# STRUCTURAL DESIGN LAB (GR22D5009)

I - M.Tech - I Semester

Mr. C Vivek Kumar

Dr.GVV Satyanarayana



# **Department of Civil Engineering**

# Gokaraju Rangaraju Institute of Engineering and Technology

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440



## **Course File Check List**

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21	Sample answer scripts and Assignments	
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**GR 22 Regulations (2022-2023)** 

#### GOKARAJU RANGARAJU

#### **INSTITUTE OF ENGINEERING AND TECHNOLOGY**

I Year M. Tech. STE – I Semester

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#### (GR22D5009) STRUCTURAL DESIGN LAB

#### Cycle I

1. Develop a template for design of one-way slab.

2. Develop a template for design of two-way Slab.

3. Develop a template for design of columns.

4. Develop a template for design of combined footing.

5. Analysis and design of continuous beam

Cycle II

6. Analysis and design of plane frame.

7. Analysis of multi-storeyed space frame.

8. Static analysis of multi-storeyed structure.

9. Dynamic analysis of multi-storeyed structure.

10. Analysis and design of Steel truss.



#### Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous) Bachupally, Hyderabad-500090

#### DEPARTMENT OF CIVIL ENGINEERING (M.Tech)

I YEAR

#### **ROOM NO: 4207**

W.E.F: 15-11-2021

	1	2	3	4	8	9	10
	9:00-10:00	10:00 - 11:00	11:00- 12:00	12:00-1:00	1:00-2:00	2:00-3:00	3:00-4:00
Monday						SD Lab	<u> </u>
Tuesday				-			
Wednesday							
Thursday				LUNCH		SD Lab	
Friday				BREAK			
Saturday							

CODE	Subject	Faculty
GR22D5009	STRUCTURAL DESIGN Lab	Mr. C Vivek Kumar & Dr.GVV Satyanarayana

CLASS COORDINATOR

PROGRAMME COORDINATOR

HOD



# Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad - 500 090. (040) 6686 4440

#### **Program Educational Objectives**

**PEO 1:** Graduates of the program will equip with professional expertise on the theories, process, methods and techniques for building high-quality structures in a cost-effective manner.

**PEO 2:** Graduates of the program will be able to design structural components using contempory soft wares and professional tools with quality practices of international standards.

**PEO 3:** Graduates of the program will be effective as both an individual contributor and a member of a development team with professional, ethical and social responsibilities.

**PEO 4:** Graduates of the program will grow professionally through continuing education, training, research, and adapting to the rapidly changing technological trends globally in structural engineering.

#### **Program Outcomes**

**PO 1:** An ability to independently carry out research /investigation and development to solve practical problems.

PO 2: An ability to write and present a substantial technical report/document.

**PO 3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelors.

**PO 4:** Possess critical thinking skills and solve core, complex and multidisciplinary structural engineering problems.

**PO 5:** Assess the impact of professional engineering solutions in an environmental context along with societal, health, safety, legal, ethical and cultural issues and the need for sustainable development.

PO 6: Recognize the need for life-long learning to improve knowledge and competence



# Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

# **COURSE OBJECTIVES**

Academic Year :	2022-2023	
Semester :	Ι	
Name of the Program:	M. Tech	Year: I Year
Course/Subject :	Structural Design Lab	Course Code : GR22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Di	GVV Satyanarayana
Designation: Assistant Prof	essor & Professor	Dept.: Civil Engineering

On completion of this Subject/Course the student shall be able to:

1.	To learn the software applications in structural engineering.
2.	To develop a template for designing of the reinforced concrete members.
3.	To learn the analysis of plane, space truss and frames subjected to different types of loadings.
4.	To study the static and dynamic analysis, design and detailing of RCC framed structural members.
5	To study the analysis and design of Steel truss members.

Signature of HOD

Signature of faculty

Date:

Date:



# Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

# **COURSE OUTCOMES**

Academic Year :	2022-2023			
Semester :	Ι			
Name of the Program:	M.Tech	Year: I Year		
Course/Subject :	Structural Design Lab	Course Code : GR22D5009		
Name of the Faculty :	Mr. C Vivek Kumar & I	Dr.GVV Satyanarayana		
<b>Designation:</b> Assistant Professor & Professor <b>Dept.:</b> Civil Engineering				
On completion of this Subject/Course the student shall be able to:				

	Outcomes
1	Understand the software usages and produce structural drawing for structural members.
2	Analyse and design the plane frame and truss subjected to different type of loading.
3	Design and detailing of RC structural members like beam, column, slab, and Footing
4	Analysis and design of RCC framed structures statically for different loading conditions.
5	Analysis and design of RCC framed structures dynamically for different loading conditions

Signature of HOD

Signature of faculty

Date:

Date:



