Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY , BANGALORE-90

LABORATORY PLAN

Academic Year 2019-20

Program:	B E – Civil Engineering
Semester :	6th
Course Code:	17CVL67
Course Title:	Software Application Lab
Credit / L-T-P:	2 / 1-0-2
Total Contact Hours:	40
Course Plan Author:	MOHAN K T

Academic Evaluation and Monitoring Cell

Hesaragatta Main Road, Chimney Hills
Chikkabanavara Post Bangalore-560090
PH-080-23721477/23721315
www.Skit.org, Email: skitprinci1@gmail.com

INSTRUCTIONS TO TEACHERS

- Classroom / Lab activity shall be started after taking attendance.
- Attendance shall only be signed in the classroom by students.
- Three hours attendance should be given to each Lab.
- Use only Blue or Black Pen to fill the attendance.
- Attendance shall be updated on-line & status discussed in DUGC.
- No attendance should be added to late comers.
- Modification of any attendance, over writings, etc is strictly prohibited.
- Updated register is to be brought to every academic review meeting as per the COE.

Table of Contents

A. LABORATORY INFORMATION....4
1. Laboratory Overview....4
2. Laboratory Content....4
3. Laboratory Material....4
4. Laboratory Prerequisites:....5
5. Content for Placement, Profession, HE and GATE....5
B. Laboratory Instructions....5
1. General Instructions....5
2. Laboratory Specific Instructions....6
C. OBE PARAMETERS....6
1. Laboratory Outcomes....6
2. Laboratory Applications....7
3. Mapping And Justification....7
4. Articulation Matrix....8
5. Curricular Gap and Experiments....9
6. Experiments Beyond Syllabus....9
D. COURSE ASSESSMENT....9
1. Laboratory Coverage....9
2. Continuous Internal Assessment (CIA)....10
D. EXPERIMENTS....10
Experiment 01 : Analyze the given truss using STAAD Pro software....10
Analyze the given truss using STAAD Pro software....10
Experiment 02:....11
Analyze the given continuous beam using STAAD Pro software....11
Experiment 03 :....12
Analyze the given Portal Frames using STAAD Pro software....12
Analyze the given Portal Frames using STAAD Pro software....12
To Analyze the given Portal Frames using STAAD Pro software....12
Experiment 04 : scheduling of project....13
Experiment 05 : design of singly reinforced beams....13
singly reinforced beams....14
Experiment 06 : design of doubly reinforced beams....14
doubly reinforced beams....14
Experiment 07 : design of one way slabs....15
Experiment 08 : design of two way slabs....16
Experiment 09 : computation of earthwork....16
Experiment 10 : design of horizontal curve....17
Experiment 11 : design of super elevation....17
F. Content to Experiment Outcomes....18
1. TLPA Parameters....18
2. Concepts and Outcomes:....19

Note : Remove “Table of Content” before including in CP Book
Each Laboratory Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. LABORATORY INFORMATION

1. Laboratory Overview

Degree:	B. E	*Program*	CIVIL
Year / Semester :	3 / 6TH	*Academic Year:*	2019-20
Course Title:	Computer Aided Detailing of Structures	*Course Code:*	17CVL67
Credit / L-T-P:	02/ 1-0-2	*SEE Duration:*	180 Minutes
Total Contact Hours:	40 Hrs	*SEE Marks:*	80 Marks
CIA Marks:	20	*Assignment*	
Course Plan Author:	MOHAN K T	*Sign*	Dt :
Checked By:		*Sign*	Dt :

2. Laboratory Content

Exp	Title of the Experiments	Lab Hours	Concept	Blooms Level
1	Analysis of plane trusses.	03	Truss	L4
2	Analysis of continuous beams.	03	Beams	L4
3	Analysis of portal frames.	03	Portal Frames	L4
4	Understanding basic features of Project management software.	03	Project Management	L3
5	Design of Singly Reinforced Beams	03	Design of Beams	L6
6	Design of Doubly Reinforced Beams	03	Design of Beams	L6
7	Design of One way Slabs	03	Design of Slabs	L6
8	Design of Two way Slabs	03	Design of Slabs	L6
9	Computation of Earthwork	03	Estimation	L3
10	Design of horizontal curve by offset method	03	Design of Horizontal Curve	L6
11	Design of Super elevation.	03	Design of super elevation	L6

3. Laboratory Material

Books & other material as recommended by university (A, B) and additional resources used by Laboratory teacher (C).

