SHANTILAL SHAH ENGINEERING COLLEGE, BHAVNAGAR

APPLIED MECHANICS DEPARTMENT

B.E. (Civil Engineering) Semester – 6th

Subject Code: 3160621	**Name of Subject: Earthquake Engineering**
Assignment No: 01	**Date of Submission: 16/03/2023**

Earthquake Basics

#	Questions
1	Differentiate between magnitude and intensity.
2	Give expression for (i) local magnitude (ii) Surface magnitude (iii) Moment magnitude.
3	Draw neat sketch of seismograph and enlist its components.
4	Define the terms: (i) epicentre (ii) Hypocentre (iii) Aftershocks (iv) Mesoseismal (v) Seismogram (vi) Accelerogram
5	Enlist various causes or earthquake.
6	List the seismic waves generated during earthquake. Which of these waves are dangerous for building structures?
7.	Explain "elastic rebound theory'.
8.	Describe "seismic waves' briefly.
9.	Give classification of earthquakes.
10.	Explain the method to locate epicentre of earthquake. Give important parameters
11.	Write short note: 'Richter magnitude scale'.
12.	Discuss various effects of earthquake.
13.	Differentiate between seismograph and seismogram.
14.	Explain interior of the earth with sketch
15.	Define tectonic plates. Discuss plate tectonic theory.
16.	Define fault? Explain various types of faults.
17.	Describe the inter-plate earthquake and intraplate earthquake?
18.	Specify different scales used to measure magnitude and intensity of earthquake

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Subject Code: 3160621	**Name of Subject: Earthquake Engineering**
Assignment No: 02	**Date of Submission: 30/03/2023**

FUNDAMENTALS OF EARTHQUAKE VIBRATIONS OF BUILDINGS

Questions

#

1 **Define:**
(i) Vibration (ii) Oscillation (iii) Damping (iv) Resonance (v) Free Vibration

2 Explain spring in Series & in Parallel.

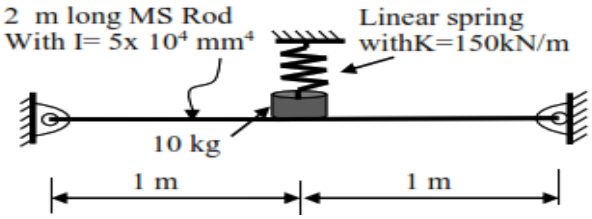
3 Describe the concept of mathematical modelling? Write the assumptions made in it.

4 Derive the equation of response of SDOF for free undamped vibration system.

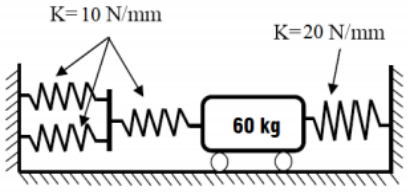
5 Derive the equation of response of SDOF for free damped vibration system.

6 Explain the concept of logarithmic decrement.

7 Find out the natural frequency & time period of the system as shown in the fig below.



8 Find out the natural frequency & time period of the system as shown in the fig below.



9 A spring mass model consisting of 9 kg mass and a spring having stiffness 3.6 N/mm was tested for viscous damped vibration and the test record showed two successive amplitudes as 1.75 and 1.5. **Determine:**
1. Natural frequency of Undamped & Damped System
2. Logarithmic Decrement
3. Damping ratio
4. Damping Coefficient
5. Damped natural period.

10 An idealized SDOF system consists of a RCC water tank shaft of 4 m outer diameter & 120 mm wall thickness, which supports a container with lumped weight of 2800 kN at its top. The effective height of column shaft is 15 m. The damper offers the resistance of 25 kN at the velocity of 3 m/sec. Calculate the damping ratio and state whether the system is under damped, over damped or critically damped. Also calculate the damped frequency. Consider $E = 25000\ Nmm^2$

