Techno India NJR Institute of Technology

Course File

Wind & Seismic Analysis (6CE3-01)

Session 2022-23

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RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

3rd Year - VI Semester: B.Tech. (Civil Engineering)

6CE3-01: WIND AND SEISMIC ANALYSIS

Credit: 2 **Max. Marks: 100 (IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Structural Systems:** Types of structures and Structure's forms, Symmetry and Asymmetry in building forms, Vertical and lateral loadresting elements, shear walls, framed tubes and various multistorey configurations.	4
3	**Design Loads:** various types of loads and relevant codes. Design loads for different types of buildings. (IS-875 part 1 & 2) & Load Flow Concept	3
4	**Wind Loads Analysis:** Wind loads & calculation of wind load on flat roof, pitched roof and single sloped roof buildings (IS: 875-Part 3).	8
5	**Earthquake Load Analysis:** Earthquake loads & calculations of earthquake loads on framed structures. (IS: 1893 – Part 1).	6
6	**Earthquake Resistant Construction:** Typical seismic failure of masonry and RCC structures. Earthquake resistant construction of buildings, and various provisions as per IS codes; IS-4326, IS-13827, IS-13828, IS-13920, IS-13935.	6
	TOTAL	28

Course Overview:

Student will learn basics of "**Wind and Seismic analysis**" from these 28 hours course. **Wind and Seismic analysis** provide a fundamental understanding of the behaviour of steel, concrete, and composite building structures. Students will able to relate the typical process of designing a building, from the first step of determining design loads, to the final step of evaluating its behaviour for unusual effects under wind and earthquake.

Wind and Seismic analysis play a significant role in ensuring that all Company's projects are aligned with strategic vision and objectives, and meet operational. **WSA** is the main requirement for the job role in the companies. Students should learn and develop problem solving abilities using this course in order to get a good job in top civil engineering company.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Comprehension	Understand the types of structures, symmetry and asymmetry in Building forms, shear walls and multi-storey configurations.
2	Analysis	Analyze design loads for different types of buildings.
3	Synthesis	Calculate wind load on flat roof, pitched roof and single sloped Roof buildings.
4	Synthesis	Calculate earthquake loads on framed structures and design of Earthquake Resistant Construction.
5	Analysis	Apply wind & seismic load for analyzing the structure to evaluate the response of lateral load.

Prerequisites:

- Students will be able to attain knowledge of Earthquake Resistant Construction as per the code provision of Indian Standards
- Students will be able to describe the theory of lateral load distribution concept and structural systems phenomena.
- Students will be able to explain the principle of building analysis and behavior of structure during lateral loads.
- Students will be able to apply wind & seismic load for analyzing the structure to evaluate the response of lateral load

Course Outcome Mapping with Program Outcome:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO361.1	3	2	2	2	1	1	1	1	1	1	1	1	1	1	2
CO361.2	2	2	1	1	1	2	1	1	2	2	2	1	1	2	2
CO361.3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	2
CO361.4	3	2	2	2	2	2	2	1	2	1	1	1	2	2	3
CO361.5	3	3	3	3	2	1	2	1	2	1	1	2	3	3	2
CO361 (AVG)	2.8	2.2	2	2	1.4	1.4	1.4	1	1.6	1.2	1.2	1.2	1.6	1.8	2.2

Lecture No.	Unit	Topic
1	**1**	**Introduction** Objective, scope and outcome of the course
2	**2**	**Structural Systems:** Types of structures and Structure's forms,
3	2	Symmetry and Asymmetry in building forms
4	2	Vertical and lateral load resting elements
5	2	Shear walls, framed tubes and various multistorey configurations
6	**3**	**Design Loads:** various types of loads and relevant codes
7	3	Design loads for different types of buildings
8	3	(IS-875 part 1 & 2) & Load Flow Concept
9	**4**	**Wind Loads Analysis:** Wind loads & calculation of wind load on flat roof
10	4	Wind loads & calculation of wind load on flat roof
11	4	Wind loads & calculation of wind load on flat roof
12	4	Wind loads & calculation of wind load on pitched roof
13	4	Wind loads & calculation of wind load on pitched roof
14	4	Wind loads & calculation of wind load on pitched roof
15	4	Wind loads & calculation of wind load on single sloped roof buildings
16	4	Wind loads & calculation of wind load on single sloped roof buildings
17	**5**	**Earthquake Load Analysis:** Earthquake loads & calculations of earthquake loads on framed structures. (IS: 1893 – Part 1)
18	5	Numerical Practice on calculations of earthquake loads
19	5	Numerical Practice on calculations of earthquake loads