Expt.	Details	Expt. in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2, 3, 4, 5	Training manuals and User manuals and Relevant course reference books		In Lib / In Dept
1			In Lib/ In dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2			In Lib
1, 2			Not Available
3, 4, 5			
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
1	https://youtu.be/w9t7Ht9HcGg		
2	https://youtu.be/RwXcH-2wE-A		
3	https://youtu.be/a5VlPG1C8js		
4	https://youtu.be/GkBQUI6waFQ		
5	https://youtu.be/mx3di5cGO6s		
6	https://youtu.be/h83KKRtbXwM		
7	https://youtu.be/gPKFfU3iTyQ		
8	https://youtu.be/FzOKmn2xG20		
9	https://youtu.be/0apI52PVi3Q		
10	https://youtu.be/6Yo8tmlC0mc		
11	https://youtu.be/FoFmtz0PwE4		
12	https://youtu.be/g4OO8yH20bc		
13	https://youtu.be/omrr9osx4dM		
14	https://youtu.be/GD760_NqXjU		
15	https://youtu.be/FA9N22DYjuQ		
16	https://youtu.be/D6axnPS3KH4		
D	**Software Tools for Design**	**-**	**-**
	Staad.Pro, ETABS, Primavera, MSP , Excel, GIS.		
E	**Recent Developments for Research**	**-**	**-**
		?	In lib
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1			
?			

4. Laboratory Prerequisites:

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

-	-	Base Course:		-	-
SNo	Course Code	Course Name	Topic / Description	Sem	Remarks
1	15CV51	Design of RC Structural Elements	Analysis and Design concepts of RCC structural elements	5	

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Expt.	Topic / Description	Area	Remarks	Blooms Level
1				
3				
3				
5				
-				

B. Laboratory Instructions

1. General Instructions

SNo	Instructions	Remarks
1	Observation book and Lab record are compulsory.	
2	Students should report to the concerned lab as per the time table.	
3	After completion of the program, certification of the concerned staff in-charge in the observation book is necessary.	
4	Student should bring a notebook of 100 pages and should enter the readings /observations into the notebook while performing the experiment.	
5	The record of observations along with the detailed experimental procedure of the experiment in the Immediate last session should be submitted and certified staff member in-charge.	
6	Should attempt all problems / assignments given in the list session wise.	
7	It is responsibility to create a separate directory to store all the programs, so that nobody else can read or copy.	
8	When the experiment is completed, should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.	
9	Any damage of the equipment or burn-out components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year	
10	Completed lab assignments should be submitted in the form of a Lab Record in which you have to write the algorithm, program code along with comments and output for various inputs given	

2. Laboratory Specific Instructions

SNo	Specific Instructions	Remarks
1	Start computer	
2	Open the text editor	
3	Select new file.	
4	Write the program	
5	Save the program with .c extension.	
6	Compile the program F9	
7	Execute the program F10	

C. OBE PARAMETERS

1. Laboratory Outcomes

Note: Identify a max of 2 Concepts per unit. Write 1 CO per concept.