S.No	ROLL NUMBER	NAME OF THE STUDENT
2	22241D2001	ADDAGATLA MAHESH KUMAR
3	22241D2002	AHMED ABDUL AZEEM
4	22241D2003	BAIRAPAKA BHARATH
5	22241D2004	BARLAPUDI ACHSAH KEERTHANA
6	22241D2005	CHAKALI SOWMYA
7	22241D2006	CHAPPIDI NARESH
8	22241D2007	DANTHALA HARIDEEP KUMAR
9	22241D2008	DEVIREDDY ANISH
10	22241D2009	DHARAVATH NAGENDAR
11	22241D2010	GANGAPURAM SUSHANTH REDDY
12	22241D2011	JEREPOTHULA RAVALIKA
13	22241D2012	KADABOHINA SAI PAVAN
14	22241D2013	KASUMURU BHARATH KUMAR
15	22241D2014	MACHARLA SRINIVAS
16	22241D2015	MALLI SREENIVASULU
17	22241D2016	SHAIK ABDUL MUQEED
18	22241D2017	SHAIK ZABI ULLAH
19	22241D2018	SONWANE SAHIL SHIVAJIRAO

Signature of HOD



## **GUIDELINES TO STUDY THE COURSE SUBJECT**

Academic Year :	2022-2023	Semester : I		
Name of the Program:	M.Tech	Year : I Year		
Course/Subject :	Structural Design Lab	Course Code : GR22D5009		
Name of the Faculty :	Mr. C Vivek Kumar & Di	r. GVV Satyanarayana		
Designation: Assistant Professor & Professor				

#### Guidelines to study the course/subject: Structural Design Lab

This course helps the students to learn and understand the concepts of reinforced cement concrete design for structural members like slabs, beams, columns, and footings along with the skills of modeling and analyzing using a MS Excel and an advanced software like STAAD.Pro. This also extends to building design statically and dynamically and also analysis of roof truss.

#### So, the students should have the following prerequisites:

- Basic Knowledge in Mathematics
- Good knowledge of Reinforced Concrete Design
- Ability to perform exercise as well as analyze and interpret data.

#### Where will this subject help?

- 1. Structural Design Lab helps apply design and analysis concepts using industry software like STAAD.Pro
- 2. To gain knowledge in analysis and design of advanced structures.
- 3. To develop a ready to access excel files for all basic structural elements



# **BOOKS AND MATERIALS**

#### TEXT BOOKS

- 1. Reinforced Concrete Design, Pillai S. U. and Menon D., Tata McGraw-Hill, 3rd Ed, 1999
- 2. Illusrate Reinforced Concrete Design, Shah & Karve
- 3. Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi.

Suggested / Reference Books			
1.	IS 456-2000; Indian Standard Code of Practice for Plain and Reinforced Concrete.		
2.	SP 16: Design Aids for Reinforced Concrete		
3.	User's Guide ETABS® 2016 Integrated Building Design Software		

Wel	Web Sites	
1.	https://standardsbis.bsbedge.com/	
2.	https://wiki.csiamerica.com/display/doc/ETABS+Training+manuals	
3.	https://www.youtube.com/watch?v=mTLmMwKvukw&list=PLELbBNWxxKaCAJL_RKmSwjUl kVRgCway9	



# **COURSE DESIGN AND DELIVERY SYSTEM (CDD)**

- The Course syllabus is written into number of learning objectives and outcomes.
- These learning objectives and outcomes will be achieved through lectures, assessments, assignments, experiments in the laboratory, projects, seminars, presentations, etc.
- Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
- The Learning Process will be carried out through assessments of Knowledge, Skills and Attitude by various methods and the students will be given guidance to refer to the text books, reference books, journals, etc.

The faculty be able to –

- Understand the principles of Learning
- Understand the psychology of students
- Develop instructional objectives for a given topic
- Prepare course, unit and lesson plans
- Understand different methods of teaching and learning
- Use appropriate teaching and learning aids
- Plan and deliver lectures effectively
- Provide feedback to students using various methods of Assessments and tools of Evaluation
- Act as a guide, advisor, counselor, facilitator, motivator and not just as a teacher alone

Signature of HOD

Date:

Signature of faculty

Date:



# **COURSE SCHEDULE**

Academic Year	:	2022-2023	
Semester	:	Ι	
Name of the Program	n:	M.Tech	Year: I Year
Course/Subject	:	Structural Design Lab	Course Code : GR22D5009
Name of the Faculty	: ]	Mr. C Vivek Kumar & Dr.GVV	Satyanarayana

Designation: Assistant Professor & Professor

The Schedule for the whole Course / Subject is:

S NO	DESCRIPTION	DAT		
S.NO	DESCRIPTION	FROM	ТО	NO. OF CLASSES
1	Instructions and Demonstration	15-11-2021	18-11-2021	1 Day
2	Cycle -I	22-11-2021	28-01-2021	7 Weeks
3	Cycle – II	03-02-2022	03-03-2022	7 Weeks
4	Revision	07-03-2022	10-03-2022	1 Week
5	Practical Examination	17-03-2022	17-03-2022	1 Week
6	End Examination	20-03-2022	20-03-2022	1 Week

Total No. of Instructional periods available for the course: 81 Hours / Periods



# STRUCTURAL ENGINEERING LAB

#### CYCLE -1 EXERCISES RELATED BUILDING STRUCTURAL ELEMENTS

- 1. Develop a template for design of one-way slab.
- 2. Develop a template for design of two-way Slab.
- 3. Develop a template for design of columns.
- 4. Develop a template for design of combined footing.
- 5. Analysis and design of continuous beam.

