Male						
Female						
Total						

7) Whether accommodation available for interns **Yes / No.**

If yes capacity: \_\_\_\_\_

8) Whether internship is charged or free:

If charged please specify amount per candidate: \_\_\_\_\_

Signature of responsible person at Industry:



**Format-2: Obtaining Consent Letter from parents/guardians**

(Undertaking from Parents)

To,

The Principal,  
\_\_\_\_\_

Subject: Consent for Industrial Training.

Sir/Madam,

I am fully aware that -

i) My ward studying in \_\_\_\_\_ semester at your \_\_\_\_\_ institute has to undergo 12 weeks of Industrial training for partial fulfillment \_\_\_\_\_ towards completion of Diploma in \_\_\_\_\_ Engineering.

ii) For this fulfillment he/she has been deputed at \_\_\_\_\_ industry, located at \_\_\_\_\_ for Industrial training /internship \_\_\_\_\_ for the period from \_\_\_\_\_ to \_\_\_\_\_.

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

- My ward will undergo the training at his/her own cost and risk during training and/or stay.
- My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
- My ward is NOT entitled to any leave during the training period.
- My ward will regularly submit a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward, who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :

Name : \_\_\_\_\_

Address : \_\_\_\_\_

Phone Number : \_\_\_\_\_







**Format-4: Issue Letter to the Industry/Organization for the training along with details of students and mentors**

To,  
The HR Manager,

\_\_\_\_\_

Subject: Placement for Industrial training of \_\_\_\_ weeks in your organization....

Reference: Your consent letter no: ....

Sir,

With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.

The purpose of this training is to equip the student with some essential skills relevant to the demands of the industry and world of work, as well as to provide exposure to the professional environment and work culture. It is hoped that this training may enhance his/her employability and livelihood opportunities. In view of the above, we kindly request your support in facilitating this Industrial Training for the student. He/she has been adequately oriented and guided on the expectations of this training, including the maintenance of a daily diary during the training period. Additionally, the institute has secured the necessary consent and undertaking from the parent/guardian regarding the guidelines for exit training. In view of all the above industry shall refrain from involving students into the mundane and housekeeping activities. Your cooperation in this regard will be highly appreciated.

Diploma programme in \_\_\_\_\_ Engg.

Sr.No	Enrollment No	Name of Student	Name and designation of Mentor

Diploma programme in \_\_\_\_\_ Engg.

Sr.No	Enrollment No	Name of Student	Name and Designation of Mentor

Kindly extend all possible cooperation to the students for above.

Thanking you

Yours sincerely,

(Principal)  
Name of the Institute:  
with Seal

Cc- To HoD/Mentor

**Format-5: Undertaking by the students**

TO

Principal

-----

Subject: Undertaking regarding Placement for Industrial training of 12/16/18 weeks duration

I .....Reg No:..... S/o/D/o.

.....Studying in ----- at -----

Institute at -----fully aware of the Industrial Training requirement and related responsibilities and participation in the ....., Industrial training between From: ..... To.....

I assure you that I will be of good behavior and be obedient to the staff and mentor during the ...../Industrial training. I will also abide and will not participate in all activity. I will also discipline myself within the rules and regulations of the Institution. I am also aware that I am participating in the ..... at my own risk and I will not hold the -----Institute responsible in any way in any eventuality namely Accident /Injury/death or whatever mishap and I myself will be solely responsible for my safety.

Place :Signature of the student

Date :Reg. No.



**Format-6: Internships Daily Diary**

Name of the Student: \_\_\_\_\_ Name of the mentor (Faculty) :

Enrollment Number: \_\_\_\_\_ Semester: \_\_\_\_\_ Academic Year

Week	Day & Date	Discussion Topics/Activity	Details of Work Allotted Till Next Session /Corrections Suggested/Faculty Remarks	Signature of Industry Mentor
Week 01	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			
.	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			
Week n	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			

**THEORY OF STRUCTURE****Course Code : 315313**

**Programme Name/s** : Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/  
**Programme Code** : CE/ CR/ CS/ LE  
**Semester** : Fifth  
**Course Title** : THEORY OF STRUCTURE  
**Course Code** : 315313

**I. RATIONALE**

Every civil engineering structure need to be design properly for ensuring its stability .Structural members often experience various types of load with different end conditions. However all such design based on some preliminarily analysis of determinate & indeterminate structural element such as Simply supported beam, cantilever beam, fixed beam, continuous beam, portal frame etc. Therefore civil engineer must have knowledge of specialized method for conducting such analysis. This course will develop the basic knowledge among the learners about various analytical technique that are required to solve civil engineering problems.

**II. INDUSTRY / EMPLOYER EXPECTED OUTCOME**

•The theoretical principles taught in the course are directly applicable to real-world field situations. By applying these Principles, students learn how to  
 "Analyze the given structural components using the relevant methods."

**III. COURSE LEVEL LEARNING OUTCOMES (COS)**

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

- CO1 - Analyze slope and Deflection in beams under different loading conditions.
- CO2 - Analyze fixed beams under different loading conditions.
- CO3 - Apply the principles of Three Moments to analyze continuous beam under the given situations.
- CO4 - Apply the Moment Distribution Method to analyze continuous beam under different loading conditions.
- CO5 - Evaluate axial forces in the members of simple truss.

**IV. TEACHING-LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SL	LH			NLH	Theory			Based on LL & TL		Based on SL				
				CL	TL	LL						FA-TH	SA-TH	Total	Practical			SLA			
															Max	Min	Max		Min	Max	
315313	THEORY OF STRUCTURE	TOS	DSC	6	-	-	3	9	3	4	30	70	100	40	-	-	-	-	25	10	125

**Total IKS Hrs for Sem. : Hrs**

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

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

**V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	<p>TLO 1.1 Use flexural equation to prepare general differential equation.</p> <p>TLO 1.2 Determine the slope and deflection for the given structural element under specific loading conditions by double integration method.</p> <p>TLO 1.3 Determine the slope and deflection for the given structural element under specific loading conditions by Macaulay's method.</p>	<p><b>Unit - I Slope and Deflection</b></p> <p>1.1 Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation).</p> <p>1.2 Double integration method to find slope and deflection of simply supported and cantilever beam subjected to concentrated load and uniformly distributed load on entire span.</p> <p>1.3 Macaulay's method for slope and deflection, application to simply supported and cantilever beam subjected to concentrated and uniformly distributed load on entire span.</p>	<p>Lecture Using Chalk-Board</p> <p>Collaborative learning</p> <p>Video</p> <p>Demonstrations</p> <p>Site/Industry Visit</p> <p>Presentations</p>
2	<p>TLO 2.1 Explain the effect of fixity in the given beam section.</p> <p>TLO 2.2 Calculate fixed end moments for the fixed beam under specific loading conditions by using first principle.</p> <p>TLO 2.3 Find end moments and reactions for fixed beam under given loading condition by using standard formulae.</p> <p>TLO 2.4 Draw S.F. and B.M. diagrams for the given fixed beam using given data.</p>	<p><b>Unit - II Fixed Beam</b></p> <p>2.1 Concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam.</p> <p>2.2 Principle of superposition, Fixed end moments from first principle for beam subjected to central point load, UDL over entire span, Point load other than mid span.</p> <p>2.3 Standard formulae to find end moments and end reactions for different loading conditions.</p> <p>2.4 Shear force and bending moment diagram of fixed beam, point of contra shear and point of contra flexure.</p>	<p>Lecture Using Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Site/Industry Visit</p> <p>Collaborative learning</p> <p>Presentations</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	<p>TLO 3.1 Draw deflected shape of continuous beam subjected to given load and end conditions by using effect of continuity</p> <p>TLO 3.2 Explain Clapeyron's theorem of three moments used for the analysis of given continuous beam.</p> <p>TLO 3.3 Analyze continuous beam under given loading conditions, using Clapeyrons theorem of three moments.</p> <p>TLO 3.4 Draw S.F. and B.M. diagram for the given continuous beam using given data.</p>	<p><b>Unit - III Continuous Beam</b></p> <p>3.1 Definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, Zero span or imaginary span theory.</p> <p>3.2 Clapeyron's theorem of three moments (no derivation) Supports at same level, spans having same and different moment of inertia.</p> <p>3.3 Clapeyron's theorem of three moments to various types of continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same and different moment of inertia, supports at same level, up to three spans and two unknown support moments only.</p> <p>3.4 Shear force and bending moment diagram of continuous beams, point of contra shear and point of contra flexure.</p>	<p>Lecture Using Chalk-Board Video Demonstrations Site/Industry Visit Collaborative learning Presentations</p>
4	<p>TLO 4.1 Explain Moment Distribution Method (M.D.M.) used for analyzing the given indeterminate beam.</p> <p>TLO 4.2 Apply M.D.M. to analyse given continuous beam with same M.I. for the given condition.</p> <p>TLO 4.3 Apply M.D.M. to analyze given continuous beam with different M.I. for the given condition.</p> <p>TLO 4.4 Plot S.F. and B.M. Diagrams for continuous beam using given data.</p> <p>TLO 4.5 Identify the type of given portal frame with justification.</p>	<p><b>Unit - IV Moment Distribution Method</b></p> <p>4.1 Introduction to moment distribution method, sign convention, Carry over factor, stiffness factor, distribution Factor, Distribution of moment.</p> <p>4.2 Application of moment distribution method to continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same moment of inertia, supports at same level, up to three spans and two unknown support moments only.</p> <p>4.3 Application of moment distribution method to continuous beams subjected to concentrated loads and uniformly distributed load over entire span having different moment of inertia, supports at same level, up to three spans and two unknown support moments only.</p> <p>4.4 Shear force and bending moment diagram of continuous beams, point of contra shear and point of contra flexure.</p> <p>4.5 Introduction to portal frames – Symmetrical and unsymmetrical portal frames with the concept of Bays and stories. (No Numerical)</p>	<p>Lecture Using Chalk-Board Collaborative learning Video Demonstrations Presentations Site/Industry Visit</p>
5	<p>TLO 5.1 Classify the trusses used in constructions.</p> <p>TLO 5.2 Calculate the support reactions for the given simple truss using analytical method.</p> <p>TLO 5.3 Calculate axial forces for the given simple truss using method of joint and method of section.</p> <p>TLO 5.4 Understand the graphical method for analysis of simple truss.</p>	<p><b>Unit - V Simple Trusses</b></p> <p>5.1 Introduction of Truss, Types of trusses (Simple, Fink, compound fink, French truss, Pratt truss, Howe truss, North light truss, King post and Queen post truss), Classification of trusses (perfect and imperfect).</p> <p>5.2 Support reactions for trusses subjected to point loads at nodal points only.</p> <p>5.3 Forces in members of truss using method of joints and Method of sections.</p> <p>5.4 Graphical method of analysis of truss. (No numerical on graphical method of analysis of truss)</p>	<p>Lecture Using Chalk-Board Collaborative learning Model Demonstration Video Demonstrations Site/Industry Visit Presentations</p>