20	5	Numerical Practice on calculations of earthquake loads
21	5	Numerical Practice on calculations of earthquake loads
22	5	Numerical Practice on calculations of earthquake loads
23	**6**	**Earthquake Resistant Construction:** Typical seismic failure of masonry and RCC structures
24	6	Earthquake resistant construction of buildings, and various provisions as per IS codes IS-4326, IS-13827, IS-13828, IS-13920, IS-13935
25	6	Numerical Problems on Earthquake resistant construction
26	6	Numerical Problems on Earthquake resistant construction
27	6	Numerical Problems on Earthquake resistant construction
28	6	Numerical Problems on Earthquake resistant construction

TEXT/REFERENCE BOOKS

1. Earthquake Resistant Building Construction by Neelam Sharma, S.K. Kataria & Sons.
2. Seismic Analysis of Structures by T.K.Datta, John Wiley & Sons (Asia) Pte Ltd.
3. Earthquake Resistant Design of Structures by Pankaj Agarwal Manish Shrikhande, Prentice-Hall of India (PHI).
4. I.S. 1893 - 2002, Criteria for Earthquake Resistance design of Structures

Course Level Problems (Test Items):

CO.NO.	Problem description
1	**A.** Explain Center of mass and Center of rigidity with an example. How their position will affect design of building for earthquake resistance? **B.** Explain the followings. a) Horizontal and vertical irregularities. b) Static and Dynamic analysis of RC buildings.
2	**A.** What are building configurations? Explain various Irregularities in buildings with sketch. **B.** Explain in brief the types of damages observed in traditional built construction during the earthquake with their sketch. **C.** Discuss the importance of ductile detailing of RC structure. Show the ductile detailing of a typical joint of beam and column of RCC framed building

3	**A.** What are the seismic strengthening arrangements for masonry buildings? Explain the horizontal reinforced band in masonry construction. **B.** Design philosophies & assumptions for earthquake resistant RC buildings as per IS 1893 (Part-1) 2002.
4	**A.** Describe the shear wall. What are the functions of shear wall in RC framed building? **B.** Explain the general principles as per IS 4326:1993 for traditional built.
5	**A.** Determine the design base shear for plane frame and plan of five storied, symmetric RC building as shown in Fig. Building is special RC moment resisting frame with brick infill walls of 250mm thick longitudinal and 150mm thick transverse wall. Take floor height=3m, Size of beams 250 × 400 mm, columns 250 × 450 mm, slab 100mm thick, unit weight of RCC= 25 kN/m^3, unit weight of brick = 20 kN/m^3, type of soil is rocky. Live load is 3.5 kN/m^2.

Assessment Methodology:

1. Assignments one from each unit.
2. Online Quiz at Google classroom.
3. Midterm subjective paper based on topics as mentioned in the modules (Twice during the semester).
4. Final paper at the end of the semester subjective.

TEACHING AND LEARNING RESOURCES UNIT-WISE

1) STRUCTURAL SYSTEMS:

Video Tutorials:

https://www.youtube.com/watch?v=78UMDvdtL5Y&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC

https://www.youtube.com/watch?v=2Oo_jsxgeIU&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=2

https://www.youtube.com/watch?v=BubfJUyfL9s&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=3

Theory concepts:

https://drive.google.com/drive/folders/1tpYcq-qGEAyjfslahbVWyqaV10g9mRSn

https://www.iitk.ac.in/nicee/IITK-GSDMA/EBB_001_30May2013.pdf

https://drive.google.com/file/d/17kRMkBpotcrWjKYRuUXQGd0kssHvPad8/view

Sample Quiz:

https://www.uh.edu/~jbutler/physical/chap18mult.html

2) WIND LOADS ANALYSIS

Video Tutorials:

https://www.youtube.com/watch?v=w8nWHy54mKs&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=8

https://www.youtube.com/watch?v=Qx5sJIspJNc&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=9

https://www.youtube.com/watch?v=WLLib6uyzYY&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=10

https://nptel.ac.in/courses/105/108/105108204/

https://nptel.ac.in/courses/105/102/105102016/

Theory concepts:

https://drive.google.com/drive/folders/1tpYcq-qGEAyjfslahbVWyqaV10g9mRSn

https://www.iitk.ac.in/nicee/IITK-GSDMA/EBB_001_30May2013.pdf

https://drive.google.com/file/d/17kRMkBpotcrWjKYRuUXQGd0kssHvPad8/view

Sample Quiz:

https://www.uh.edu/~jbutler/physical/chap18mult.html

3) EARTHQUAKE LOAD ANALYSIS AND EARTHQUAKE RESISTANT CONSTRUCTION:

Video Tutorials:

https://www.youtube.com/watch?v=p-tfixit380&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=14

https://www.youtube.com/watch?v=Vp6K4MYmRHQ&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=15

https://www.youtube.com/watch?v=vvkOSv4ASjg&list=PLozwvoadUfmrvXImKgDCSliwQn3EAvwNC&index=16

Theory concepts:

https://drive.google.com/drive/folders/1tpYcq-qGEAyjfslahbVWyqaV10g9mRSn

https://www.iitk.ac.in/nicee/IITK-GSDMA/EBB_001_30May2013.pdf

https://drive.google.com/file/d/17kRMkBpotcrWjKYRuUXQGd0kssHvPad8/view

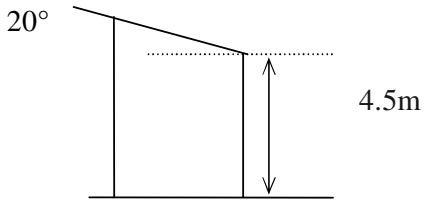
Sample Quiz:

https://www.uh.edu/~jbutler/physical/chap18mult.html

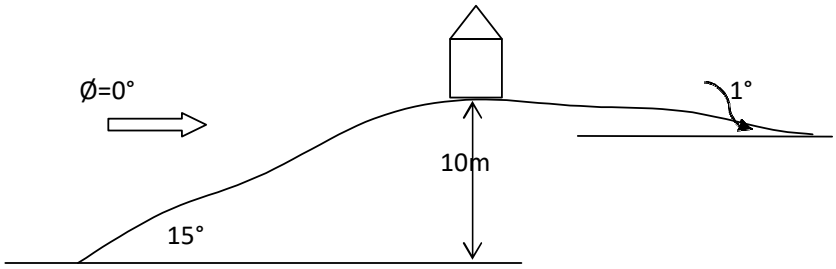
TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY
VI Sem, III Year, Civil Department
Wind & Seismic Analysis (6CE1-03)

ASSIGNMENT-1

1. Calculate wind load on rectangular clad building with mono-slope roof, Building is proposed to construct in Delhi. Consider height (h) = 4.5m, width (w) =10m, length (l) =18m, roof angle (α) =20°, terrain category= 2, ground is flat and life of building is 25 years. Also, one of long side wall of building is open.



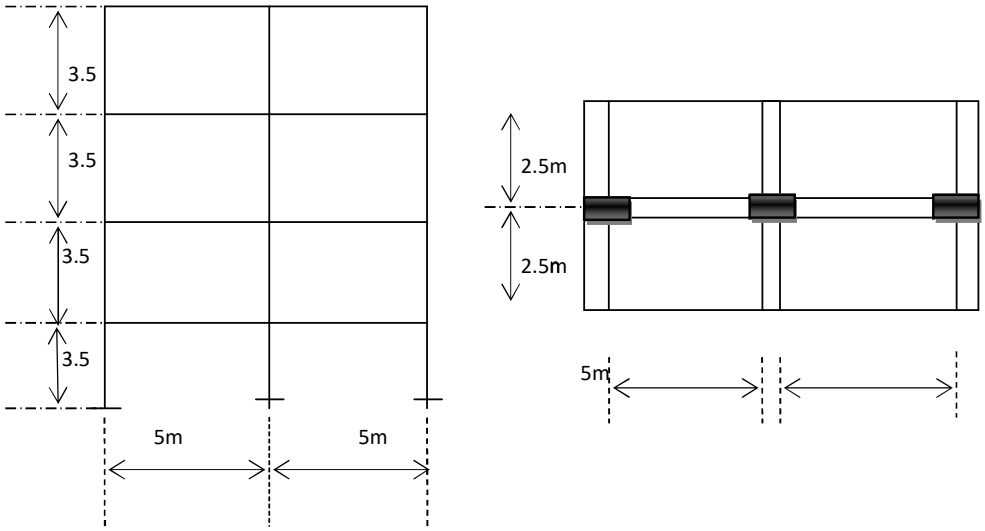
2. Calculate wind pressure and design forces on walls and roof of rectangular clad building with pitched roof, having plan dimensions 10m × 30m and height 5m. as shown in Fig.1. Building is situated in Jaipur on a hilltop 10m high having upwind and downwind slope of 15° and 1°, respectively as shown in Fig. The building has 16 opening of 1.5m × 1.5 m size and roof angle (α) =15°. The columns and trusses are at 5m c/c longitudinally spaced and spacing of purlins is 1.4m c/c.