#### CYCLE -2 EXERCISES RELATED TO ADVANCED STRUCTURES

- 6. Analysis and design of plane frame.
- 7. Analysis of multi-storeyed space frame.
- 8. Static analysis of multi-storeyed structure.
- 9. Dynamic analysis of multi-storeyed structure.
- 10. Analysis and design of Steel truss.



## Gokaraju Rangaraju Institute of Engineering and Technology Department of Civil Engineering SCHEDULE OF INSTRUCTIONS

Academic Year	:	2022-2023		
Semester	:	Ι		
Name of the Program	n:	M.Tech	Year: I Year	
Course/Subject	:	Structural Design Lab	Course Code : GR22D5009	
Name of the Faculty : Mr. C Vivek Kumar & Dr.GVV Satyanarayana				

**Designation:** Assistant Professor & Professor

The Course plan for the whole Course / Subject is:

Lesso n No.	Date	No. of Periods	Topics / Sub-Topics	Objectives & Outcomes Nos.	
1.	11/15/2021	3	Introduction to Structural Design Lab	CO- 1-5	COB- 1-5
2.	11/18/2021	3	Introduction to STAAD.Pro	CO- 3	COB- 3
3.	11/22/2021	3	Develop a template for design of one- way slab.	CO- 1, 3	COB- 1, 3
4.	11/25/2021	3	Develop a template for design of one- way slab.	CO- 3	COB- 3
5.	11/29/2021	3	Develop a template for design of one- way slab.	CO- 1, 3	COB- 1, 3
6.	12/2/2021	3	Develop a template for design of two-way Slab	CO- 3	COB-3
7.	12/6/2021	3	Develop a template for design of two-way Slab	CO- 1, 3	COB- 1, 3
8.	12/9/2021	3	Develop a template for design of columns	CO- 3	COB- 3
9.	12/13/2021	3	Develop a template for design of columns	CO- 1, 3	COB- 1, 3
10.	12/20/2021	3	Develop a template for design of combined footing.	CO- 3	COB- 3
11.	12/23/2021	3	Develop a template for design of combined footing.	CO- 1, 3	COB- 1, 3

12.	12/27/2021	3	Analysis and design of continuous beam	CO- 1-5	COB- 1-5
13.	1/3/2022	3	Analysis and design of plane frame	CO- 1-3	COB- 1-4
14.	1/21/2022	3	Analysis of multi-storeyed space frame.	CO- 1-3	COB- 1-4
15	1/22/2022	3	Analysis of multi-storeyed space frame.	CO- 1-3	COB- 1-4
16	1/28/2022	3	Static analysis of multi-storeyed structure	CO- 1 & 3	COB- 1 – 4
17	2/3/2022	3	Static analysis of multi-storeyed structure	CO- 1 & 3	COB- 1 – 4
18	2/7/2022	3	Dynamic analysis of multi-storeyed structure RSM	CO- 1 & 3	COB- 1 – 4
19	2/10/2022	3	Dynamic analysis of multi-storeyed structure. THM	CO- 1 & 3	COB- 1 – 4
20	2/14/2022	3	Dynamic analysis of multi-storeyed structure.THM	CO- 1 & 3	COB- 1 – 4
21	2/21/2022	3	Analysis and design of Steel truss	CO- 1-5	COB- 1-5
22	2/24/2022	3	Analysis and design of Steel truss	CO- 1-5	COB- 1-5
23	2/28/2022	3	Revision	CO- 1-3	COB- 4
24	3/3/2022	3	Revision	CO 3 - 5	COB-1&5
25	3/7/2022	3	Internal Lab Exam	CO- 1-5	COB-1

Signature of HOD Date:

Signature of faculty Date:



Academic Year :	2022-2023	Semester	:	Ι	
Name of the Program:	M.Tech	Year	:	I Year	
Course/Subject :	Structural Design Lab	Course Code	e :	GR22D5009	
Name of the Faculty :	Mr. C Vivek Kumar & D	r.GVV Satyana	rayana		
Designation: Assistant Professor & Professor Department: Civil Engineering				Engineering	
Lesson No: 1		Duration of	Lesson	: <u>3 hrs</u>	
Lesson Title: Introduction of RC design & IS code					
	of Re design & 15 code				

On completion of this lesson the student shall be able to:

1. Understand the RC design basics & usage of IS code

# **TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Structural Elements Introduction of RC design Usage of IS code

Assignment Questions:

1. Write down the codes for design of RCC Building Structural Elements (CO1, COB1)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	: GR2	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & D	Dr.GVV Satyanar	ayana	
<b>Designation:</b> Assistant Prot	fessor & Professor	Department:	Civil E	Ingineering
Lesson No: 2		Duration of I	Lesson:	<u>3 hrs</u>

Lesson Title: Design of all the Structural Components of Frame Buildings

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of a structural member: Beam (Manually)
- 2. Use IS 456 to design and perform checks involved in design
- 3. Design for shear reinforcements in beam

**TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Beam Design: Reinforcements for target moment (for singly and doubly reinforced scenarios) Shear design in beams

Using IS Codes

Assignment / Questions:

1. Determining moment carrying capacity of a structural member: Beam (CO 1, COB1)



Academic Year	:	2022-2023		Semester	:	Ι
Name of the Program:		M.Tech		Year	:	I Year
Course/Subject :		Structural Design Lab	I	Course Code	e : GR2	22D5009
Name of the Faculty :		Mr. C Vivek Kumar	& D1	GVV Satyana:	rayana	
Designation: Assistant Professor & Professor				Department	: Civil E	ngineering
Lesson No: 3			Dura	tion of Lesson	: <u>3 hrs</u>	
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Lesson Title: Design of all the Structural Components of Frame Buildings (MS Excel)

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Designing of beam using Excel
- 2. Design for shear reinforcements in beam in Excel

# **TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Beam Design: Steps involved in Excel Shear design in beams Steps involved in Excel

Assignment / Questions:

1. Excel file for Cantilever beam (CO 1, COB1)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyana	rayana	
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Engineeri				Engineering
Lesson No: 4		Duration of	Lesson	: <u>3 hrs</u>
Lesson Title: Design of all the Structural Components of Frame Buildings (Manually)				

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of a structural member: One-way Slabs (Manually)
- 2. Use IS 456 to design and perform checks involved in design

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### **TEACHING POINTS** :

Slab Design: Reinforcements for target moment (one way)

Taking loads from IS 875

Using IS Codes in design

Assignment / Questions:

- 1. Calculate the live loads from IS 875 Part II for different buildings (CO 1, COB1)
- 2. Calculate the total ultimate load for those conditions for the given slab (CO 1, COB1)



Academic Year :	2022-2023	Semester	:	Ι	
Name of the Program:	M.Tech	Year	:	I Year	
Course/Subject :	Structural Design Lab	Course Code	e:GR	22D5009	
Name of the Faculty : Mr. C Vivek Kumar & Dr.GVV Satyanarayana					
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Engineering					

Lesson No: 5Duration of Lesson: 3 hrsLesson Title: Design of all the Structural Components of Frame Buildings (MS Excel)

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

1. Design of a structural member: One-way Slabs in Excel

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### TEACHING POINTS :

Slab Design: using Excel (One way slab)

Assignment / Questions:

1. Interpolation excel files for increasing and decreasing data (CO 1, COB1)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Cod	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Di	GVV Satyana:	arayana	
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Engineering				
Lesson No: 6		Duration of	Lesson	: <u>3 hrs</u>
Lesson Title: Design of all the Structural Components of Frame Buildings (Manually)				

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of a structural member: Two-way Slabs (Manually)
- 2. Use IS 456 to design and perform checks involved in design

# **TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Slab Design: Reinforcements for target moment (two way) Load distribution from slabs to beams

Using IS Codes

Assignment / Questions:

- 1. Load Distribution from two way slab onto the beams (CO 1, COB1)
- 2. Load Distribution from one way slab onto its longer beams (CO 1, COB1)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Cod	e : GF	R22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Di	r.GVV Satyana	arayana	
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Engineering				
Lesson No: 7		Duration of	Lesson	1: <u>3 hrs</u>
Lesson Title: Design of all the Structural Components of Frame Buildings (MS Excel)				

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

1. Design of a structural member: Slabs (MS Excel)

**TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Slab Design: using Excel (Two way slab)

Assignment / Questions:

1. Cantilever Slab design in MS Excel (CO 1, COB1)



Academic Year	:	2022-2023	Semester	:	Ι
Name of the Program	1:	M.Tech	Year	:	I Year
Course/Subject	:	Structural Design Lab	Course Code	e : GR2	22D5009
Name of the Faculty	:	Mr. C Vivek Kumar & I	Dr.GVV Satyanaı	rayana	
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Engineering				Ingineering	
Lesson No: 8 & 9			Duration of l	Lesson:	<u>3 hrs</u>
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Lesson Title: Design of all the Structural Components of Frame Buildings (Manual and Excel)

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of a structural member: Columns (Manually)
- 2. Use SP 16 to get % steel from Moment and Axial Loads
- 3. Design column loaded with biaxial action in MS Excel

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

TEACHING POINTS :

Column Design: Using IS Codes in biaxial bending column design Extracting % steel from SP 16

Creating an Excel File for a column (biaxial) design in MS Excel

Assignment / Questions:

- 1. Capacity of a given column (CO2, COB2)
- 2. Effective lengths of various end conditions for columns



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyana	rayana	
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Engineering			Engineering	
Lesson No: 10 & 11		Duration of	Lesson:	: <u>3 hrs</u>
Lesson Title: Design of all the Structural Components of Frame Buildings (Manual and Excel)				

# **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of Footing (combined)
- 2. Design Footing in MS Excel

**TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Footing Design: Reinforcements for target strength

Various shear failure cases

Creating an Excel File for a Footing Design in MS Excel

Assignment / Questions:

1. Differences between combined footing and isolated footing (CO2, COB2)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Cod	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	GVV Satyana:	rayana	
<b>Designation:</b> Assistant Prot	fessor & Professor	Department	: Civil E	Engineering
Lesson No: 12		Duration of	Lesson	: <u>3 hrs</u>
Lesson Title: Introduction c	f Design Software			

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

1. Understand the interface of STAAD PRO software

# **TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

STAAD PRO user interface GRID & Structural Wizard coordinate system

Assignment / Questions:

1. Advantages of STAAD PRO and Different types of cursors and coordinates. (CO 3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GI	R22D5009
Name of the Faculty : N	/Ir. C Vivek Kumar & Dr.GVV Sa	tyanarayana		
Designation: Assistant Profess	sor & Professor Depart	ment: Civil En	gineeri	ing
Lesson No: 13	Duratio	on of Lesson: <u>3</u>	hrs	
Lesson Title: Modelling of Bu	ilding using Software			

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Model a Beam in STAAD PRO
- 2. Design of beam using STAAD PRO
- 3. Check for the reinforcements and compare with already designed beam

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### TEACHING POINTS :

Modelling of Beam using Coordinate system.

Beam Design: using STAAD Pro

Fetch the reinforcement details

Identify the SFD and BMD

Assignment / Questions:

1. Analyzing the capacity of a modeled beam – SFD & BMD (CO2.3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Cod	<b>e</b> : G	R22D5009
Name of the Faculty :	Mr. C Vivek Kumar & D	r.GVV Satyana	arayan	a
Designation: Assistant Professor & Professor Department: Civil Engineering				

Lesson No: 14Duration of Lesson: 3 hrsLesson Title: Modelling of Building using Software

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

1. Modeling of a portal frame using STAAD PRO

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### **TEACHING POINTS** :

Portal Frame modelling using STAAD Pro Identify the SFD and BMD

Assignment / Questions:

1. Creating similar frames to analyse the SFD and BMD values (CO3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	: GR2	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyanar	ayana	
<b>Designation:</b> Assistant Professor & Professor <b>Department:</b> Civil Enginee			Ingineering	
Lesson No: 15		Duration of I	Lesson:	<u>3 hrs</u>
Lesson Title: Design of G+3 storey building using Software				

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

1. Model a 3D building

**TEACHING AIDS**: Lab Manual, Laptop, Projector, Demonstration.**TEACHING POINTS**:

Modelling in 3D Defining creating and assigning the sections

Assignment / Questions:

1. Model a structure for different plans (CO3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR2	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyanar	ayana	
Designation: Assistant Prof	essor & Professor	Department:	Civil E	Ingineering
Lesson No: 16, 17		Duration of I	Lesson:	<u>3 hrs</u>
Lesson Title: Design of G+3	storey building using Softwar	е		

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Applying loads on the 3D modeled building
- 2. Analyze the building

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### TEACHING POINTS :

3D modeling

Applying the loads involved

Analysis on the building

Assignment / Questions:

1. Application of loads based on IS 875 (CO3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyana	rayana	
Designation: Assistant Prof	essor & Professor	Department	: Civil E	Engineering
Lesson No: 18		<b>Duration of</b>	Lesson	: <u>3 hrs</u>
Lesson Title: Practice on St	ructural design software			

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Model a 3D building
- 2. Applying loads on the 3D modeled building
- 3. Analyze the building

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### **TEACHING POINTS** :

3D modeling

Applying the loads involved with dead and live load

Statical ana Analysis on the building

Assignment / Questions:

1. Model for varying plans (CO3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & D	r.GVV Satyana	rayana	
Designation: Assistant Prof	essor & Professor	Department	: Civil E	Engineering
Lesson No: 19		Duration of	Lesson	: <u>3 hrs</u>

Lesson Title: Practice on Structural design software

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Model a 3D building
- 2. Applying loads on the 3D modeled building
- 3. Analyze the building

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### **TEACHING POINTS** :

3D modeling

Applying the loads involved with wind load and seismic load

Analysis on the building

Assignment / Questions:

1. Model for varying plans and heights (CO3, COB3)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyanaı	rayana	
<b>Designation:</b> Assistant Prof	essor & Professor	Department:	Civil E	Engineering
Lesson No: 20		Duration of l	Lesson:	: <u>3 hrs</u>

Lesson Title: Design of all the Structural Components of Retaining Wall

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of Multi-storied building
- 2. Response spectrum analysis

#### **TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### TEACHING POINTS :

Design of following components of G+5 building.

- 1. Modelling of Multi-storey building with seismic load
- 2. Importing the response spectrum data
- 3. Analysis of structure under dynamic loading

#### Assignment / Questions:

- 1. Short notes on dynamic analysis of structure (CO3,4, COB4)
- 2. Make a note of different types dynamic analysis (CO3,4, COB4)



Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Code	e : GR	22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	.GVV Satyana	rayana	
<b>Designation:</b> Assistant Prof	essor & Professor Depart	ment: Civil Er	ngineeri	ng
Lesson No: 21		<b>Duration of</b>	Lesson	: <u>3 hrs</u>

Lesson Title: Design of all the Structural Components of Retaining Wall (MS Excel)

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Design of Multi-storied building
- 2. Time History analysis

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### **TEACHING POINTS** :

Design of following components of G+5 building.