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Apply the knowledge related to slope and deflections to solve the problems / questions in given situation.	1	<p>Sample Question's..... ( Course teacher will decide the number of numerical as per the time constraint)</p> <p>A) Draw the neat sketch indicating maximum slope and maximum deflection of cantilever beam subjected to point load at its free end. B) State the suitable boundary conditions for given type of beam to calculate integration constants C1 and C2. C) Prepare the General differential equation for given type of beam for different loading conditions along with the required data. D) Calculate the Slope and Deflection by using Macaulay's method for a simply supported beam and cantilever beam for various loading conditions such as</p> <ol style="list-style-type: none"> <li>1. Beam subjected to single point load.</li> <li>2. Beam subjected to two point loads.</li> <li>3. Beam subjected to point load and udl.</li> </ol> <p>Along with the required data</p>	4	CO1
LLO 2.1 Apply the knowledge related to fixed beam to solve the problems / questions in given situation.	2	<p>Sample Question's..... (Course teacher will decide the number of numerical as per the time constraint)</p> <p>A) Compare the fixed beam and simply supported beam subjected to same loading conditions. B) Compare the support moments calculated by first principle and standard formula for fixed beam for various loading conditions. C) Draw net BM of fixed beam for given loading conditions along with the required data. D) Draw the SFD and calculate the pt. of contra shear of continuous beam for given support moments and loads along with the required data. E) Calculate pt. of contra flexure for given BMD and pt. of contra shear for given SFD along with the required data.</p>	4	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Apply the knowledge related to continuous beam to solve the problems / questions in given situation.	3	<p>Sample Question's..... (Course teacher will decide the number of numerical as per the time constraint)</p> <p>A) Explain the effect of continuity with neat sketch? OR Draw the neat sketch of continuous beam indicating sagging and hogging bending moment when it is subjected to external loading.</p> <p>B) State Clapeyron's theorem of three moment for same and different Moment of Inertia. Also state the meaning of each term involved.</p> <p>C) Calculate the support moments of continuous beam having same moment of inertia and varying moment of inertia for given loading conditions using Clapeyron's three moment theorem.</p> <p>D) Draw the SFD and calculate the pt. of contra shear of continuous beam for given support moments and reactions along with the required data.</p> <p>E) Calculate the Net Bending moment , Max. bending moment and pt. of contra flexure from given BMD and required data of continuous beam.</p>	4	CO3
LLO 4.1 Apply the knowledge related to continuous beam to solve the problems / questions in given situation.	4	<p>Sample Question's..... (Course teacher will decide the number of numerical as per the time constraint)</p> <p>A) State the distribution of carry over factor for a continuous beam for different support conditions.</p> <p>B) Calculate the stiffness factor and Distribution Factor for diagram such as number of members connecting at same point whose having different support conditions and varying MI. (Diagram should be provided by course teacher)</p> <p>C) Calculate the support moments of continuous beam having same or varying moment of inertia for given loading conditions using moment distribution method.</p> <p>D) Draw the SFD and calculate the pt. of contra shear of continuous beam for given loading conditions and support moments along with the required data .</p> <p>E) Calculate pt. of contra flexure and pt. of contra shear for given BMD and SFD of continuous beam along with the required data.</p>	4	CO4
LLO 5.1 Apply the knowledge related to truss to solve the problems / questions in given situation.	5	<p>Sample Question's..... (Course teacher will decide the number of numerical as per the time constraint )</p> <p>A) Draw a neat sketch of any four types of trusses.</p> <p>B) State the assumptions for analysis of trusses.</p> <p>C) Identify the perfect and imperfect truss from given trusses</p> <p>D) Find the redundancy for given imperfect trusses.</p> <p>E) Calculate the axial forces developed in simple supported truss and cantilever truss subjected to external loading along with the required data.</p>	4	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
<p><b>Note : Out of above suggestive LLOs -</b></p> <ul style="list-style-type: none"> <li>• '*1' Marked Practicals (LLOs) Are mandatory.</li> <li>• Minimum 80% of above list of lab experiment are to be performed.</li> <li>• Judicial mix of LLOs are to be performed to achieve desired outcomes.</li> </ul>				

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

### Assignment

- (Minimum TWO activities is compulsory for all students under SLH)
1. Collect the data from YouTube/videos showing change in deflected shape due to change in number of supports in a beam.
  2. Apply the moment distribution method to analyze the portal frames.
  3. Apply the graphical method to analyze the truss.
  4. Prepare truss using given number of members and joints to carry given load. (use web tools/ video games available on internet such as X construction)
  5. Explain the procedure to calculate maximum & minimum Stress for hollow rectangular chimney.
  6. Explain the procedure to calculate maximum & minimum Stress for hollow circular chimney.
  7. Write the procedure to calculate Maximum & minimum stress for a trapezoidal Dam section.

### Micro project

- (Minimum ONE activity is compulsory for all students under SLH)
1. Prepare the chart of maximum slope and deflection for standard cases of simply supported beam and cantilever beam.
  2. Prepare chart of free bending moments for standard cases of simply supported beam and fixed end moments for standard cases of fixed beam.
  3. Collect information of three continuous beams having different support conditions on actual sites and study the reinforcement provided.
  4. Compare the results of manual analysis and software analysis of continuous beam by using open source software. (Such as <https://platform.skyciv.com/login>)
  5. Compare the results of manual analysis and software analysis of Single bay single story portal frame by using open source software. (Such as <https://platform.skyciv.com/login>)
  6. Prepare models of any one type of truss.
  7. Collect information and photographs of any three types of simple trusses.
  8. Compare the results of manual analysis and software analysis of truss by using open source software. (Such as <https://platform.skyciv.com/login>)

### Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Open Source software used for Analysis Such as <a href="https://platform.skyciv.com/login">https://platform.skyciv.com/login</a>	All

**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Slope and Deflection	CO1	12	2	4	8	14
2	II	Fixed Beam	CO2	8	2	4	4	10
3	III	Continuous Beam	CO3	14	2	8	6	16
4	IV	Moment Distribution Method	CO4	16	2	4	12	18
5	V	Simple Trusses	CO5	10	2	4	6	12
<b>Grand Total</b>				<b>60</b>	<b>10</b>	<b>24</b>	<b>36</b>	<b>70</b>

**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- Two-unit tests of 30 marks each will be conducted and average of two-unit tests to be considered. Under SLA : Assignment, Microproject (60% Weightage to process and 40% weightage to product), Question and Answer

**Summative Assessment (Assessment of Learning)**

- Pen and Paper Test (Written Test)

**XI. SUGGESTED COS - POS MATRIX FORM**

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

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

**XII. SUGGESTED LEARNING MATERIALS / BOOKS**

Sr.No	Author	Title	Publisher with ISBN Number
1	Ramanrutham S.	Theory of Structures	Dhanpatrai & Sons, Delhi ISBN : 978-93-84378-10-3
2	Khurmi R. S.	Theory of Structures	S. Chand and Co., New Delhi, 2006 ISBN:978-81-21905-20-6

Sr.No	Author	Title	Publisher with ISBN Number
3	Bhavikatti S. S.	Structural Analysis Vol-1	Vikas Publishing House Pvt.Ltd. New Delhi; ISBN: 978-81-25927-90-7
4	Junnarkar S. B.	Mechanics of structures, Volume-I and II	Charotar Publishing House, Anand ISBN:978-93-80358-99-4
5	Pandit G.S. and Gupta S.P.	Theory of Structures	Tata McGraw Hill, New Delhi, 2006 ISBN :978-00-74634-93-6

### XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	<a href="https://youtu.be/oa5ojjGEUSw?si=nNu8rSHo9YYquTmB">https://youtu.be/oa5ojjGEUSw?si=nNu8rSHo9YYquTmB</a>	Introduction and Need of Structural Analysis Prof. Amit Shaw, Department of Civil Engineering, I.I.T. Kharagpur.
2	<a href="https://sa2-iiitd.vlabs.ac.in/exp/slope-deflection-method-1-beams/simulation.html">https://sa2-iiitd.vlabs.ac.in/exp/slope-deflection-method-1-beams/simulation.html</a>	Virtual Lab for slope-deflection-method beams/simulation, Virtual Labs by IIT Delhi
3	<a href="https://www.youtube.com/watch?v=GUOKSExdjq8">https://www.youtube.com/watch?v=GUOKSExdjq8</a>	Lecture Series on deflection of beam by Prof. S.K. Bhattacharya, Department of Civil Engineering, I.I.T. Kharagpur.
4	<a href="https://www.youtube.com/watch?v=vi0tjfDSjNY">https://www.youtube.com/watch?v=vi0tjfDSjNY</a>	Lecture Series on deflection of beam by Prof. S.K. Bhattacharya, Department of Civil Engineering, I.I.T. Kharagpur.
5	<a href="https://bsa-iiith.vlabs.ac.in/exp/continuous-beams/index.html">https://bsa-iiith.vlabs.ac.in/exp/continuous-beams/index.html</a>	Virtual Lab for Continuous beams/simulation, Virtual Labs by IIT Delhi
6	<a href="https://bsa-iiith.vlabs.ac.in/exp/portal-frames/index.html">https://bsa-iiith.vlabs.ac.in/exp/portal-frames/index.html</a>	Virtual Lab for Portal Frame/simulation, Virtual Labs by IIT Delhi
7	<a href="https://bsa-iiith.vlabs.ac.in/exp/retaining-walls/theory.html">https://bsa-iiith.vlabs.ac.in/exp/retaining-walls/theory.html</a>	Virtual Lab for Retaining wall or Dam/simulation, Virtual Labs by IIT Delhi
8	<a href="https://youtu.be/yyxRHt62Wfo?si=4rF9ds2SedQ77NR4">https://youtu.be/yyxRHt62Wfo?si=4rF9ds2SedQ77NR4</a>	Analysis of Truss: Method of Sections Prof. Amit Shaw, Department of Civil Engineering, I.I.T. Kharagpur.
9	<a href="https://youtu.be/5gExoUfZoBY?si=9bB5Z71ECZAbBbRL">https://youtu.be/5gExoUfZoBY?si=9bB5Z71ECZAbBbRL</a>	Analysis of Truss: Method of Joints Prof. Amit Shaw, Department of Civil Engineering, I.I.T. Kharagpur.
<p><b>Note :</b></p> <ul style="list-style-type: none"> <li>Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students</li> </ul>		

<b>Programme Name/s</b>	<b>: Civil Engineering/ Civil &amp; Rural Engineering/ Construction Technology/ Civil &amp; Environmental Engineering/</b>
<b>Programme Code</b>	<b>: CE/ CR/ CS/ LE</b>
<b>Semester</b>	<b>: Fifth</b>
<b>Course Title</b>	<b>: WATER RESOURCE ENGINEERING</b>
<b>Course Code</b>	<b>: 315314</b>

### I. RATIONALE

Water is essential resource for all the living thing on earth, making its conservation crucial. With increasing demand and unpredictable rainfall in India, efficient water management system is more important than ever. Irrigation structures like dams, diversion headworks, canals play a key role in this effort. Water Resource Engineering deals in the planning, designing, constructing, and executing these hydraulic structures which are used to used to store, distribute and conserve the water sources. The primary goal of water resources engineering is to control and regulate water for various purposes including flood control, irrigation, hydroelectric power development etc. This course will enable the students to use and apply the basic principles and practices related to irrigation engineering and utilisation of supplied water at field.

### II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Suggest the relevant irrigation systems for the given site conditions.

### III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Evaluate the hydrological parameters of the given site.
- CO2 - Compute the Canal capacity for the crop water requirement of the given command area.
- CO3 - Suggest the suitable type of dam for the given site condition.
- CO4 - Execute the Minor and Micro Irrigation Schemes.
- CO5 - Propose the type of Diversion Headwork in the irrigation scheme.

### IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Credits	Paper Duration	Assessment Scheme									
				Actual Contact Hrs./Week			SL	LH	NLH			Theory			Based on LL & TL				Based on SL		Total Marks
				CL	TL	LL						FA-TH	SA-TH	Total	Practical		SLA				
															FA-PR	SA-PR	Max	Min	Max	Min	
315314	WATER RESOURCE ENGINEERING	WRE	DSC	4	-	2	-	6	2	3	30	70	100	40	50	20	25@	10	-	-	175

**Total IKS Hrs for Sem. : 1 Hrs**

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

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

## V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	<p>TLO 1.1 Classify the irrigation projects on the basis of given criteria.</p> <p>TLO 1.2 Explain the term “hydrological cycle”.</p> <p>TLO 1.3 Describe the characteristics of Rain gauge station to be installed in the given location.</p> <p>TLO 1.4 Estimate mean rainfall in the given area using the relevant method.</p> <p>TLO 1.5 Explain the factors affecting Runoff for given site condition.</p> <p>TLO 1.6 Determine the Maximum Flood Discharge using the relevant empirical method from the given data.</p>	<p><b>Unit - I Introduction to Irrigation and Hydrology</b></p> <p>1.1 Irrigation: Definition, necessity and Classification of Irrigation projects, advantages and ill effects of excess irrigation.</p> <p>1.2 Hydrology: Definition of Hydrological cycle, Rainfall, Evaporation.</p> <p>1.3 Rain Gauge: Symon's rain gauge and automatic rain gauge - Tipping bucket type.</p> <p>1.4 Methods of calculating mean rainfall: Arithmetic mean, Thiessen polygon and Isohyetal method.</p> <p>1.5 Runoff: Definition, factors affecting Runoff (No Numerical questions).</p> <p>1.6 Maximum Flood Discharge measurement: Empirical methods.</p>	<p>Video</p> <p>Demonstrations</p> <p>Lecture Using Chalk-Board</p> <p>Presentations</p> <p>Site/Industry Visit</p> <p>Collaborative learning</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	<p>TLO 2.1 Explain the terms, “Cropping seasons, Crop period, Duty, Delta, base period, Culturable Command Area, Gross Command Area, intensity of irrigation.”</p> <p>TLO 2.2 Establish the relationship between duty, delta and base period.</p> <p>TLO 2.3 Compute the crop water requirement and canal capacity from the given data.</p> <p>TLO 2.4 Propose the relevant method of supplying irrigation water in the cropping season.</p> <p>TLO 2.5 Suggest relevant measures of silt control in a given type of dam with justification.</p> <p>TLO 2.6 Compute the control levels for the given reservoir from the given data.</p>	<p><b>Unit - II Crop water requirement and Reservoir Planning</b></p> <p>2.1 Crop Water requirement: Cropping seasons, Crop period, Duty, Delta, base period, Culturable Command Area, Gross Command Area, intensity of irrigation, factors affecting duty.</p> <p>2.2 Relation between duty, delta and base period.</p> <p>2.3 Numerical on water requirement and capacity of canal. IKS: Rahat water Irrigation system in India.</p> <p>2.4 Methods of Irrigation: Surface, subsurface and overhead irrigation.</p> <p>2.5 Silting of Reservoir: Rate of silting, factors affecting silting and control measures.</p> <p>2.6 Control levels in reservoir. Numerical on fixing control levels of reservoir.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations Site/Industry Visit Collaborative learning</p>
3	<p>TLO 3.1 Classify the dams based on given criteria.</p> <p>TLO 3.2 Draw a labeled cross-sectional sketch of Earthen dam.</p> <p>TLO 3.3 Propose the suitable control measure to reduce the seepage through the foundation and embankment of earthen dam.</p> <p>TLO 3.4 Explain with the sketch the various forces acting on the gravity dam.</p> <p>TLO 3.5 Propose the types of spillways for given type of dam with justification.</p> <p>TLO 3.6 Propose the types of energy dissipaters for the given type of dam with justification.</p>	<p><b>Unit - III Dams and Spillways</b></p> <p>3.1 Dam and its classification based on use, materials and hydraulic design.</p> <p>3.2 Earthen Dams: Components with function, typical cross section.</p> <p>3.3 Methods of construction of earthen dam, seepage through embankment and foundation and its control, Types of failure of earthen dam and its preventive measures.</p> <p>3.4 Gravity Dams: Forces acting on dam, typical cross section, drainage gallery.</p> <p>3.5 Spillways: Definition, function, Types. Emergency and service spillway - ogee spillway and discharge over spillway, Spillway gates .</p> <p>3.6 Energy dissipation.</p>	<p>Lecture Using Chalk-Board Model Demonstration Video Demonstrations Presentations Site/Industry Visit Collaborative learning Case Study</p>
4	<p>TLO 4.1 Explain the procedure for construction of given type of Bandhara.</p> <p>TLO 4.2 Propose the suitable location for construction of percolation tank.</p> <p>TLO 4.3 Design the typical layout of Lift Irrigation system in the given situation.</p> <p>TLO 4.4 Design the typical layout of Drip and Sprinkler irrigation for the given condition.</p> <p>TLO 4.5 Suggest the layout for the Well Irrigation scheme in the given site conditions.</p>	<p><b>Unit - IV Minor and Micro Irrigation</b></p> <p>4.1 Bandhara irrigation: Introduction, Layout, components, construction.</p> <p>4.2 Percolation Tanks: Selection of site, need, construction.</p> <p>4.3 Lift irrigation scheme: Components and their functions, layout.</p> <p>4.4 Drip and Sprinkler Irrigation: components, layout, suitability.</p> <p>4.5 Well irrigation: Introduction, types, advantages and disadvantages.</p>	<p>Lecture Using Chalk-Board Video Demonstrations Case Study Presentations Site/Industry Visit Collaborative learning</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	<p>TLO 5.1 Classify the weirs based on given conditions.</p> <p>TLO 5.2 Suggest the suitable site for barrage construction.</p> <p>TLO 5.3 Draw a labeled sketch of the given type of diversion headwork.</p> <p>TLO 5.4 Classify the canal on the basis of alignment and position in the given canal network.</p> <p>TLO 5.5 Suggest the relevant type of construction material used for lining of given canal.</p> <p>TLO 5.6 Propose the relevant type of Cross Drainage work in given site condition.</p> <p>TLO 5.7 Propose the relevant types of regulators used for specific purpose in canal irrigation system</p>	<p><b>Unit - V Diversion Headwork and Canals</b></p> <p>5.1 Weirs: Introduction, components, classification. K.T. weir : components and construction.</p> <p>5.2 Barrages : Introduction, components and their functions, location.</p> <p>5.3 Diversion headwork : Layout, components and their function.</p> <p>5.4 Canals: Definition, classification according to alignment and position in the canal network, cross section of canal in embankment and cutting, partial embankment and cutting.</p> <p>5.5 Canal lining: Purpose, construction material used, advantages.</p> <p>5.6 Cross Drainage works: Aqueduct, siphon aqueduct, super passage, level crossing.</p> <p>5.7 Canal regulators: Head regulator, Cross regulator, escape, falls and outlets.</p>	<p>Lecture Using Chalk-Board Model</p> <p>Demonstration Video</p> <p>Demonstrations</p> <p>Case Study</p> <p>Presentations</p> <p>Site/Industry Visit</p> <p>Collaborative learning</p>

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Estimate average rainfall or Runoff from the given data	1	*Estimation of average rainfall OR Runoff using relevant method.	2	CO1
LLO 2.1 Estimate the water requirement for the cropping season for given area.	2	*Estimation of crop water requirement for the given data and cropping season.	2	CO2
LLO 3.1 Estimate Canal capacity based on the given data.	3	Computation of Canal capacity from crop water requirement .	2	CO2
LLO 4.1 Compute the control levels for the reservoir from given data	4	*Computation of control levels for the reservoir.	2	CO2
LLO 5.1 Prepare a detailed technical presentation on major dams in India.	5	*Prepare a detailed report on any two major dams in India by observing relevant videos.	2	CO3
LLO 6.1 Prepare detailed technical report for the identified water resource project.	6	Site visit to any nearby water resource project (Dam/Canal/Weir/diversion headwork/any other irrigation project) and prepare detailed technical report.	2	CO3
LLO 7.1 Prepare detailed technical presentation on any one micro or minor irrigation scheme.	7	*Prepare detailed report on any one irrigation scheme (Micro OR Minor) by site visit or observing relevant videos.	2	CO4
LLO 8.1 Prepare a detailed report on financial assistance of central/state government schemes for the Jalayukt shivar Yojana / Farm ponds / Drip Irrigation scheme.	8	Collect information and Prepare a detailed report on financial assistance of central/state government schemes for the Jalayukt shivar Yojana / Farm ponds / Drip Irrigation scheme.	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 9.1 Draw a labeled sketch of existing Cross section of canal in filling OR cutting OR partial cutting and filling	9	*Sketch the existing Cross section of canal in filling OR in cutting OR in partial cutting and filling, nearby area by measuring actual dimensions.	2	CO5
LLO 10.1 Draw a labeled sketch of Cross Drainage works using actual measurements.	10	Sketch any one existing Cross Drainage works in nearby area by measuring the actual dimensions.	2	CO5

**Note : Out of above suggestive LLOs -**

- '\*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

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

### Micro project

- Prepare a report of cropping pattern, for the given minor or major irrigation project in your area with reference to growth in yield.
- Prepare a report on any one executed system of rainwater harvesting with reference to its necessity, broad design parameters, economics in your area along with your comments.
- Conduct online / internet survey for Watershed management project (s) in the Maharashtra State with a detailed report of at least five relevant technical inputs.
- Summarize the relevant information in the form of the report from internet regarding types of satellite imagery to capture the necessary details of the given water resource projects.
- Prepare a report on any one executed system of Farm ponds or Jalayukt shivar schemes or drip irrigation scheme with emphasis on its suitability, costing, utility and maintenance after undertaking the visit to it.
- Visit to the nearby rain gauge station and obtain information for the average rainfall for the particular day.
- NOTE: "These are the optional activities for extra learning of students".

### Assignment

- Compare Automatic & Nonautomatic rain gauges based on any four points.
- Prepare details report of IMD rain gauge stations in your locality.
- Visit to a drip irrigation installation in your area & write brief report.
- Prepare a short report on well irrigation based on yield & season wise crops grown.
- Prepare a model of dam by using locally available material.
- Write the initiatives taken by state government for drip irrigation & sprinkler irrigation.
- Write a short report on cooperative equal water distribution system in your area.
- Measure evaporation of water in summer season by using available vessels & equipment's.
- NOTE: "These are the optional activities for extra learning of students".

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	N.A	

**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Irrigation and Hydrology	CO1	7	4	4	4	12
2	II	Crop water requirement and Reservoir Planning	CO2	9	0	4	12	16
3	III	Dams and Spillways	CO3	11	4	8	6	18
4	IV	Minor and Micro Irrigation	CO4	5	2	4	4	10
5	V	Diversion Headwork and Canals	CO5	8	0	8	6	14
<b>Grand Total</b>				<b>40</b>	<b>10</b>	<b>28</b>	<b>32</b>	<b>70</b>

**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- Two-unit tests of 30 marks each will be conducted and average of two-unit tests considered. For formative assessment of laboratory learning 50 marks. Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

**Summative Assessment (Assessment of Learning)**

- Pen and Paper Test (Written Test), Term Work, Practical examination.