#	COs	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	Students should be able to analyze the Plane Trusses	06	Truss	Demonstrate	Assignment	L4
2	Students should be able to analyze the continuous beams.	06	Beams	Demonstrate	Assignment	L4
3	Students should be able to analyze the Portal Frames	06	Portal Frames	Demonstrate	Assignment and Slip Test	L4
4	Students should be able to Schedule the project using MSP	12	Project Management	Demonstrate	Assignment	L3
5	Students should be able to design the Singly Reinforced Beams	2	Design of Beams	Demonstrate	Assignment	L6
6	Students should be able to design Doubly Reinforced Beams	2	Design of Beams	Demonstrate	Assignment	L6
7	Students should be able to design One Way Slabs	2	Design of Slabs	Demonstrate	Assignment	L6
8	Students should be able to design Two way Slabs.	1	Design of Slabs	Demonstrate	Assignment and Slip Test	L6
9	Students should be able to measure earthwork.	1	Estimation	Demonstrate	Assignment	L3
10	Students should be able to design horizontal curve	1	Design of Horizontal Curve	Demonstrate	Assignment	L6
11	Students should be able to design Super elevation.	1	Design of super elevation	Demonstrate	Assignment	L6
-	**Total**	**40**	-	-	-	-

2. Laboratory Applications

SNo	Application Area	CO	Level
1	Analysis of Plane Trusses.	CO1	L4
2	Analyze the Continous Beams.	CO2	L4
3	Analysis of Portal Frames.	CO3	L4
4	Project Management..	CO4	L4
5	Design of singly reinforced beams.	CO5	L4
6	Design of doubly reinforced beams.	CO6	L4
7	Design of one way slabs.	CO7	L4
8	Design of two way slabs.	CO8	L4
9	Useful in the estimation f earthwork calculations.	CO9	L4
10	In the design of highways.	CO10	L4
11	In the design of highways.	CO11	L4

Note: Write 1 or 2 applications per CO.

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Mapping		Mapping Level	Justification
CO	**PO**	**-**	**-**
CO1	PO1	L4	Applying the knowledge of engineering science fundamental concepts to analyze the plane Trusses
CO1	PO5	L4	STAAD PRO can be used as a tool for analyzing Plane Trusses.
CO1	PO11	L4	knowledge of analyzing and apply the concepts of designs to make plans and projects.
CO2	PO1	L4	Applying the knowledge of engineering science fundamental concepts to analyze the Continuous beams
CO2	PO5	L4	STAAD PRO can be used as a tool for analyzing Continous Beams.
CO2	PO11	L4	knowledge of analyzing and apply the concepts of designs to make plans and projects.
CO3	PO1	L4	Applying the knowledge of engineering science fundamental concepts to analyze the Portal Frames
CO3	PO5	L4	STAAD PRO can be used as a tool for analyzing Portal Frames
CO3	PO11	L4	knowledge of analyzing and apply the concepts of designs to make plans and projects.
CO4	PO1	L3	Applying the knowledge of engineering science fundamental concepts in planning, scheduling and controlling the project
CO4	PO5	L3	Microsoft office project which can be used as a project scheduling software or for small buildings.
CO4	PO11	L3	knowledge of project Scheduling helps in the project management
CO5	PO1	L6	Applying the knowledge of engineering science fundamental concepts to design the Singly Reinforced beams
CO5	PO5	L6	Excel is the tool used for designing of singly Reinforced Beams.
CO5	PO11	L6	Knowledge of design concepts can be used in the project purposes.
CO6	PO1	L6	Applying the knowledge of engineering science fundamental concepts to design the Doubly Reinforced beams
CO6	PO5	L6	Excel is the tool used for designing of Doubly Reinforced Beams.
CO6	PO11	L6	Knowledge of design concepts can be used in the project purposes.
CO7	PO1	L6	Applying the knowledge of engineering science fundamental concepts to design the One Way Slabs
CO7	PO5	L6	Excel is the tool used for designing of One Way Slabs.
CO7	PO11	L6	Knowledge of design concepts can be used in the project purposes.
CO8	PO1	L6	Applying the knowledge of engineering science fundamental concepts to design the Two Way Slabs
CO8	PO5	L6	Excel is the tool used for designing of Two Way Slabs.
CO8	PO11	L6	Knowledge of design concepts can be used in the project purposes.
CO9	PO1	L3	Applying the knowledge of engineering science fundamental concepts to Measure the quantities of Earthwork.
CO9	PO5	L3	Excel is the tool used for measuring the earthwork quantities
CO10	PO1	L6	Applying the knowledge of engineering science fundamental concepts to design Horizontal Curves
CO10	PO5	L6	Excel is the tool used for designing of horizontal Curves.
CO10	PO11	L6	Knowledge of design concepts can be used in the project purposes.
CO11	PO1	L6	Applying the knowledge of engineering science fundamental concepts to design of Super elevation.
CO11	PO5	L6	Excel is the tool used for designing of Super Elevation.
CO11	PO11	L6	Knowledge of design concepts can be used in the project purposes.