- 1. Modelling of Multi-storey building with seismic load
- 2. Importing the time history data
- 3. Analysis of structure under dynamic loading

#### Assignment / Questions:

- 1. Short notes on Time history analysis (CO4, COB4)
- 2. Loads and Load combinations (CO4, COB4)



Academic Year :	2022-2023	Semester : I
Name of the Program:	M.Tech	Year : I Year
Course/Subject :	Structural Design Lab	Course Code : GR22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr	. GVV Satyanarayana
Designation: Assistant Prof	essor & Professor	Department: Civil Engineering
Lesson No: 22 & 23		Duration of Lesson: <u>3 hrs</u>
Lesson Title: Analysis of Br	ridge Deck slab	

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

On completion of this lesson the student shall be able to:

- 1. Modelling of roof trusses using STAAD.Pro
- 2. Analysis of the model

**TEACHING AIDS** : Lab Manual, Laptop, Projector, Demonstration.

#### **TEACHING POINTS** :

Modelling steps involved for roof truss using Staad pro

Materials and support conditions

Loads over roof truss

#### Assignment / Questions:

- 1. Make a note of different Types of Trusses (CO5, COB5)
- 2. Differences between Truss and Roof(CO5,COB5)



## **COURSE COMPLETION STATUS**

Academic Year :	2022-2023	Semester	:	Ι
Name of the Program:	M.Tech	Year	:	I Year
Course/Subject :	Structural Design Lab	Course Cod	<b>e</b> : G	R22D5009
Name of the Faculty :	Mr. C Vivek Kumar & Dr.GVV	Satyanarayana		

Designation: Assistant Professor & Professor

Actual Date of Completion & Remarks, if any

Cycle	Remarks	Objectives Achieved	Outcomes Achieved
Cycle I	Covered in Time	1,2,3	1,2,3
Cycle II	Covered in Time	1,3,4,5	1,3,4,5

Signature of HOD

Date:

Signature of faculty

Date:



Academic Year	: 2022-2023	Semester	:	I			
Name of the Program	<b>m</b> : M.Tech	Year	:	I Year			
Course/Subject	:Structural Design Lab	Course Code : GR22D5009					
Name of the Faculty : Mr. C Vivek Kumar & Dr.GVV Satyanarayana							
Designation	: Assistant Professor & Professor	Department	: Civil E	ngineering			

#### 1. TARGET:

- a) Percentage for pass: 100%
- b) Percentage of class:

First class with distinction	20
First class	20
Pass class	00
Total strength	21

#### 2. COURSE PLAN & CONTENT DELIVERY

• 100 practice classes held for detailed demonstration of experiments and for analyzing real time experiments in the lab.

#### **3. METHOD OF EVALUATION**

- 3.1 
  Continuous Assessment Examinations (CAE-I, CAE-II)
- 3.2 
  Assignments/Seminars
- 3.3 D Mini Projects
- $3.4 \square Quiz$
- 3.5 
  Semester/End Examination
- $3.6 \square$  Others

**4.** List out any new topic(s) or any innovation you would like to introduce in teaching the subjects in this Semester.



# GokarajuRangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

## Assessment in relation to CO's and COB's

#### Assessment:

- 1. Assignment
- 2. Internal Examination
- 3. External Examination
- 4. Practical Projects
- 5. Viva

Course Outcomes Assessments	1	2	3	4	5
1	Х	Х	Х	Х	Х
2	Х	Х	Х	Х	Х
3	Х	Х	Х	Х	Х
4					
5					

Course Objectives Assessments	1	2	3	4	5
1	Х	Х	Х	Х	Х
2	Х	Х	Х	Х	Х
3	Х	Х	Х	Х	Х
4					
5					



## GokarajuRangaraju Institute of Engineering and Technology (Autonomous) Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

## Mappings of CO's, COB's Vs PO's, POB's

**Course Objectives - Course Outcomes Relationship Matrix** 

Course Outcomes Course Objectives	1	2	3	4	5
1	Х	Х	Х		
2	Х	Х			
3	Х		Х		
4		Х			
5				Х	X

# **Course Outcomes - Program Outcomes relations (Contributions: High, Medium and Low)**

Structural Design Lab (GR22D5009) CO's	1	2	3	4	5	6
To learn the software applications in structural engineering.	Н	Н	Н		М	М
To develop a template for designing of the reinforced concrete members.	Н	Н	Н			М
To learn the analysis of plane, space truss and frames subjected to different types of loadings.	М	М	М			М
To study the static and dynamic analysis, design and detailing of RCC framed structural members.	М	Н	Н		М	М
To study the analysis and design of Steel truss members.	Н	Н	Н	М	М	М

<b>Course Objectives</b> -	- Program	Outcomes	(PO's)	<b>Relationship Matrix</b>
		0	$(= \circ \circ)$	