**XI. SUGGESTED COS - POS MATRIX FORM**

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

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

## XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Punmia, B.C., Pande B, Lal	Irrigation and water power Engineering	Lakshmi Publications, New Delhi - 110 002. Edition2016 ISBN 13: 9788131807637
2	Sharma R.K. and Sharma T.K	Irrigation Engineering	S.Chand and Company Ltd.Delhi ISBN 13: 9788121921282 Ed.2002
3	Basak N.N.	Irrigation Engineering	McGraw Hill Education India Pvt. Ltd. New Delhi.Edition1999 ISBN 13: 9780074635384
4	Dahigaonkar J.G.	Irrigation Engineering	Asian Book Pvt. Ltd., New Delhi ISBN 13: 9788184120080
5	S.K.Garg	Irrigation and Hydraulic structures	Khanna Publishers, Delhi. ISBN: 978-81-7409-047-9

## XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	<a href="https://wrd.maharashtra.gov.in/">https://wrd.maharashtra.gov.in/</a>	Water resource department, government of Maharashtra, India
2	<a href="https://archive.nptel.ac.in/courses/126/105/126105010/">https://archive.nptel.ac.in/courses/126/105/126105010/</a>	Introduction to Irrigation Engineering and Hydrology
3	<a href="https://www.youtube.com/watch?v=fx1uUek3Iqq">https://www.youtube.com/watch?v=fx1uUek3Iqq</a>	Hydrological cycle and Methods of computing Average rainfall
4	<a href="https://nptel.ac.in/courses/105105110">https://nptel.ac.in/courses/105105110</a>	Surface & ground water resources
5	<a href="https://www.youtube.com/results?search_query=crop+water+requirement">https://www.youtube.com/results?search_query=crop+water+requirement</a>	Crop water requirement
6	<a href="https://archive.nptel.ac.in/courses/126/105/126105010/">https://archive.nptel.ac.in/courses/126/105/126105010/</a>	Crop water requirement
7	<a href="https://www.youtube.com/watch?v=bDwow2-WzHo">https://www.youtube.com/watch?v=bDwow2-WzHo</a>	Introduction to Dams
8	<a href="https://archive.nptel.ac.in/courses/105/105/105105110/">https://archive.nptel.ac.in/courses/105/105/105105110/</a>	Notes on Gravity Dam

<b>Sr.No</b>	<b>Link / Portal</b>	<b>Description</b>
9	<a href="https://archive.nptel.ac.in/courses/105/105/105105110/">https://archive.nptel.ac.in/courses/105/105/105105110/</a>	Notes on Spillways and Energy Dissipators
10	<a href="https://archive.nptel.ac.in/courses/126/105/126105019/">https://archive.nptel.ac.in/courses/126/105/126105019/</a>	Micro irrigation engineering
11	<a href="https://archive.nptel.ac.in/courses/126/105/126105010/">https://archive.nptel.ac.in/courses/126/105/126105010/</a>	Sprinkler irrigation and Drip Irrigation
12	<a href="https://archive.nptel.ac.in/courses/126/105/126105010/">https://archive.nptel.ac.in/courses/126/105/126105010/</a>	Irrigation wells
13	<a href="https://www.youtube.com/watch?v=pEdY37n7CdE">https://www.youtube.com/watch?v=pEdY37n7CdE</a>	Introduction to Canal
14	<a href="https://www.nitsri.ac.in/Department/Civil%20Engineering/CIV-604_IHS-6th_CIVIL-Chapter-5_Notes.pdf">https://www.nitsri.ac.in/Department/Civil%20Engineering/CIV-604_IHS-6th_CIVIL-Chapter-5_Notes.pdf</a>	Cross Drainage works
15	<a href="https://www.youtube.com/watch?v=Ps99Cs0RQJs">https://www.youtube.com/watch?v=Ps99Cs0RQJs</a>	Canal design

**Note :**

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

**Programme Name/s** : Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/  
**Programme Code** : CE/ CR/ CS/ LE  
**Semester** : Fifth  
**Course Title** : EMERGING TRENDS IN CIVIL ENGINEERING  
**Course Code** : 315315

### I. RATIONALE

Civil Engineering is the oldest form of engineering and also the discipline of thinking and building. However, in the era of latest technological development, a civil engineer is required to keep himself updated with the latest trend and techniques in the field to stay competitive and avoid falling behind ensuring its scientific priority and significance. There are genuine, realistic applications and benefits to updating the industry's current needs. These cutting-edge building innovations fundamentally change the scenario of construction sector. It is therefore necessary to figuring out how to incorporate these advancements into their strategies and workflows in various ways. This course will help the learners to know the basic knowhow of all such emerging trends in civil engineering.

### II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Suggest the relevant emerging techniques for the given civil engineering works.

### III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Suggest the relevant softwares for given construction projects.
- CO2 - Select the relevant advance materials for given civil engineering work.
- CO3 - Propose the suitable advance construction equipments for the given work situation.
- CO4 - Adopt the relevant techniques for sustainable construction.
- CO5 - Suggest the relevant advance techniques for given construction activity.

### IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
				CL	TL	LL					FA-TH	SA-TH	Total		Practical		SLA				
							Max	Min					Max	Min	Max	Min	Max	Min			
315315	EMERGING TRENDS IN CIVIL ENGINEERING	ETC	DSC	3	-	-	-	3	1	1.5	30	70*#	100	40	-	-	-	-	-	-	100

**Total IKS Hrs for Sem. : 0 Hrs**

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

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

## V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe merits and demerits of soft computing techniques. TLO 1.2 Suggest the suitable software/s for the given purpose in construction activity.	<b>Unit - I Softwares in Civil Engineering</b> 1.1 Merits and Demerits of soft computing technique. 1.2 Applications of Civil Engineering softwares : Build-Master, HEC-RAS, STRAP, WaterGEMS, ArcGIS, STAAD-Pro, RISA-Connection, MIDAS, Building Information Modeling (BIM), Procure, Primavera Pro, Virtual Reality Software-VR, MX Road Software, Building Planning & Management System (BPMS), Plaxis 3D, Autodesk Construction Cloud, Powerplay, Geo5.	Lecture Using Chalk-Board Video Demonstrations Presentations Demonstration
2	TLO 2.1 Suggest the advanced construction material for given type of construction. TLO 2.2 Enumerate the properties of given construction material. TLO 2.3 Use the relevant advance construction material for the given purpose in construction activity.	<b>Unit - II Advance Construction Materials</b> 2.1 Properties and applications of building materials: Pollution absorbing bricks, Cooling bricks, 3D printed bricks, Interlocking bricks, Translucent wood, Sound proofing walls, Epoxy flooring. 2.2 Properties and applications of road materials: Recycled asphalt shingles, Self healing asphalt, Precast Pre-stressed Concrete Panels (PPCP) 2.3 Properties and applications of concrete materials: Synthetic concrete, New admixtures: Masterglanium, Polycarboxylic Ether, Nano concrete, Light transmitting concrete, Foam concrete, Bendable concrete or Engineered Cementitious Composite (ECC), Concrete Fabric, Hydrophobic concrete, Green concrete, Timbercrete, Ferrock.	Lecture Using Chalk-Board Presentations Video Demonstrations Case Study

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	<p>TLO 3.1 Suggest the relevant survey equipment for specified purpose.</p> <p>TLO 3.2 Propose the relevant type of construction equipment for given purpose.</p> <p>TLO 3.3 Suggest the relevant advance material handling equipment in given situation.</p>	<p><b>Unit - III Advance Construction Equipments</b></p> <p>3.1 Survey equipments: LiDAR, Direct Reading Grade Rods, 3D Laser scanning, Robotic Markout, Google Earth.</p> <p>3.2 Construction equipments: Earth moving equipment: Skid and crawler loaders, Trenchers, Scrappers, Wheeled loading shovels, Advanced plastering machine, Bridge girder launcher.</p> <p>3.3 Material handling equipments: Types of cranes: Floating crane, Rough terrain crane, Bridge Over head crane, Conveyors, Hoists, Types of Forklifts: Telehandler forklift, Rough Terrain forklift, Types of paver: Tracked pavers, Hybrid offset paver, Side feeders, Road header, and Types of Tunnel boring machine: Horizontal boring, Vertical boring, Line boring.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations Case Study</p>
4	<p>TLO 4.1 Explain the necessity of energy audit with relevant methods.</p> <p>TLO 4.2 Propose the relevant recyclable material for the given construction activity.</p> <p>TLO 4.3 Explain the term,</p>	<p><b>Unit - IV Sustainability in Construction</b></p> <p>4.1 Energy Audit: Necessity and methods.</p> <p>4.2 Properties of renewable ,recyclable material and recycling of construction debris with its applications.</p> <p>4.3 Sustainable Drainage system(SuD's) : Principles, Components and Benefits of SuDs.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations Case Study</p>
5	<p>TLO 5.1 Use the relevant building construction techniques for the specified purpose in construction activity.</p> <p>TLO 5.2 Suggest the relevant road construction technique in given situation.</p> <p>TLO 5.3 Undertake the relevant ground improvement technique in the given situation.</p>	<p><b>Unit - V Advance Construction Techniques</b></p> <p>5.1 Building construction techniques: Pre-engineered building using Mivan technology, Façade Technology, Fire protection buildings, 3D printing.</p> <p>5.2 Road construction techniques: Road Printer, Smart roads, Anti-icing roads, Piezoelectric roads, Hyper loop construction, Precast arch bridge construction.</p> <p>5.3 Ground improvement techniques: Advanced piling techniques : Mono piling, Micro Piles, Soil Nailing, Sand Drains, Pre-Fabricated Vertical Drains, Thermal Methods: Soil heating and Soil freezing.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations Case Study</p>

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

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

**Micro project**

- Prepare a report on Zero Energy Building and Green Building stating its case study mentioning material required advantages and disadvantages and applications etc.
- Prepare a report on advanced tools/equipments for the site safety.

- Prepare the charts showing different types of safety rules and regulations of site.
- Prepare a report on Techniques of Earthquake Resistant Structures mentioning methods, merits, practical difficulties, applications etc.
- These are optional activities, which can be preferred by students for extra learning.

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system (Any computer system with appropriate configuration)	All
2	LCD Projector with accessories	All

**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Softwares in Civil Engineering	CO1	6	6	6	2	14
2	II	Advance Construction Materials	CO2	6	6	6	2	14
3	III	Advance Construction Equipments	CO3	8	8	6	4	18
4	IV	Sustainability in Construction	CO4	4	4	4	2	10
5	V	Advance Construction Techniques	CO5	6	6	6	2	14
<b>Grand Total</b>				<b>30</b>	<b>30</b>	<b>28</b>	<b>12</b>	<b>70</b>

**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- Two unit test (MCQ) of 30 marks each will be conducted and average of two-unit test to be considered.