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Experiment Outcomes	Program Outcomes														-
Expt.	CO.#	**At the end of the experiment student should be able to . . .**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	Level
1	17CVL67.1	Students should be able to	3	3	3	2	3	2	2	3	3	3	3	3				L6

		analyze the Plane Trusses																
2	17CVL67.2	Students should be able to analyze the continuous beams.	3	3	3	2	3	2	2	3	3	3	3	3				L6
3	17CVL67.3	Students should be able to analyze the Portal Frames	3	3	3	2	3	2	2	3	3	3	3	3				L6
4	17CVL67.4	Students should be able to Schedule the project using MSP	3	3	3	2	3	2	2	3	3	3	3	3				L6
5	17CVL67.5	Students should be able to design the Singly Reinforced Beams	3	3	3	2	3	2	2	3	3	3	3	3				L6
6	17CVL67.6	Students should be able to design Doubly Reinforced Beams	3	3	3	2	3	2	2	3	3	3	3	3				L6
7	17CVL67.7	Students should be able to design One Way Slabs	3	3	3	2	3	2	2	3	3	3	3	3				L6
8	17CVL67.8	Students should be able to design Two way Slabs.	3	3	3	2	3	2	2	3	3	3	3	3				L6
9	17CVL67.9	Students should be able to measure earthwork.	3	3	3	2	3	2	2	3	3	3	3	3				L6
10	17CVL67.10	Students should be able to design horizontal curve	3	3	3	2	3	2	2	3	3	3	3	3				L6
11	17CVL67.11	Students should be able to Super elevation.	3	3	3	2	3	2	2	3	3	3	3	3				L6
-	**CS501PC**	**Average attainment (1, 2, or 3)**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**				**-**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

5. Curricular Gap and Experiments

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Expt	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

Note: Write Gap topics from A.4 and add others also.

6. Experiments Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Expt	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					
6					
7					
8					
9					

10					
11					
12					
13					
14					
15					

D. COURSE ASSESSMENT

1. Laboratory Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Unit	Title	Teaching Hours	No. of question in Exam							CO	Levels
			CIA-1	CIA-2	CIA-3	Asg-1	Asg-2	Asg-3	SEE		
1	Analysis of plane trusses.	03	1	-	-	-	-	-	1	CO1	L6
2	Analysis of continuous beams.	03	1	-	-	-	-	-	1	CO2	L6
3	Analysis of portal frames.	03	1	-	-	-	-	-	1	CO3	L6
4	Understanding basic features of Project management software.	03	1	-		-	-	-	1	CO4	L6
5	Design of Singly Reinforced Beams	03	-	1	-	-	-	-	1	CO5	L6
6	Design of Doubly Reinforced Beams	03	-	1	-	-	-	-	1	CO6	L6
7	Design of One way Slabs	03		1	-	-	-	-	1	CO7	L6
8	Design of Two way Slabs	03	-	1	-	-	-	-	1	CO8	L6
9	Computation of Earthwork	03	-	-	1	-	-	-	1	CO9	L6
10	Design of horizontal curve by offset method	03	-	-	1	-	-	-	1	CO10	L6
11	Design of Super elevation.	03	-	-	1	-	-	-	1	CO11	L6
-	**Total**	**40**	**7**	**8**	**5**	**5**	**5**	**5**	**20**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	15	CO1, CO2, CO3, CO4	L5, L6
CIA Exam – 2	-	CO5, CO6, CO7,CO8,	L5, L6
CIA Exam – 3	-	CO9,CO10,CO11,	L5, L6
Assignment - 1	-	-	-
Assignment - 2	-	-	-
Assignment - 3	-	-	-
Seminar - 1	-	-	-
Seminar - 2	-	-	-
Seminar - 3	-	-	-
Other Activities – define – Slip test			
Final CIA Marks	**20**	**-**	**-**