3. Discuss the external pressure coefficient and internal pressure coefficient for pitched roof clad rectangular buildings.
4. Explain Center of mass and Center of rigidity with an example. How their position will affect design of building for earthquake resistance?
5. Explain the followings.

a) Horizontal and vertical irregularities.
b) Static and Dynamic analysis of RC buildings.

6. Determine the design base shear for plane frame and plan of five storied, symmetric RC building as shown in Fig. Building is special RC moment resisting frame with brick infill walls of 250mm thick longitudinal and 150mm thick transverse wall. Take floor height=3m, Size of beams 250 × 400 mm, columns 250 × 450 mm, slab 100mm thick, unit weight of RCC= 25 kN/m^3, unit weight of brick = 20 kN/m^3, type of soil is rocky. Live load is 3.5 kN/m^2.



TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY

B.tech 3 rd year, **VI Semester, Civil engineering**

Wind & Seismic Analysis (6CE1-03)

ASSIGNMENT-2

1) What are building configurations? Explain various Irregularities in buildings with sketch.

2) Describe the shear wall. What are the functions of shear wall in RC framed building?

3) What is the Aspect ratio of building? Also discuss the advantages of its.

4) a) Explain in brief the types of damages observed in traditional built construction during the earthquake with their sketch.

b) Explain the general principles as per IS 4326:1993 for traditional built.

5) Explain in brief the types of damages observed in traditional built construction during the earthquake with their sketch.

6) Discuss the importance of ductile detailing of RC structure. Show the ductile detailing of a typical joint of beam and column of RCC framed building.

OBJECTIVE QUESTIONS

1. Which of the following describes the build up and release of stress during an earthquake?
   - ☐ The Modified Mercalli Scale
   - ☐ The elastic rebound theory
   - ☐ the principle of superposition
   - ☐ The travel time difference
2. The amount of ground displacement in a earthquake is called the _____ .
   - ☐ Epicenter
   - ☐ Dip
   - ☐ Slip
   - ☐ Focus
3. The point where movement occurred which triggered the earthquake is the _____ .
   - ☐ Dip
   - ☐ epicenter
   - ☐ Focus
   - ☐ strike
4. Which of the following sequences correctly lists the different arrivals from first to last?
   - ☐ P waves ... S waves.... Surface waves
   - ☐ Surface waves ... P waves.... S waves
   - ☐ P waves ... Surface waves ... S waves
   - ☐ S waves ... P waves.... Surface waves
5. How do rock particles move during the passage of a P wave through the rock?
   - ☐ Back and forth parallel to the direction of wave travel
   - ☐ back and forth perpendicular to the direction of wave travel
   - ☐ in a rolling circular motion
   - ☐ the particles do not move
6. Detailed studies of what earthquake allowed researchers to develop the elastic rebound theory?.
   - ☐ the 1906 San Francisco earthquake
   - ☐ the 1964 Anchorage, Alaska earthquake
   - ☐ the 1755 Lisbon, Portugal earthquake
   - ☐ the 1985 Mexico City earthquake

7. How many seismograph stations are needed to locate the epicenter of an earthquake?
   - ☐ 1
   - ☐ 2
   - ☐ 3
   - ☐ 4
8. Earthquakes can occur with _____ faulting.
   - ☐ Normal
   - ☐ reverse
   - ☐ thrust
   - ☐ all of these
9. Approximately what percentage of earthquakes occurs at plate boundaries?
   - ☐ 25%
   - ☐ 50%
   - ☐ 75%
   - ☐ 90%
10. Which type of faulting would be least likely to occur along the mid-Atlantic ridge?
   - ☐ Normal
   - ☐ reverse
   - ☐ transform
   - ☐ all of these could occur