Program Outcomes Course Objectives	1	2	3	4	5	6
1	Н	Η	Н		М	М
2	Н	Н	Н			М
3	М	М	М			М
4	М	М	М			М
5	Н	Η	Н	М	М	М

# **Course Outcomes - Program Outcomes relations (PO's) Relationship Matrix**

Program Outcomes Course Outcomes	1	2	3	4	5	6
1	Х	х	х		х	х
2	х	X	x			x
3	х	X	x			x
4	х	X	x			x
5	х	х	x	х	x	х

# Courses (with title & code)-Program Outcomes (PO's) Relationship Matrix Course: Structural Design Lab

Program Outcomes Courses	1	2	3	4	5	6
1	Х		Х	Х	Х	Х

# **Program Educational Objectives (PEOs) - Course Outcomes Relationship Matrix**

Program Educational Objectives Course Outcomes	1	2	3	4
1	х			х
2	х		х	х
3	Х	х	х	
4	Х	х		
5	Х		Х	Х



### GokarajuRangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

## **Rubric Template – Structural Design Lab**

Academic Year : 2022-2023

Name of the Program: M.Tech

Semester : Ι

**Course/Subject** :Structural Design Lab Year I Year : **Course Code :** GR22D5009

Name of the Faculty :Mr. C Vivek Kumar & Dr.GVV Satyanarayana

Designation : Assistant Professor & Professor **Department:** Civil Engineering

Name of the	Performance	Beginning	Developing 2	Reflecting Development 3	Accomplished	Exemplary 5	Score
Student	Criteria Level of knowledge on fundamental laboratory tests and collect, analyze or synthesize appropriate data.	Inability to perform fundamental laboratory tests or collect, analyze, or synthesize appropriate data	Able to collect, analyze, and synthesize data related to the properties and behavior of soils in the geotechnical laboratory	Ability to observe collection of samples, perform fundamental laboratory tests, and collect, analyze, and synthesize appropriate data.	Knowledge on collection of Samples & independently perform fundamental laboratory tests, and collect, analyze, and synthesize appropriate data with few procedural errors	Full knowledge on collection of soil samples, independently perform fundamental laboratory tests, and collect, analyze, and synthesize appropriate data with no procedural errors	5
	Level of knowledge on properties of SCC mixes and assessment using appropriate laboratory analysis.	Low level of knowledge on scc properties and the respective laboratory analyses.	Able to understand the importance of SCCmixes and effecting factors.	Ability to apply the knowledge of scc properties in choosing appropriate laboratory analysis	Full Knowledge on properties of scc and assessment of vital parameters using laboratory analyses.	Analyzing all practical aspects of scc properties and their key role in the field of construction.	5
	Level of knowledge on tensile, compressive and flexure strength properties and their real time applications.	Low level of knowledge on strength parameters and their real time applications.	Able to understand the strength parameters under various loading conditions.	Ability to apply the knowledge in the determination of strength parameters	Full knowledge on strength parametersand the respective laboratory analyses.	Analyzing the importance of strength parameters under various existing conditions and their respective applications.	5

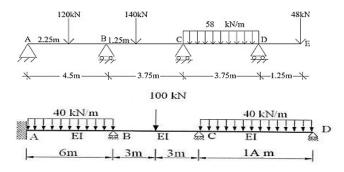
#### Department of Civil Engineering Structural Design Lab External Examination

#### Time: 9.30 AM to 12.00 PM

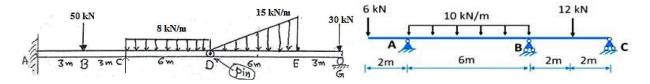
Date: 21/03/2022

- Design a reinforced concrete slab for a hall measuring 3 m x 8 m. The slab is supported over the RCC beams 250 mm wide and spaced at 4 m c/c. The superimposed load is 4 kN/m<sup>2</sup>. Use M20 concrete and Fe415 steel. Assume necessary data required.
- Design a reinforced concrete slab for a hall measuring 2.5 m x 7.5 m. The slab is supported over the RCC beams 250 mm wide and spaced at 3.5 m c/c. The superimposed load is 4.5 kN/m<sup>2</sup>. Use M25 concrete and Fe415 steel. Assume necessary data required.
- 3. Design a slab over a room 4 m x 6 m as per IS code. The edge of the slab is simply supported, and the corner are not held down. The live load on the slab is 3 kN/m<sup>2</sup>. The slab has a bearing of 150 mm on supporting walls. Use M20 concrete and Fe415 steel.
- 4. Design a slab over a room 4 m x 5 m as per IS code. The edge of the slab is simply supported, and the corner are not held down. The live load on the slab is 4 kN/m<sup>2</sup>. The slab has a bearing of 150 mm on supporting walls. Use M25 concrete and Fe415 steel.
- 5. Design a short column of size 400 mm x 500 mm subjected an axial load Pu = 250 kN and biaxial bending moment as follows: Mux = 150 kN-m, Muy = 120 kN-m, Use M25 concrete and Fe 415 steel.
- 6. Design a short column of size 500 mm x 600 mm subjected an axial load Pu = 200 kN and biaxial bending moment as follows: Mux = 150 kN-m, Muy = 120 kN-m, Use M20 concrete and Fe 415 steel.
- Design a combined rectangular footing for RC columns A and B separated by 4m c/c. Column A is 500x500 sq.mm and column B 600x600 sq.mm CSA and carries 1200 kN and 1600 kN respectively. SBC of soil is 200 kN/m<sup>2</sup>. Use M25 and Fe415 grades.
- Design a continuous beam of three equal spans of 3m to carry a DL of 15 kN/m<sup>2</sup> and LL of 10 kN/m<sup>2</sup>. Use M20 concrete and Fe415 steel. [Mid Span]
- Design a continuous beam of three equal spans of 3m to carry a DL of 15 kN/m<sup>2</sup> and LL of 10 kN/m<sup>2</sup>. Use M20 concrete and Fe415 steel. [End Span]