-

SNo	Description	Marks
1	Observation and Weekly Laboratory Activities	05 Marks
2	Record Writing	10 Marks for each Expt
3	Internal Exam Assessment	25 Marks
4	Internal Assessment	40 Marks

5	SEE	60 Marks
-	**Total**	**100 Marks**

D. EXPERIMENTS

Experiment 01 : Analyze the given truss using STAAD Pro software.

-	**Experiment No.:**	1	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Analyze the given truss using STAAD Pro software.						
2	Course Outcomes	Students should be able to analyze the Plane Trusses.						
3	Aim	To find the reactions at the supports and draw the bending moment, shear force and axial forces in diagram using STAAD pro.						
4	Material / Equipment Required	Lab Manual						
5	Procedure, Program, Activity, Algorithm, Pseudo	1.Open staad software. 2. A new project is started with units meters and kilonewtons and structure type as plane. 3.the given structure is drawn in the workspace using graphical user interface of the software according to given dimensions. 4.define the material property as steel and assign defined property to drawn truss using commands. 5. define supports and assign to specified nodes. 6. define nodal loads and assign to specified nodes in truss member by using node cursor. 7. perform analysis command. 8. the file was saved and run command was performed. 9. it is made sure that no errors are obtained . 10. post processing mode was selected. 11. the results are properly arranged using the tools. 12. printouts are taken						
6	Results & Analysis	Results at support A = Results at support B =						
7	Application Areas	Design of beams						
8	Remarks							
9	Faculty Signature with Date							

Experiment 02:

-	**Experiment No.:**	2	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Analyze the given continuous beam using STAAD Pro software.						
2	Course Outcomes	Students should be able to analyze the continuous beams						
3	Aim	To find the reactions at the supports and draw the bending moment,						

		shear force and axial forces in diagram using STAAD pro.
4	Material / Equipment Required	Lab Manual
5	Theory, Formula, Principle, Concept	Basic knowledge of design of beams.
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1.Open staad software. 2. A new project is started with units meters and kilonewtons and structure type as plane. 3.the given structure is drawn in the workspace using graphical user interface of the software according to given dimensions. 4.define the material property as steel and assign defined property to drawn truss using commands. 5. define supports and assign to specified nodes. 6. define nodal loads and assign to specified nodes in truss member by using node cursor. 7. perform analysis command. 8. the file was saved and run command was performed. 9. it is made sure that no errors are obtained . 10. post processing mode was selected. 11. the results are properly arranged using the tools. 12. printouts are taken
7	Results & Analysis	Results at support A = Results at support B =
8	Application Area	Design of continous beams
9	Remarks	
10	Faculty Signature with Date	

Experiment 03 :

Analyze the given Portal Frames using STAAD Pro software.

-	**Experiment No.:**	3	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Analyze the given Portal Frames using STAAD Pro software.						
2	Course Outcomes	Students should be able to analyze the Portal Frames.						
3	Aim	To Analyze the given Portal Frames using STAAD Pro software.						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept	-						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	Open STAAD pro software. Start with new project set unit's to m & KN and structure type as Plane. Select structural wizard to develop a plan according to given problem.						