**Summative Assessment (Assessment of Learning)**

- Online MCQ examination

**XI. SUGGESTED COS - POS MATRIX FORM**

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

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

## XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	MSBTE, Mumbai.	Learning Manual of Emerging Trends in Civil Engineering	MSBTE, Mumbai.
2	Dr. Manoranjan Samal	Advanced Construction Techniques and Equipment	S.K. Kataria & Sons, 2022, ISBN: 978-93-5014-751-1
3	Dr. R. P. Rethaliya	Advanced Construction and Equipment	Atul Prakashan, Ahmedabad, 1 January 2019, ISBN: 978-93-81518.94-6
4	Dr. R. Vigneswaran	Advanced Construction Technology	Magnus Publication, ISBN: 978-81-964838-0-7
5	K. Ganesh Babu, H. Sudarsana Rao, Y. Amarnath	Emerging Trends in Civil Engineering Select Proceedings of ICETCE 2018	Springer Publication, 12 January 2020 ISBN:978-9811514036
6	Mohit Bajpai Dr. A.V. Sudhakara Reddy and Dr. V. Lakshmi Devi	Emerging Trends in Engineering and Technology (Volume - 5)	Integrated Publicaions, New Delhi, ISBN:978-93-93502-97-1

## XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	<a href="https://www.engineeringcivil.com/software">https://www.engineeringcivil.com/software</a> .	Introduction of software in civil engineering
2	<a href="https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html">https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html</a>	Advance construction material
3	<a href="https://geniebelt.com/blog/10-innovative-construction-materials">https://geniebelt.com/blog/10-innovative-construction-materials</a>	Innovative construction material
4	<a href="https://www.viatechnik.com/blog/modern-construction-machines-theyre-used/">https://www.viatechnik.com/blog/modern-construction-machines-theyre-used/</a>	Modern construction machines

**EMERGING TRENDS IN CIVIL ENGINEERING****Course Code : 315315**

<b>Sr.No</b>	<b>Link / Portal</b>	<b>Description</b>
5	<a href="https://www.academia.edu/28172313/ADVANCED_BUILDING_CONSTRUCTION_EQUIPMENT">https://www.academia.edu/28172313/ADVANCED_BUILDING_CONSTRUCTION_EQUIPMENT</a>	Advance building construction equipments
6	<a href="https://theconstructor.org/construction/sustainability-construction-civil-engineering/9492/">https://theconstructor.org/construction/sustainability-construction-civil-engineering/9492/</a>	Concept of sustainability
7	<a href="https://www.susdrain.org/delivering-suds/using-suds/suds-components/suds-components">https://www.susdrain.org/delivering-suds/using-suds/suds-components/suds-components</a>	Sustainable drainage system(SuDs)
8	<a href="https://www.designingbuildings.co.uk/wiki/Advanced_construction_technology">https://www.designingbuildings.co.uk/wiki/Advanced_construction_technology</a>	Advanced construction technology
9	<a href="https://www.constructionjunkie.com/blog/2018/1/7/the-16-most-interesting-advances-in-construction-technology-of-2017">https://www.constructionjunkie.com/blog/2018/1/7/the-16-most-interesting-advances-in-construction-technology-of-2017</a>	Most interesting advances in construction technology
10	<a href="https://mysubs.in/buy/recent-trends-in-civil-engineering-and-technology-journal-subscription?gclid=Cj0KCQjw6IfoBRCiARIsAF6q06scZ5teDIexIYz_j85yy2ZH_v1kiQcytNvYf3AelfE3LcZndTbhrOwaAqv2EALw_wcB">https://mysubs.in/buy/recent-trends-in-civil-engineering-and-technology-journal-subscription?gclid=Cj0KCQjw6IfoBRCiARIsAF6q06scZ5teDIexIYz_j85yy2ZH_v1kiQcytNvYf3AelfE3LcZndTbhrOwaAqv2EALw_wcB</a>	Recent Trends In Civil Engineering & Technology (RTCET)
11	<a href="https://www.nobroker.in/blog/mivan-construction-technology-explained/">https://www.nobroker.in/blog/mivan-construction-technology-explained/</a>	Mivan construction technology
<b>Note :</b>		
<ul style="list-style-type: none"> <li>Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students</li> </ul>		

MSBTE Approval Dt. 24/02/2025

Semester - 5, K Scheme

**Programme Name/s** : Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/  
**Programme Code** : CE/ CR/ CS/ LE  
**Semester** : Fifth  
**Course Title** : ENERGY CONSERVATION & GREEN BUILDING  
**Course Code** : 315316

## I. RATIONALE

In current scenario various civil engineering construction practices in exploiting the natural resources which in turn contributes to global climate change and environmental degradation. The Energy Conservation and Green Building course is essential for addressing the pressing challenges of climate change and environmental degradation by reducing carbon footprints and promoting sustainable development. It equips students with the latest knowledge and skills in energy-efficient practices and sustainable building techniques, offering significant economic benefits through cost savings and compliance with regulatory standards. Additionally, it fosters healthier living environments, encourages innovation, and prepares individuals to meet the growing demand for sustainability professionals in the job market.

## II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

To implement various strategies of green building to enhance sustainable environment and to address economic and social challenges of the modern world.

## III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Justify the need of Energy Conservation and Green building
- CO2 - Implement the green principles in the green building construction
- CO3 - Suggest the relevant construction material and techniques for the green building construction.
- CO4 - Conduct the green and environment audit for a green building
- CO5 - Propose a relevant rating system for assessment of given type of green building.

## IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TL				Based on SL			
				CL	TL	LL					FA-TH	SA-TH	Total	Practical		SLA					
				Max	Max	Max	Max	Min			Max	Min	Max	Min	Max	Min					
315316	ENERGY CONSERVATION & GREEN BUILDING	ECG	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

**Total IKS Hrs for Sem. : Hrs**

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

**V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Justify the need of energy conservation in the given civil engineering project TLO 1.2 Adopt the legal provisions in the energy conservation and Green building in given situation. TLO 1.3 Explain the principles and importance of green building TLO 1.4 Implement the relevant principles in green building required for sustainable development	<b>Unit - I Fundamental of Green Building and Energy Conservation</b> 1.1 Introduction to Energy Conservation: Global energy consumption scenario, Energy conservation: Definition, objectives and Importance. 1.2 Salient features of Energy Conservation Act – 2001 1.3 Introduction to Green Building: Definition and Importance of green building concept, History and evolution of green building construction practices, Role of Green Building in sustainable development 1.4 Overview of Sustainable construction: Environmental, economic, and social development	Presentations Video Demonstrations Site/Industry Visit Case Study

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	<p>TLO 2.1 Identify the principles of the given category of green building considering sustainability aspects</p> <p>TLO 2.2 Explain the Salient features of green building</p> <p>TLO 2.3 Illustrate the relevant benefits of green building for the given criteria</p> <p>TLO 2.4 Discuss the future trend in construction of green building</p> <p>TLO 2.5 Evaluate the economic impact of Green Building construction on Stakeholders.</p>	<p><b>Unit - II Green Building Concepts And Sustainable Practices</b></p> <p>2.1 Green Building Principles: a. Sustainable Site Design b. Energy Efficiency and conservation c. Water Efficiency and conservation d. Materials selection and life cycle analysis e. Indoor environmental quality (IEQ)</p> <p>2.2 Salient features of Green Building</p> <p>2.3 Benefits of Green building: Environmental, economic and social benefits.</p> <p>2.4 Future trends in green building</p> <p>2.5 Economical Consideration of green buildings: Initial cost, long term Financial Benefits and Economic Impacts on Stakeholders.</p>	<p>Presentations</p> <p>Video</p> <p>Demonstrations</p> <p>Site/Industry Visit</p> <p>Case Study</p>
3	<p>TLO 3.1 Suggest the relevant types of sustainable materials required for the green building construction</p> <p>TLO 3.2 Propose the relevant energy-efficient technologies based on the given climatic condition</p> <p>TLO 3.3 Implement the professional standards related to sustainability set by various professional organizations</p>	<p><b>Unit - III Sustainable Building Materials and Technologies</b></p> <p>3.1 Sustainable building Materials: (Bamboo, Hempcrete, Recycled Plastic Lumber, Ferrock, Cross-Laminated Timber (CLT) etc) Uses, characteristic, advantages, benefits and limitations, Criteria for selecting sustainable materials.</p> <p>3.2 Energy-Efficient Technologies: a. Building envelope improvement system: Insulation, windows and glazing, air sealing, Cool roofs and green roofs system. b. Building management system: energy management. c. Lighting: LED and daylighting strategies. d. HVAC unit in green Building: Concept and importance</p> <p>3.3 Ethics and Professional Responsibility: Ethical considerations in sustainable design and construction, The role of professionals in promoting sustainability.</p>	<p>Presentations</p> <p>Video</p> <p>Demonstrations</p> <p>Site/Industry Visit</p> <p>Case Study</p>
4	<p>TLO 4.1 Justify the necessity of audit in the given green building construction.</p> <p>TLO 4.2 Create a comprehensive audit plan based on given criteria.</p> <p>TLO 4.3 Conduct an audit of the given Green building.</p> <p>TLO 4.4 Prepare the action plan based on the given audit report</p>	<p><b>Unit - IV Green Building Audit</b></p> <p>4.1 Introduction to Green Building Audits: Definition, scope, Importance and benefits of green building audit.</p> <p>4.2 Planning and Preparation for Green Building Audits: Setting audit objectives and scope, Developing an audit plan and checklist.</p> <p>4.3 Conducting the Green Building Audits: On-site audit procedures and techniques, Data collection methods (e.g., interviews, observations, document reviews).</p> <p>4.4 Reporting and Documentation: Audit reports and documentation, Communicating audit findings and recommendations, Corrective Actions and Continuous Improvement.</p>	<p>Presentations</p> <p>Video</p> <p>Demonstrations</p> <p>Site/Industry Visit</p> <p>Case Study</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Explain the role of the relevant agency responsible for conducting an audit green building TLO 5.2 Conduct an energy audit as per the given type of green rating system.	<b>Unit - V Green Building Standards and Certification Systems</b> 5.1 Functions of government organization working for Energy conservation and Audit(ECA): Ministry of New and Renewable Energy (MNRE), Bureau of Energy efficiency (BEE) Maharashtra Energy Development Agency (MEDA). 5.2 Green building rating system: Leadership in Energy and Environmental Design (LEED) criteria, Indian Green Building council (IGBC) and Green Rating for Integrated Habitat Assessment. (GRIHA): Salient Features and Evaluation Criteria for assessment	Presentations Video Demonstrations Site/Industry Visit Case Study

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Analyze the collected energy data to identify trends, peak usage periods, and potential inefficiencies.	1	*Measurement of energy consumption of existing building.	2	CO1
LLO 2.1 Collect and document information on existing energy efficiency policies and methods implemented by the institution	2	Collection of the relevant documents on existing energy efficiency policies and methods.	2	CO1
LLO 3.1 Conduct a site assessment to evaluate the suitability of the building for solar installation.	3	*Estimation of solar plant capacity of a building on the basis of total electricity consumption.	2	CO2
LLO 4.1 Identify the benefits of green belts in improving building energy efficiency	4	Identify the impact of green belt on the energy level of the building. (By physical verification).	2	CO2
LLO 5.1 Identify the components of HVAC systems in the context of green building design.	5	Identify the components of HVAC unit with space calculation.	2	CO3
LLO 6.1 Prepare a report on properties and performance characteristics of sustainable building materials	6	*Collect the information of any five sustainable building materials for a proposed green building project.	2	CO3
LLO 7.1 Develop a set of ethical guidelines for green building construction.	7	Comparison of ethical guideline provided by various organization for green building construction.	2	CO3
LLO 8.1 Effectively plan and prepare for the energy audit thorough understanding of the chosen energy rating system.	8	*Prepare the action plan for converting conventional building into green building on the basis of energy audit.	2	CO4
LLO 9.1 Develop a comprehensive action plan for converting the conventional building into a green building.	9	*Preparation of action plan for upgrading existing green building to next level.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Determine the building's compliance with green building standards and the rating system.	10	*Comparative Study of IGBC and GRIHA Certification Processes in Buildings.	2	CO5

**Note : Out of above suggestive LLOs -**

- '\*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

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

### Assignment

- Visit to construction site to identify energy resources
- Prepare a report on silent provision made in energy conservation act – 2001
- Prepare a report on sustainable building material available in vicinity.
- Compare the working methodology of different Government organizations such as ECA, MNRE, MEDA & BEE
- Collect the sample Audit Report of any one rating Agency such as IGBC, GRIHA etc.
- Prepare a report on Local Construction Techniques and locally available material which will vary from city to city or from state to state.
- NOTE : These are the optional activities for extra learning of students.

### Micro project

- Prepare a report by taking case study to classify the terms and the construction methodologies between Traditional building and Green building.
- Conduct an energy audit of a small building to identify areas of energy wastage and propose energy-saving measures
- Collect the relevant information of recent technologies in green building construction and prepare a report on it.
- Prepare a questionnaire for environmental audit.
- Design a green roof for a small building or shed. Research suitable plants, materials, and construction methods that promote energy efficiency, improve air quality, and manage stormwater runoff.
- Design a rainwater harvesting system for a building or home. Calculate potential water savings, design storage solutions, and propose implementation steps.
- Explore ways to reuse or upcycle building materials (e.g., reclaimed wood, recycled glass) in construction or renovation projects. Calculate the environmental impact and cost savings.
- Research and analyze different green building certification programs (e.g., LEED, IGBC). Compare their criteria, costs, and benefits, and propose steps for a building to achieve certification.
- NOTE : These are the optional activities for extra learning of students.