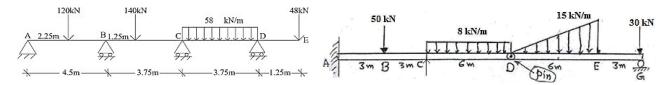
10. Analyse and design the RCC beam for the following support and load conditions. Show SFD and BMD.



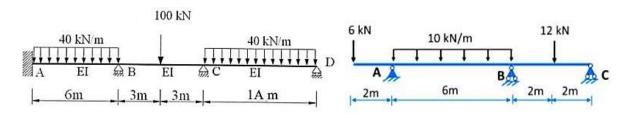
11. Analyse and design the RCC beam for the following support and load conditions. Show SFD and BMD.



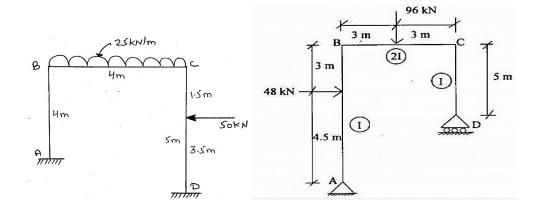
12. Analyse and design the RCC beam for the following support and load conditions. Show SFD and BMD.



13. Analyse and design the RCC beam for the following support and load conditions. Show SFD and BMD.



14. Analyse and design the RCC Frame for the following support and load conditions. Show SFD and BMD.



- 15. Analyse and Design the 3D frame (G+5) with a size of 15 m x 20 m consists of 3 m x 4 m Bay size with DL, LL with their load combinations. Assume whichever data necessary.
- 16. Analyse and Design the 3D frame (G+6) with a size of 20 m x 25 m consists of 4 m x 5 m Bay size with DL, LL with their load combinations. Assume whichever data necessary.
- 17. Analyse and Design the 3D frame (G+7) with a size of 25 m x 20 m consists of 5 m x 4 m Bay size with DL, LL with their load combinations. Assume whichever data necessary.
- 18. Analyse and Design the 3D steel truss with a size of 12 m x 20 m consists of 5 m Bay size with DL, LL with their load combinations. Assume whichever data necessary.



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## **M. Tech STRUCTURAL ENGINEERING**

#### STRUCTURAL DESIGN LAB INTERNAL EXAM MARK SHEET

GR22 2022-23 D 20 110 A A GR22D5009										
	Branchcode		Subject	Subject Name	Lab Internals	Assessment Marks	Record Marks	Lab Attendance Marks	Sessional Marks	
1	20	22241D2001	GR22D5009	Structural Design Lab	7	8	9	7	31	
2	20	22241D2002	GR22D5009	Structural Design Lab	8	9	9	10	36	
3	20	22241D2003	GR22D5009	Structural Design Lab	6	10	9	2	27	
4	20	22241D2004	GR22D5009	Structural Design Lab	8	8	9	6	31	
5	20	22241D2005	GR22D5009	Lab	8	8	9	5	30	
6	20	22241D2006	GR22D5009	Structural Design Lab	7	10	9	3	29	
7	20	22241D2007	GR22D5009	Structural Design Lab	6	10	9	6	31	
8	20	22241D2008	GR22D5009	Structural Design Lab	/	10	9	7	33	
9	20	22241D2009	GR22D5009	Structural Design Lab	7	8	9	1	25	
10	20	22241D2010	GR22D5009	Structural Design Lab	8	10	9	3	30	
11	20	22241D2011	GR22D5009	Structural Design Lab	8	10	9	4	31	
12	20	22241D2012	GR22D5009	Structural Design Lab	8	8	9	8	33	
13	20	22241D2013	GR22D5009	Structural Design Lab	9	10	10	2	31	
14	20	22241D2014	GR22D5009	Structural Design Lab	7	10	9	3	29	
15	20	22241D2015	GR22D5009	Structural Design Lab	10	10	10	7	37	
16	20	22241D2016	GR22D5009	Structural Design Lab	7	10	10	4	31	
17	20	22241D2017	GR22D5009	Structural Design Lab	8	8	9	4	29	
18	20	22241D2018	GR22D5009	Structural Design Lab	9	10	9	9	37	
19	20	22241D2019	GR22D5009	Structural Design Lab	5	5	5	1	16	

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