		The given structure is drawn in the workspace using the graphical user interface of the software. Define section property as rectangular according to given dimension assigned to the members drawn by using assign to view option / assign to selected beams Create support condition as fixed and assign to nodes at base of model. Define load cases and assign to the members. Perform analysis command was given, the file was saved and run analysis command was executed. It is made sure that there is no error is indicated in the output window Post processing mode was selected The results were properly arranged using the tools, Printouts were taken
7	Results & Analysis	Reaction at support Bending moments Shear forces
8	Application Areas	
9	Remarks	
10	Faculty Signature with Date	

Experiment 04 : scheduling of project

-	**Experiment No.:**	4	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	CALENDAR						
2	Course Outcomes							
3	Aim	To create a new base calendar that has 6 working days per week and 10 hours between. The calendar should include holidays on the third Saturday of the month. Assign the new base calendar as project calendar.						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept	Basic knowledge of design of retaining wall						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	Go to project menu > properties > change working time. Click create new calendar. If we want to begin with a default calendar, click create new base calendar. Else you want to create a new calendar based on existing calendar, click make a copy of and then click calendar name in the calendar bar. In the "name box", type your name of a new base calendar. Click ok.						

		On the calendar, select the days u want to change. Click the "detail" tab and set working time for the next working sheet. Click ok. Now the "option" tab has to be clicked > calendar option for project set working time. For editing calendar, refer "work weeks" and "exceptions".
7	Results & Analysis	
8	Application Areas	
9	Remarks	
10	Faculty Signature with Date	

Experiment 05 : design of singly reinforced beams.

-	**Experiment No.:**	5	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	singly reinforced beams						
2	Course Outcomes							
3	Aim	To design a singly reinforced beam section to resist the moment given						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept							
6	Procedure, Program, Activity, Algorithm, Pseudo Code							
7	Results & Analysis	Breadth of beam provided = Depth of beam provided = Area of steel Provided =						
8	Application Areas							
9	Remarks							

Design of A Singly Reinforced Beam

Step	Formulae	Value	Unit & Remarks
Effective Span	L	6	m, given
Span to effective depth ratio	L/d	20	From Code
Effective Depth	d=span/20	0.3	m
b/d Ratio	b/d	0.5	Assumed
Breadth	b=MAX(C4*C5,0.20)	0.2	m
Cover	c	0.05	m
Overall Depth	D	0.35	m
X_u	X_u/d =0.48	0.144	m
Weight Density of Concrete	γ	25	kN/Cu.m
Self-Weight/m run	b x D x γ	1.75	kN/m
Live Load	LL	3	kN/m
Total Load	TL = Self Weight + LL	4.75	kN/m
Factored Load	FL= 1.5 x TL	7.125	kN/m
Factored BM	FL x L x L/8	32.0625	kN/m
Check for 'd'	FM=0.138 x fck x b x dxd	0.24101	m
	Sufficient or not	OK	
Ast	0.36 fck b Xu/0.87 fy	574.325	Sq. mm
A_0	.85 b d / fy	122.892	Sq. mm
Area of steel Provided	min (Ast, A_0)	574.325	Sq. mm

10	Faculty Signature with Date	

Experiment 06 : design of doubly reinforced beams

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	doubly reinforced beams						
2	Course Outcomes							
3	Aim							
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept	Basic knowledge of design of water tank						
6	Procedure, Program, Activity, Algorithm, Pseudo Code							
7	Results & Analysis							
8	Application Areas							
9	Remarks							
10	Faculty Signature with Date							

Design of A Singly Reinforced Beam

Step	Formulae	Value	Unit & Remarks
Effective Span	L	6	m, given
Span to effective depth ratio	L/d	20	From Code
Effective Depth	d=span/20	0.3	m
b/d Ratio	b/d	0.5	Assumed
Breadth	b=MAX(C4*C5,0.20)	0.2	m
Cover	c	0.05	m
Overall Depth	D	0.35	m
X_u	X_u/d =0.48	0.144	m
Weight Density of Concrete	γ	25	kN/Cu.m
Self-Weight/m run	b x D x γ	1.75	kN/m
Live Load	LL	3	kN/m
Total Load	TL = Self Weight + LL	4.75	kN/m
Factored Load	FL= 1.5 x TL	7.125	kN/m
Factored BM	FL x L x L/8	32.0625	kN/m
Check for 'd'	FM=0.138 x fck x b x dxd	0.24101	m
	Sufficient or not	OK	
Ast	0.36 fck b Xu/0.87 fy	574.325	Sq. mm
A_0	.85 b d / fy	122.892	Sq. mm
Area of steel Provided	min (Ast, A_0)	574.325	Sq. mm