### Model/Prototype

- Develop a prototype for a smart home energy monitoring system. Use sensors to monitor energy usage and provide real-time feedback to homeowners on their consumption habits.
- Make a model of solar energy plant.
- NOTE : These are the optional activities for extra learning of students.

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	All practical's are based on Field visits, survey, and report writing. No specific equipment's are required.	All

**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamental of Green Building and Energy Conservation	CO1	4	4	4	0	8
2	II	Green Building Concepts And Sustainable Practices	CO2	8	4	4	6	14
3	III	Sustainable Building Materials and Technologies	CO3	6	2	8	0	10
4	IV	Green Building Audit	CO4	10	0	8	10	18
5	V	Green Building Standards and Certification Systems	CO5	12	0	8	12	20
<b>Grand Total</b>				<b>40</b>	<b>10</b>	<b>32</b>	<b>28</b>	<b>70</b>

**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

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

**Summative Assessment (Assessment of Learning)**

- Pen and Paper Test (Written Test), Term Work, Practical examination.

**XI. SUGGESTED COS - POS MATRIX FORM**

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

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

## XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Sam Kubba	Handbook of Green Building Design and Construction	Butterworth-Heinemann; 1st edition (30 July 2012); CBSPD - NEW DELHI -110092 , ISBN-13 :978-0123851284
2	Bureau of Energy Efficiency (BEE)	Energy Conservation Building Code - India	Bureau of Energy Efficiency (BEE)
3	Indian Green Building Council (IGBC)	Introduction to Green Buildings & Built Environment	BS Publications
4	K. V. Sharma, P. Venkatasashaiah	Energy management and conservation	I K International Publishing House Pvt. Ltd, ISBN-13:978-9381141298
5	Chetan singh, solanki	Renewable energy technologies: a practical guide for beginners	PHI Learning Pvt. Ltd., 2008 ISBN 8120334345, 9788120334342

## XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	<a href="https://www.mahaurja.com/">https://www.mahaurja.com/</a>	Official website of Maharashtra Energy Development Agency (MEDA)
2	<a href="https://mnre.gov.in/">https://mnre.gov.in/</a>	official website of Ministry of New and Renewable Energy
3	<a href="https://beeindia.gov.in/en/about-bee">https://beeindia.gov.in/en/about-bee</a>	Official website of Ministry of New and Renewable Energy
4	<a href="https://www.youtube.com/watch?v=VE2tpwGCN0U">https://www.youtube.com/watch?v=VE2tpwGCN0U</a>	Green Building Ratings and Components

<b>Sr.No</b>	<b>Link / Portal</b>	<b>Description</b>
<p><b>Note :</b></p> <ul style="list-style-type: none"><li>Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students</li></ul>		

**Programme Name/s** : Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/  
**Programme Code** : CE/ CR/ CS/ LE  
**Semester** : Fifth  
**Course Title** : **PRECAST & PRESTRESSED CONCRETE STRUCTURES**  
**Course Code** : 315317

### I. RATIONALE

Precast and Pre-stressed Concrete construction technology is widely used across the world for its inherent advantages. It has been adopted in India from past many years, but was mostly limited to civil structures such as tunnels, bridges, flyovers and underpasses. Today, with critical housing shortages, rising labour and input costs and an increased emphasis on quality and timely delivery, more and more developers are opting for innovative construction practices like precast and pre-stressed concrete. Hence it is essential to make upcoming engineering community aware about this. This course is designed to provide basic knowledge of precast and pre-stressed elements, their design aspects, pre-stressing techniques, methods and basic design principles.

### II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Execute effectively the construction work involving precast and pre-stressed concrete

### III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Propose the relevant precast concrete element for a given situation
- CO2 - Use the relevant components for the prefabricated structure.
- CO3 - Justify the relevance of pre-stressed concrete in a given situation.
- CO4 - Suggest the relevant methods / systems for given construction work.
- CO5 - Evaluate losses in a given pre-stressed concrete construction and Propose a suitable cable profile.

### IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory	Based on LL & TL				Based on SL					
				CL	TL	LL						Practical				SLA					
							Max	Max			Max	Min	Max	Min	Max	Min	Max	Min			
315317	PRECAST & PRESTRESSED CONCRETE STRUCTURES	PPC	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

**Total IKS Hrs for Sem. : 0 Hrs**

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

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

## V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	<p>TLO 1.1 Justify the necessity of the precast concrete in civil engineering.</p> <p>TLO 1.2 Suggest the structural elements that can be casted in precast for the given situation.</p> <p>TLO 1.3 Describe the various components for a Prefabricated building</p> <p>TLO 1.4 Describe the various elements for Non-structural precast concrete.</p> <p>TLO 1.5 Elaborate the IS specifications and provisions for given pre-cast element.</p> <p>TLO 1.6 Conduct the given test on the given components of precast structure</p>	<p><b>Unit - I Precast concrete and its Elements</b></p> <p>1.1 Definition and necessity of precast, Advantages and disadvantages. Materials used.</p> <p>1.2 Study of Structural Precast concrete elements such as fencing poles, transmission poles, paver blocks, doors and window frames, Manhole covers, precast Mesh etc.</p> <p>1.3 Study of Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, staircase elements.</p> <p>1.4 Non-structural precast concrete elements such as bridge panels, tunnel lining, cannel lining, piles, box culvert etc.</p> <p>1.5 Materials required, IS specifications, casting tolerances, fabricating systems, joints, testing, storage and transportation, equipment's for elements such as PCC, RCC, PSC, SCC, Ferro-cement, Autoclaved Aerated Concrete (AAC) and Foam concrete.</p> <p>1.6 Testing of Precast components.</p>	<p>Demonstration Lecture Using Chalk-Board Presentations Site/Industry Visit Video Demonstrations</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	<p>TLO 2.1 Explain the term, “Prefabricated Building Construction”</p> <p>TLO 2.2 Describe modular co-ordination with standard specifications for the given prefabricated elements.</p> <p>TLO 2.3 Classify different prefab systems used in civil engineering.</p> <p>TLO 2.4 Explain the requirements of structural joints of the given prefabricated elements.</p> <p>TLO 2.5 Elaborate the procedure of the storage, transportation and erection for a given precast element.</p> <p>TLO 2.6 Suggest the relevant combinations of mixed and composite construction for the given situation.</p> <p>TLO 2.7 Evaluate the effect of Prefabricated structure on the environment.</p>	<p><b>Unit - II Prefabricated Buildings</b></p> <p>2.1 Concept and Benefits of Prefabricated Construction, Prefabricated Construction Process.</p> <p>2.2 Precast load bearing and non-load bearing wall panels, floor systems, Material characteristics, Plans &amp; Standard specifications, concept of modules, modular co-ordination, modular grids and finishes.</p> <p>2.3 Prefab systems and its classification, structural schemes.</p> <p>2.4 Joints – requirements of structural joints and their design considerations for above elements.</p> <p>2.5 Manufacturing, storage, curing, transportation and erection of above elements, equipment needed.</p> <p>2.6 Introduction to Mixed and composite construction.</p> <p>2.7 Ecological aspect of use of Prefabricated building.</p>	<p>Demonstration Lecture Using Chalk-Board Presentations Site/Industry Visit Video Demonstrations</p>
3	<p>TLO 3.1 Differentiate between pre stressing and post tensioning process used in civil construction</p> <p>TLO 3.2 Apply the prestressing techniques in the required situation.</p> <p>TLO 3.3 Distinguish the prestressed concrete material with other construction materials in given situation.</p> <p>TLO 3.4 Justify the need of high strength material for prestressed concrete.</p> <p>TLO 3.5 Suggest the relevant type of pre-stressing steel for given structural member.</p>	<p><b>Unit - III Fundamentals of Pre-stressed Concrete</b></p> <p>3.1 Concept of pre stressing and post tensioning, basic terminology.</p> <p>3.2 Applications of pre-stressed concrete.</p> <p>3.3 Advantages and disadvantages of pre-stressed concrete with respect to other construction material.</p> <p>3.4 Materials used and their properties, Necessity of high-grade materials. Types of Special concrete/ High Strength concrete and requirements for precast and prestressed members</p> <p>3.5 Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits and applications.</p>	<p>Demonstration Lecture Using Chalk-Board Presentations Site/Industry Visit Video Demonstrations</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	<p>TLO 4.1 Suggest the relevant method of pre-stressing for given structural element.</p> <p>TLO 4.2 Explain Hoyer system of pre-tensioning with labelled sketch.</p> <p>TLO 4.3 Explain relevant system of post-tensioning based on the given criteria with labelled sketch.</p>	<p><b>Unit - IV Methods and Systems of pre-stressing</b></p> <p>4.1 Methods of pre-stressing : Internal and External pre-stressing, Pre and Post tensioning- applications, merits and demerits</p> <p>4.2 Systems for pre tensioning: process, applications, merits and demerits - Hoyer system</p> <p>4.3 Systems for post-tensioning - process, applications, merits and demerits - Freyssinet system, Magnel Blaton system, Gifford Udall system.</p>	<p>Demonstration</p> <p>Lecture Using Chalk-Board</p> <p>Presentations</p> <p>Site/Industry Visit</p> <p>Video</p> <p>Demonstrations</p>
5	<p>TLO 5.1 Identify the reasons for loss of pre-stress in the given element.</p> <p>TLO 5.2 Describe the situations in which the given elements exhibit the loss of pre-stress.</p> <p>TLO 5.3 Elaborate the IS specifications and provisions for losses in case of Pre and Post tensioning.</p> <p>TLO 5.4 Explain the assumptions made in the analysis of pre-stressed concrete beams.</p> <p>TLO 5.5 Draw the cable profiles for various load combinations in the given situation.</p> <p>TLO 5.6 Evaluate the effect of the given cable profile on fiber stresses.</p>	<p><b>Unit - V Losses of pre-stress and Analysis of Pre-stressed rectangular beam section</b></p> <p>5.1 Pre-stressing force in Cable, Meaning of Loss of Pre-stress.</p> <p>5.2 Loss of pre-stress during the tensioning process - loss due to friction, length effect, wobbling effect and curvature effect, Loss of pre-stress at the anchoring stage, Loss of pre-stress occurring subsequently: losses due to shrinkage of concrete, creep of concrete, elastic shortening, and creep in steel.</p> <p>5.3 IS recommendations for % losses in case of Pre and Post tensioning.</p> <p>5.4 Basic assumptions in analysis of pre-stressed concrete beams.</p> <p>5.5 Cable Profile in simply supported rectangular beam section – concentric, eccentric straight and parabolic</p> <p>5.6 Effect of cable profile on maximum stresses at mid span and at support. (No Numerical problems in theory examination)</p>	<p>Demonstration</p> <p>Lecture Using Chalk-Board</p> <p>Presentations</p> <p>Site/Industry Visit</p> <p>Video</p> <p>Demonstrations</p>

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Verify the actual dimension of precast element at site with that of drawing.	1	*Verification of the dimensions of any three precast elements mentioned in the drawing through physical inspection. (e.g. manhole covers, paver blocks, hollow blocks, solid blocks, curb stones etc)	2	CO1