5E5065

Roll No. : _____ Total Printed Pages : 4

5E5065

B. Tech. (Sem. V) (Main / Back) Examination, November 2018
Civil Engg.
5CE5A Building Design

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 26

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. IS : 875 Part-3 2. IS : 1893 Part-1

http://www.rtuonline.com

UNIT - I

1 (a) What do you understand by over turning in a building ? 6

(b) What are tube in tube structure of high rise building ? 6

(c) Explain concept of load flow to different structural components with figure. 4

OR

(a) Write different configuration of high rise buildings. 4

(b) Calculate equivalent uniformly distributed load for bending moment and shear force for a beam if load transferred on such beam from a slab is triangular in nature. 8

(c) Define stiffness of building and how this will affect design ? 4

UNIT - II

2 Calculate wind load on wall and roof of a rectangular clad building with pitched roof, having plan dimensions 10 m × 50 m and height 5 m. The building is situated in Delhi in an industrial area 500 m inside open land on a fairly level topography. Walls have 20 opening of 1.5 m × 1.5 m size, if roof angle is 15°. 16

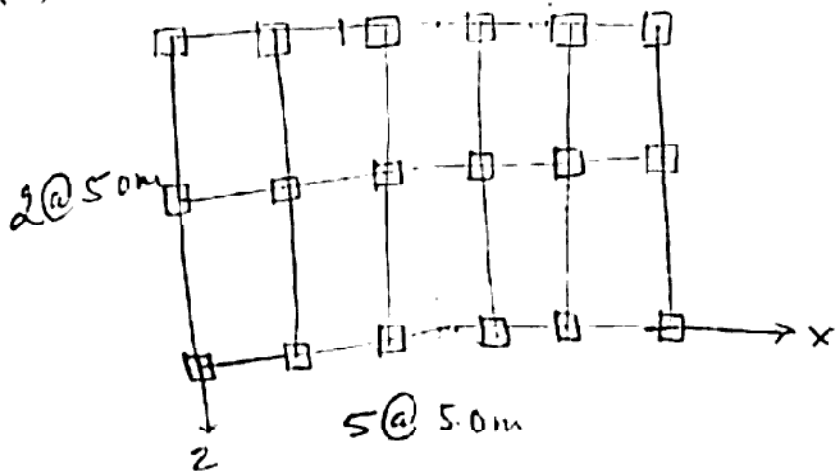
OR

2 Calculate wind load on a rectangular Clad Building with monoslope roof with overhang. Consider height (h) = 5.0 m, length (l) = 20 m, width (w) = 10 m, roof angle α = 20° and overhang is 0.5 m, ground is flat, terrain category-2, life of building 25 years and building is situated at Surat. 16

UNIT - III

3 Calculate force in given frame building with following data:

(i) Column size = 400 mm × 400 mm
(ii) Beam size = 300 mm × 400 mm
(iii) Floor thickness = 120 mm
(iv) Live load on floor = 4.0 kN/m^2
(v) Brick wall thickness = 150 mm
(vi) Storey height = 4.0 m each
(vii) No. of storeys = 5



Plan of Building

OR 16

3 (a) What do you understand by centre of mass and centre of rigidity ? 4

(b) The plan of building have four shear wall. All four walls are in M25 grade concrete, 200 mm thick and 4 m long. Storey height is 3.5 m. Floor consists of cast in sita reinforced concrete. Design shear force on the building is 100 kN in either direction. Determine the design lateral force on different shear walls. 12

UNIT - IV

4 (a) How do you define wall and column in a masonry building. With the help of diagram draw effective length of walls for various cases as per code. 8

(b) Write construction practices required for ensure earthquake resistance in Masonry Building. 8

OR

4 (a) Explain the ductile detailing in column and beam connections. 8

(b) What do you understand by slenderness ratio of wall and column in design of Masonry. 4

(c) Explain the behaviour of infill wall in Masonry construction. 4

UNIT - V

(a) Explain the difference between grid floor and ribbed floor and draw the diagram to illustrate the difference. 8

(b) Explain in detail about panels and precast elements. 8

OR