Experiment 07 : design of one way slabs

-	**Experiment No.:**	7	**Marks**		**Date Planned**		**Date Conducted**	
1	Title							
2	Course Outcomes							
3	Aim							
4	Material Equipment Required	Lab Manual						

5	Theory, Formula, Principle, Concept	
6	Procedure, Program, Activity, Algorithm, Pseudo Code	**10. Excel Application: Design of one way slab.** **DESIGN OF ONE WAY SLAB** **Given** Clear Span of slab (L) = 5 m Support Thickness = 200 mm Grade of Concrete = M20 Compressive Strength of Concrete (f_{ck}) = 20 N/mm² Grade of Steel = Fe415 Compressive Strength of Steel (f_y) = 415 N/mm² Floor Finish = 1 kN/m² Live Load = 4 kN/m² Density of Concrete (γ) = 25 kN/m³ Support Condition = Simply Supported = 25 d_{eff} = **200** mm Assume Cover = 25 mm **Overall Depth(D)** = **225** mm **b** = **1000** mm **Effective Span** = **5200** mm **Calculation of Loads** Dead Load = **(Density (γ)xD)** = 5.625 kN/m² Live Load = 4 kN/m² Floor Finish = 1 kN/m² Total Load (W) = DL+LL+FF W = 10.625 kN/m² Factored Load (W_f) = 15.94 kN/m² **Calculation of Moments** **ALL EDGES DISCONTINUOUS** M_u = **Mu** = **53.87** kN-m **Calculation of Shear Force** V_u =
7	Results & Analysis	
8	Application Areas	
9	Remarks	
10	Faculty Signature with Date	

Experiment 08 : design of two way slabs

-	**Experiment No.:**	8	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Design of Two Way Slab.						
2	Course Outcomes							
3	Aim	To create Excel sheet for Designing Two way slab.						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept							
6	Procedure, Program, Activity, Algorithm, Pseudo Code							
7	Results & Analysis							
8	Application Areas							
9	Remarks							
10	Faculty Signature with Date							

Experiment 09 : computation of earthwork

-	**Experiment No.:**	9	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Earthwork						
2	Course Outcomes							
3	Aim	To tabulate the earthwork of a stretch having a level section by using a spread sheet application.						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept	Calculation of area is carried out by any one of the following methods: a) Mid-ordinate method b) Average ordinate method c) Trapezoidal rule d) Simpson's rule Trapezoidal rule : 1^{st} area ={O1 + O2} /2 * d. 2^{nd} area ={O2 + O3} /2 * d. 3^{rd} area ={O3 + O4} /2 * d. Last area $=O_{n-1} + O_n$ / 2 * d. Total area=d/2{ O1+2O2+2O3+……+2On-1+On} $\text{AREA} = \frac{\text{common distance}((1^{st}\text{ ordinate} + \text{last ordinate}) + 2(\text{sum of other ordinates})}{2}$						
6	Procedure, Program, Activity, Algorithm, Pseudo Code							
7	Results & Analysis	Volume of earthwork using trapezoidal rule = ... Volume of earthwork using prismoidal rule = ...						
8	Application Areas							
9	Remarks							
	Faculty Signature with Date							