<b>Practical / Tutorial / Laboratory Learning Outcome (LLO)</b>	<b>Sr No</b>	<b>Laboratory Experiment / Practical Titles / Tutorial Titles</b>	<b>Number of hrs.</b>	<b>Relevant COs</b>
LLO 2.1 Prepare report of field visit or video demonstration to a manufacturing unit of precast products with reference to the points such as manufacturing process, curing, stacking, handling, in-house inspec	2	*Prepare report of field visit or by video demonstration to a manufacturing unit (of precast elements such as bridges, girders, fencing pole, transmission pole, electric pole, concrete sleepers etc.)	2	CO1
LLO 3.1 Test the given solid or hollow precast blocks to determine its compressive strength and water absorption.	3	*Determination of compressive strength and water absorption of given solid or hollow precast blocks	2	CO1
LLO 4.1 Test the given Auto clave Aerated Concrete Block (AAC) to determine its compressive strength and water absorption.	4	Determination of compressive strength and water absorption of given Auto clave Aerated Concrete Block (AAC).	2	CO1
LLO 5.1 Test the given paver blocks to determine its compressive strength and water absorption.	5	* Determination of compressive strength and water absorption of given paver blocks	2	CO1
LLO 6.1 Conduct the load test on the given manhole cover to predict its behavior after failure.	6	Carry out load test on given manhole cover as per IS 12592:2002 Annex C	2	CO1
LLO 7.1 Prepare a report on the basis of field visit or video demonstration of a precast manufacturing unit of building elements with reference to the points such as manufacturing process, curing, stacking, h	7	Organize field visit or video demonstration of precast manufacturing unit (such as lintel, chajja, door frame, wall panels, stair steps etc.)	2	CO2
LLO 8.1 Prepare a report on various types of pre-stressing wires / cables / strands for given situation on the basis of review of technical brochure/ specifications.	8	Collection of samples of various types of pre-stressing wires / cables / strands with their technical specifications/brochure.	2	CO3
LLO 9.1 Prepare a report on different types of joints for various precast components for a given situation.	9	*Collect information and photographs of for Various types of joints of precast members. (minimum five different type of joints)	2	CO2
LLO 10.1 Draw a detailed cross section of cable profile for a given situation. (Central point load and uniformly distributed load) for eccentric prestressing force and axial force.	10	*Draw a detailed longitudinal and cross section of cable profile for different loading conditions.	2	CO5

**Note : Out of above suggestive LLOs -**

- '\*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

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

**Micro project**

- Collect pictorial information about precast structural elements (i. e. slab panel, wall panel, beam, column etc).
- Collect data of pre-stressed components manufactured in your vicinity.
- Write a detailed report of visit to any one prefabricated unit.
- Collect data for materials required for precast elements, with their suppliers, sale price etc.
- Prepare a power point presentation on systems of pre-stressing (minimum 8 slides)
- Present a seminar on testing of precast units.
- Collect samples of at least five precast elements from your area.
- Prepare a visit report on bridge site to know the panel sizes, method of pre-stressing.

**Assignment**

- Write stepwise procedure of Erection of prefabricated structures.
- Compare minimum five cast in situ and precast elements with respect to time required, quality and cost.
- Write stepwise procedure of pre tensioning of a bridge Girder by observing respective video demonstration.
- Write a stepwise procedure of post tensioning of Bridge panel or Flat Slab by observing respective video demonstration.
- Collect information of IS codes related to various precast elements.
- NOTE: The suggested micro project/ Assignments are optional and given for students additional learning.

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

<b>Sr.No</b>	<b>Equipment Name with Broad Specifications</b>	<b>Relevant LLO Number</b>
1	Hot air electric oven having temperature range 50 C to 2500 C, removable 2-3 stainless steel shelves, thermostat, digital temp controller, with mineral wool insulation, door walls with silicon rubber gasket and lock	3,4,5
2	Compression Testing Machine: Digital display manual control compression testing; machine; Max. Capacity (KN): 2000 ; Measuring range: 4%-100% of FS; Max. distance between two platen (mm): 330; Compression plate size (mm): 220×220; Max. piston stroke (mm): 0-20; Max. piston speed (mm/min): Approx. 30; Column clearance 300×200; Oil pump motor power (KW): 1.5	3,4,5
3	Digital display balance of capacity 10 kg having LC 10 gm and of capacity 30 kg having LC 10 gm	3,4,5,6

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
4	Universal Testing Machine: Capacity – 1000 kN. Type: Mechanical type / digital, electrically Operated with accessories such as (1) Tensile test attachment for wire specimen, (2) Compression test attachment, (3) Transverse test attachment with bending Punch, along with service tools and operation manual	3,4,5,6
5	Test frame for load test for manhole covers	6

### IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Precast concrete and its Elements	CO1	8	2	8	4	14
2	II	Prefabricated Buildings	CO2	9	2	8	6	16
3	III	Fundamentals of Pre-stressed Concrete	CO3	7	2	4	6	12
4	IV	Methods and Systems of pre- stressing	CO4	6	0	4	6	10
5	V	Losses of pre-stress and Analysis of Pre-stressed rectangular beam section	CO5	10	4	8	6	18
<b>Grand Total</b>				<b>40</b>	<b>10</b>	<b>32</b>	<b>28</b>	<b>70</b>

### X. ASSESSMENT METHODOLOGIES/TOOLS

#### Formative assessment (Assessment for Learning)

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

#### Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test), Term Work, Practical examination.

### XI. SUGGESTED COS - POS MATRIX FORM

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

**PRECAST & PRESTRESSED CONCRETE STRUCTURES****Course Code : 315317**

CO3	2	2	1	2	1	2	2			
CO4	1	2	2	2	2	1	2			
CO5	2	2	2	2	2	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -

\*PSOs are to be formulated at institute level

**XII. SUGGESTED LEARNING MATERIALS / BOOKS**

Sr.No	Author	Title	Publisher with ISBN Number
1	Marzuki , Nor Ashikin	Pre-Cast and Pre-Stress Technology: Process, Method and Future Technology	Create space Independent Publication ISBN 10: 1499353391 ISBN 13: 978-1499353396
2	Elliott, Kim S.	Precast Concrete Structures	CRC Press, New York, 2011 ISBN- 13: 9781498723992
3	Lin, T.Y.	Design Of Pre-stressed Concrete Structures	John Wiley and Sons, New York, 2014 ISBN- 8: 0471018988
4	Krishna Raju, N.	Pre-stressed Concrete	Tata McGraw Hill, New Delhi, 2012 ISBN 10: 1259003361 ISBN 13: 9781259003363
5	Nagarajan, Pravin	Pre-stressed Concrete Structures	Pearson Education India ISBN 9332517614, 9789332517615

**XIII. LEARNING WEBSITES & PORTALS**

Sr.No	Link / Portal	Description
1	<a href="https://youtu.be/WWm5S2L-VCI?si=30k3M9OWF0fyEqJk">https://youtu.be/WWm5S2L-VCI?si=30k3M9OWF0fyEqJk</a>	Build a home in 8 weeks with Precast Concrete Homes.
2	<a href="https://youtu.be/nlgYwCQsoEs?si=Pexa85CsY9VEjBW3">https://youtu.be/nlgYwCQsoEs?si=Pexa85CsY9VEjBW3</a>	Precast House
3	<a href="https://youtu.be/F-eiUHWN3-s?si=nB-fKEt7on-w2DLp">https://youtu.be/F-eiUHWN3-s?si=nB-fKEt7on-w2DLp</a>	The Key Design Principles for Precast Concrete Design
4	<a href="https://youtu.be/hMwwPjKeHnc?si=7jieERxp6MoYWFpl">https://youtu.be/hMwwPjKeHnc?si=7jieERxp6MoYWFpl</a>	Watch How Precast Concrete Wall Panels are Installed for a House
5	<a href="https://youtu.be/2OUgqlzDIrw?si=GHRLAmm3VCr5UyrB">https://youtu.be/2OUgqlzDIrw?si=GHRLAmm3VCr5UyrB</a>	FOAM CONCRETE, affordable house built in 6 days!
6	<a href="https://youtu.be/blM396ZtCY4?si=0qnjs1mMQdO-0Vi6">https://youtu.be/blM396ZtCY4?si=0qnjs1mMQdO-0Vi6</a>	hollow block making process in India, concrete hollow bricks, hollow bricks machine
7	<a href="https://youtu.be/h3N0vzU5VO8?si=oYLDfBWYQY0ShLxy">https://youtu.be/h3N0vzU5VO8?si=oYLDfBWYQY0ShLxy</a>	AAC Block Making Process
8	<a href="https://youtu.be/4KYPltsNAWs?si=Ak_QoFz20p4IIsVf">https://youtu.be/4KYPltsNAWs?si=Ak_QoFz20p4IIsVf</a>	Lecture 1 - Prestressing System by NPTEL
9	<a href="https://youtu.be/4NelroYGY3U?si=vhPOEijKq-U_5QWk">https://youtu.be/4NelroYGY3U?si=vhPOEijKq-U_5QWk</a>	Lecture-2-Type of Prestressing
10	<a href="https://youtu.be/aJfCAgeJ55I?si=7c-VEBxz0Kmq5Wr5">https://youtu.be/aJfCAgeJ55I?si=7c-VEBxz0Kmq5Wr5</a>	Lecture-3-Prestressing System and Devices (Pre-Tensioning) by NPTEL
11	<a href="https://youtu.be/9ROVbBANMUU?si=4VVbRi8vS4JxIuJO">https://youtu.be/9ROVbBANMUU?si=4VVbRi8vS4JxIuJO</a>	Lecture-4-Prestressing System and Devices (Post-Tensioning) by NPTEL
12	<a href="https://youtu.be/Mlvfc6xScMo?si=uRxbbFL269c8-9jS">https://youtu.be/Mlvfc6xScMo?si=uRxbbFL269c8-9jS</a>	Pre-Tensioning VS Post Tensioning

<b>Sr.No</b>	<b>Link / Portal</b>	<b>Description</b>
13	<a href="https://youtu.be/yOuk_DSuTb0?si=wdq-wbMZSmleCFBp">https://youtu.be/yOuk_DSuTb0?si=wdq-wbMZSmleCFBp</a>	Prestressed Concrete
14	<a href="https://youtu.be/mfZo_HvMmM8?si=mP0Bqf7vRdnN7Xke">https://youtu.be/mfZo_HvMmM8?si=mP0Bqf7vRdnN7Xke</a>	Prestressed Concrete - Unbonded Post-Tensioning
<b>Note :</b> <ul style="list-style-type: none"><li>Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students</li></ul>		

**Programme Name/s** : Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/  
**Programme Code** : CE/ CR/ CS/ LE  
**Semester** : Fifth  
**Course Title** : ROAD TRAFFIC ENGINEERING  
**Course Code** : 315318

### I. RATIONALE

Transportation is backbone of our country. For smooth flow of traffic without any congestion, Traffic engineering is an important aspect of road transportation. Due to the abundant growth in population and infrastructure development, there is urgent need for proper planning, management and designing. Similarly, on street parking and off street parking on road and road side is also very important to improve the road dynamics including safety of vehicle users as well as pedestrians. Relevant legislations also play important role to improve traffic regulation and rules for smooth and safe flow of traffic. This course is expected to develop basic knowledge of performing various traffic surveys, analysis and interpretation of the data and provide the solutions for smooth flow of traffic.

### II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Manage the traffic flow condition effectively and efficiently in the given locality.

### III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Analyze the traffic characteristics for the given road pattern.
- CO2 - Undertake relevant types of traffic surveys for the identified situation.
- CO3 - Design the typical parking pattern for the given area.
- CO4 - Justify the need of lighting along with arboriculture for given road section.
- CO5 - Suggest the preventive measures to avoid accidents.

### IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										
				Actual Contact Hrs./Week			SLH	NLH			Theory	Based on LL & TL				Based on SL		Total Marks			
				CL	TL	LL						Practical				SLA					
							FA-TH	SA-TH				Total		FA-PR		SA-PR			Max	Min	
315318	ROAD TRAFFIC ENGINEERING	TEN	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

**Total IKS Hrs for Sem. : Hrs**

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

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self learning hours shall not be reflected in the Time Table.
7. \* Self learning includes micro project / assignment / other activities.

**V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	<p>TLO 1.1 Explain the necessity of traffic management in the given locality.</p> <p>TLO 1.2 Describe the characteristics of road users in the given situation.</p> <p>TLO 1.3 Describe the vehicular characteristics for the given road section.</p> <p>TLO 1.4 Signify the importance of the road characteristics for the given road condition.</p> <p>TLO 1.5 Determine reaction time of driver in the given situation.</p>	<p><b>Unit - I Fundamentals of Traffic Engineering.</b></p> <p>1.1 Traffic engineering- Definition, objects, scope`</p> <p>1.2 Road user's characteristics-physical, mental, emotional factors.</p> <p>1.3 Vehicular characteristics-width, length, height, weight, speed, efficiency of breaks.</p> <p>1.4 Road characteristics-gradient, curve of a road, design speed, friction between road and tyre surface.</p> <p>1.5 Reaction time-factors affecting reaction time. PIEV Theory.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	<p>TLO 2.1 Clarify the use of terms such as, “Speed, journey, Time and Delay Studies” in traffic survey.</p> <p>TLO 2.2 Collect traffic volume count data for the given road section.</p> <p>TLO 2.3 Analyze the data collected for origin-destination studies of the given road.</p> <p>TLO 2.4 Evaluate spot-speed study data collected for the given road.</p> <p>TLO 2.5 Explain the term, “ITS (Intelligent Transport system)” with its application.</p> <p>TLO 2.6 Suggest the relevant measure/s to control the Urban Traffic conditions in the given situation.</p>	<p><b>Unit - II Traffic Surveys and Intelligent Transport system</b></p> <p>2.1 Introduction and Use of Speed, journey, Time and Delay studies.</p> <p>2.2 Traffic volume count data-representation and analysis of data.</p> <p>2.3 Necessity of O-D study and its methods.</p> <p>2.4 Speed studies, spot speed studies and its presentation.</p> <p>2.5 ITS and Its application.</p> <p>2.6 Difficulties in Urban Traffic conditions and measures to meet the problems.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations</p>
3	<p>TLO 3.1 Justify the need of parking in the given area.</p> <p>TLO 3.2 Undertake the relevant type of survey for parking purpose in a given locality.</p> <p>TLO 3.3 Explain the impact of unplanned parking</p> <p>TLO 3.4 Compute the parking space requirement in the given area using IRC standards.</p> <p>TLO 3.5 Draw layouts of different On-street parking for given locality.</p> <p>TLO 3.6 Propose the relevant Off-street parking pattern for the given locality.</p> <p>TLO 3.7 Justify the necessity of Parking regulation.</p>	<p><b>Unit - III Parking studies</b></p> <p>3.1 Need of parking survey and common terms.</p> <p>3.2 Types of Parking Survey.</p> <p>3.3 Parking Problems, ill Effects of parking.</p> <p>3.4 Parking Space Requirement as per IRC standards.</p> <p>3.5 On-street parking facilities and layout.</p> <p>3.6 Off-street parking facilities and methods.</p> <p>3.7 Need for Parking regulation and its types.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations</p>
4	<p>TLO 4.1 Design the street lighting system for the given road section.</p> <p>TLO 4.2 Suggest the relevant type of trees for road side plantation based on the given criteria to increase the visibility.</p> <p>TLO 4.3 Justify the need of protecting the road side plantation.</p> <p>TLO 4.4 Describe the methods of protecting the road side plantation.</p>	<p><b>Unit - IV Street lighting and Arboriculture</b></p> <p>4.1 Street lighting –definition, sources necessity, types-luminaire, foot candle, lumen, factors affecting their utilization and maintenance.</p> <p>4.2 Factors affecting visibility at night.</p> <p>4.3 Arboriculture- definition, objectives, factors affecting selection of type of trees.</p> <p>4.4 Maintenance of trees-protection and care of road side trees</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	<p>TLO 5.1 Explain the types of collision occurring during road accident.</p> <p>TLO 5.2 Explain the causes of accident occurred on the given road section.</p> <p>TLO 5.3 Suggest preventive measures to avoid the accidents on the given road section</p> <p>TLO 5.4 Interpret the given symbol employed in collision condition diagram.</p> <p>TLO 5.5 Suggest preventive measures used for Pedestrian safety.</p> <p>TLO 5.6 Explain the relevant legislation related to road user's safety.</p>	<p><b>Unit - V Road Accident Studies</b></p> <p>5.1 Road Accidents-Definition, Types-Collision and non-collision accidents.</p> <p>5.2 Causes of accidents.</p> <p>5.3 Measures to prevent road accidents.</p> <p>5.4 Collision and condition diagram</p> <p>5.5 Considerations regarding Pedestrian safety.</p> <p>5.6 Legislation and law enforcement, education and propaganda.</p>	<p>Lecture Using Chalk-Board Presentations Video Demonstrations</p>

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare a report on Road user's and Vehicular characteristics for any existing road.	1	*Identification of road traffic characteristics for any existing road.	2	CO1
LLO 2.1 Analyze the measured traffic volume at an intersection in peak hours (Morning & Evening).	2	Traffic volume analysis for the given section of road.	2	CO2
LLO 3.1 Prepare a report on analysis of the relevant data collected during O-D study with a brief Description report on factors affecting trip generation.	3	*Analysis of the relevant data with a brief report on Factors affecting trip generation.	2	CO2
LLO 4.1 Determine the percentile speed graphically based on measured data of the spot speed on corridor of given road way.	4	*Determination of percentile speed using the distribution of spot speeds data.	2	CO2
LLO 5.1 Conduct the parking survey for institute campus with your recommendations on improvement of parking system.	5	Carry out parking survey and prepare a report on vehicle parking systems.	2	CO3
LLO 6.1 Observe the traffic and parking behavior at a crowded area to identify the relevant issues to be addressed.	6	*Analysis of Local Traffic and Parking Behavior in a Crowded Area.	2	CO3
LLO 7.1 Prepare a site visit report on the existing street lighting system of any two types of roads in your area.	7	Field visit to observe Existing Street Lighting Systems.	2	CO4
LLO 8.1 Identify the existing type of trees to suggest relevant maintenance required.	8	*Identification of type of tree on a given road to suggest relevant maintenance strategy.	2	CO4
LLO 9.1 Draw a collision diagram with a labelled sketch for the point of conflicts on the basis of the observation made at a busy intersection.	9	Field visit to an intersection to identify the point of conflicts.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Prepare the report on the Field visit to an intersection to identify Causes of Accidents and required Preventive Measures.	10	*Field visit to an intersection to identify Causes of Accidents and required Preventive Measures.	2	CO5

**Note : Out of above suggestive LLOs -**

- '\*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

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

### Assignment

- Write criteria for application of speed limits of 50,65,80 and 100kmph.
- Identify the criteria for provision of grade separated intersection.
- Explain pedestrian crossing design.
- Prepare a chart of Parking Space Requirement as per IRC standards.
- Download road safety audit form(A-1) and find causes and intensity of accident.
- Illustrate uniform motor vehicle Act.1988 for traffic regulation.
- These are the optional activities for extra learning of students.

### Micro project

- Perform traffic survey of busy road junction of city in groups and to suggest measures for improvement.
- Illustrate the technique shifting of trees while widening of road.
- Prepare a report on ITS (Intelligent Traffic Survey) in any three countries.
- Identify the any three method of the planting, protecting and maintaining the trees along the road.
- Prepare a model of any three traffic controlling devices.
- Prepare a report on advanced Vehicle Control System(.IVHS)
- These are the optional activities for extra learning of students.

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

## VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
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**ROAD TRAFFIC ENGINEERING****Course Code : 315318**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system (Any computer system with basic configuration) Drawing board with accessories	All
2	Drawing board with accessories.	All
3	LCD Projector with accessories	All
4	Measuring tape.	All
5	Line Dori, white wash, brush	All

**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Traffic Engineering.	CO1	4	0	8	0	8
2	II	Traffic Surveys and Intelligent Transport system	CO2	10	4	8	6	18
3	III	Parking studies	CO3	10	4	8	6	18
4	IV	Street lighting and Arboriculture	CO4	8	0	8	4	12
5	V	Road Accident Studies	CO5	8	2	0	12	14
<b>Grand Total</b>				<b>40</b>	<b>10</b>	<b>32</b>	<b>28</b>	<b>70</b>

**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

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

**Summative Assessment (Assessment of Learning)**

- Pen and Paper Test (Written Test), Term Work, Practical examination.

**XI. SUGGESTED COS - POS MATRIX FORM**

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

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CO4	2	1	1	1	3	2	2		
CO5	2	1	2	2	2	2	2		

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

**XII. SUGGESTED LEARNING MATERIALS / BOOKS**

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr.L.R.Kadiyali	Traffic Engineering and Transport Planning	Khanna Publishers, Delhi, 2001, ISBN:10: 8185240779;
2	Arora, N. L.	Transportation Engineering	Khanna Publishers, Delhi, 1996, ISBN: 81-7319-0933,
3	Vazirani, V N Chaondola, S P	Transportation Engineering Vol. I & II	Khanna Publishers. Delhi, 2016 ISBN: 9780128038185; 9780128038895
4	Saxsena, S C	Traffic planning and design	Dhanpat Rai & Sons Delhi, 2016 ISBN-10: 8123915500
5	Khanna S.K., Justo, C E G and Veeraragavan, A.	Highway Engineering	New Chand and Brothers, Rookie, 2010, ISBN 978-8185240800

**XIII. LEARNING WEBSITES & PORTALS**

Sr.No	Link / Portal	Description
1	<a href="https://archive.nptel.ac.in/courses/105/101/105101008/">https://archive.nptel.ac.in/courses/105/101/105101008/</a>	Fundamentals of Traffic Engineering and Traffic Surveys
2	<a href="https://www.youtube.com/watch?v=G7qU7HOw9QA">https://www.youtube.com/watch?v=G7qU7HOw9QA</a>	Fundamentals of Traffic Engineering
3	<a href="https://www.scribd.com/doc/216984580/nptel-ceTEI-L38">https://www.scribd.com/doc/216984580/nptel-ceTEI-L38</a>	Parking studies
4	<a href="https://www.youtube.com/playlist?list=PLCC59953860B62145">https://www.youtube.com/playlist?list=PLCC59953860B62145</a>	Road Accident Studies
5	<a href="https://archive.nptel.ac.in/courses/105/105/105105215/">https://archive.nptel.ac.in/courses/105/105/105105215/</a>	Traffic engineering
6	<a href="https://www.youtube.com/results?search_query=spot+speed+study+traffic-engineering+nptel">https://www.youtube.com/results?search_query=spot+speed+study+traffic-engineering+nptel</a>	Spot speed studies
7	<a href="https://www.youtube.com/watch?v=U46xKnQjfnI&amp;list=PLXkUO1gJka5Ly7H99IILMdJw415xZoBvR&amp;index=2">https://www.youtube.com/watch?v=U46xKnQjfnI&amp;list=PLXkUO1gJka5Ly7H99IILMdJw415xZoBvR&amp;index=2</a>	Traffic stream and traffic volume
8	<a href="https://www.youtube.com/watch?v=WSxdh50iZpU">https://www.youtube.com/watch?v=WSxdh50iZpU</a>	Road arboriculture

**Note :**

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