Experiment 10 : design of horizontal curve

-	**Experiment No.:**	10	**Marks**		**Date Planned**		**Date Conducted**	
1	Title							
2	Course Outcomes							
3	Aim	To calculate the ordinates at 10 m interval from the long chord for the given horizontal curve.						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept							

		x distance / Ordinate O_0 = / $O_0 = R - \sqrt{R^2 - {}^{L}/_{2}{}^{2}}$ O_{10} = / $O_x = \sqrt{R^2 - x^2} - (R - O_0)$ O_{40} =
6	Procedure, Program, Activity, Algorithm, Pseudo Code	
7	Results & Analysis	Necessary ordinates were calculated and an approximate plot is made using excel chart.
8	Application Areas	
9	Remarks	
10	Faculty Signature with Date	

Experiment 11 : design of super elevation

-	**Experiment No.:**	11	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Super Elevation						
2	Course Outcomes							
3	Aim	To prepare a programmed spread sheet to design the super elevation at a horizontal curve.						
4	Material / Equipment Required	Lab Manual						
5	Theory, Formula, Principle, Concept							
6	Procedure, Program, Activity, Algorithm, Pseudo Code	**Design of Super Elevation** Allowable Super Elevation: 0.07 Allowable Coefficient of Friction (f): 0.15 Design Speed (v): 100 75% of Design Speed: = 75 % of Design Speed Radius of Circular Curve(R): 220 Super Elevation Calculated: = $V^2/225*R$ Super Elevation to be provided: SE Cal (or) 0.07 whichever is less f = Friction Developed: $F = V^2/(127 * R - \text{Allowable})$ Sufficiency of Friction Coefficient: F Developer should be less than allowable friction Allowable Speed: If f is not sufficient limit the speed at curve by $V = \sqrt{(27.94 * R)}$						
7	Results & Analysis	Super Elevation Provided = Speed limit proposed =						
8	Application Areas							
9	Remarks							
10	Faculty Signature with Date							

F. Content to Experiment Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Expt-#	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1	Analysis of plane trusses.	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
2	Analysis of continuous beams.	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
3	Analysis of portal frames.	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
4	Understanding basic features of Project management software.	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
5	Design of Singly Reinforced Beams	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
6	Design of Doubly Reinforced Beams	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
7	Design of One way Slabs	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
8	Design of Two way Slabs	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
9	Computation of Earthwork	3	L6	L6	- -	Lecture/ Practical	Slip Test/Assignment
10	Design of horizontal curve by offset method	3	L6	L6		Lecture/ Practical	Slip Test/Assignment
11	Design of Super elevation.	3	L6	L6		Lecture/ Practical	Slip Test/Assignment

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Expt - #	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome **Student Should be able to ...**
A	*I*	*J*	*K*	*L*	*M*	*N*

1	Analysis of plane trusses.	Truss	Truss	Truss	Condition	Students should be able to analyze the Plane Trusses
2	Analysis of continuous beams.	Beams	Beams	Beams	Condition	Students should be able to analyze the continuous beams.
3	Analysis of portal frames.	Portal Frames	Portal Frames	Portal Frames	Condition	Students should be able to analyze the Portal Frames
4	Understanding basic features of Project management software.	Project Management	Project Management	Project Management	Condition	Students should be able to Schedule the project using MSP
5	Design of Singly Reinforced Beams	Design of Beams	Design of Beams	Design of Beams	Condition	Students should be able to design the Singly Reinforced Beams
6	Design of Doubly Reinforced Beams	Design of Beams	Design of Beams	Design of Beams	Condition	Students should be able to design Doubly Reinforced Beams
7	Design of One way Slabs	Design of Slabs	Design of Slabs	Design of Slabs	Condition	Students should be able to design One Way Slabs
8	Design of Two way Slabs	Design of Slabs	Design of Slabs	Design of Slabs	Condition	Students should be able to design Two way Slabs.
9	Computation of Earthwork	Estimation	Estimation	Estimation	Condition	Students should be able to measure earthwork.
10	Design of horizontal curve by offset method	Design of Curve.	Design of Curve.	Design of Curve.	Condition	Students should be able to design horizontal curve
11	Design of Super elevation.	Design of Curve.	Design of Curve.	Design of Curve.	Condition	Students should be able to design Super elevation.