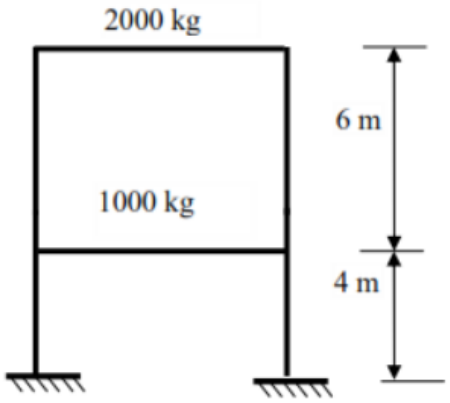
11 A SDOF vibrating system is having following parameters. m = 200 kg, k = 160 N/m, c = 40 N – sec / m. **Determine:**

(i) The damping ratio
(ii) The natural frequency of damped vibration
(iii) Logarithmic decrement
(iv) The ratio of two successive amplitudes
(v) The number of cycles after which the original amplitude is reduced to 50%

12 A mass has a frequency of 10 Hz, when mass is decreased by 0.4 kg, the frequency is changed by 25%. **Determine:**

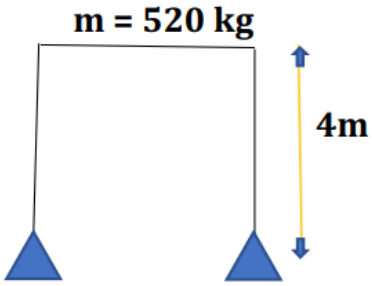
i. The Mass (m)
ii. The Spring Constant (k)

13 Find out the natural frequencies and draw the corresponding mode shapes for the given frame as shown in fig below. Take EI (column) = $1.5 \times 10^{12}\ Nmm^2$



14 A three-story building frame with uniform floor height of 4m is having lumped masses of 8 tonnes, 6 tonnes and 4 tonnes at first, second and third floor respectively with uniform storey stiffness of 1000 kN/m at each floor. Calculate natural frequency and draw corresponding mode shapes. Also verify the orthogonal condition and normalization of modes.

15 A steel frame as shown in fig supports a rotating machine which exerts a horizontal force at gantry level of 51500 sin 11.5t N. Assume 5 % of Critical damping. What is the steady state displacement of vibration?
Also state system will have resonance or not?
Take E = 21 X 10^{10} N/m^2 I = 1500 X 10^{-7} m^4



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B.E. (Civil Engineering) Semester – 6th

Subject Code: 3160621	**Name of Subject: Earthquake Engineering**
Assignment No: 03	**Date of Submission: 27/04/2023**

Design Philosophy

#	Questions
1	Using static co-efficient method find the design lateral seismic forces and its Distribution along the height for a building having following details. (i) Location: Ahmadabad (ii) Configuration: 4 bays of 5 m each along x and y direction (iii) Height: ground + 4 storey each of 3.0 m floor height (iv) Columns: 300 x 300 mm all, Beams: 300 x 450 mm, Slab: 150 mm thick RCC (v) Walls: Outer 250 mm brick masonry, inner 150 mm brick masonry, Parapet: 230 mm thick 1 m high brick masonry (vi) Live Load=2 kN/m^2 Floor finish = 1 kN/m^2 roof finish=2 kN/m^2
2.	Calculate base shear for the 10 story R.C. frame building for hospital located in a city of earthquake Zone – V, using seismic coefficient method for the following data : 1. No. of bays in X – direction - 9 2. No. of bays in Y – direction - 7 3. Bay width in both direction – 4 m 4. Clear Story height below beam bottom – 3 m 5. Thickness of Slab - 140 mm 6. Size of web of Beam - 230 mm x 460 mm 7. Size of Column - 460 mm x 600 mm 8. Internal wall thickness - 120 mm 9. External wall thickness - 250 mm 10. Live Load - 4 kN/m2 Assume suitable data if required. Give your calculation with appropriate clause number of code and draw shear distribution at each floor level.

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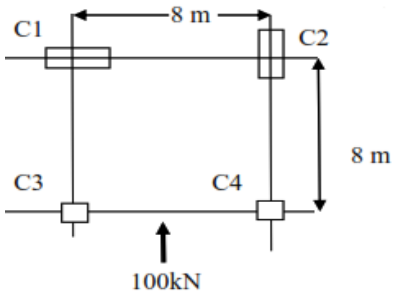
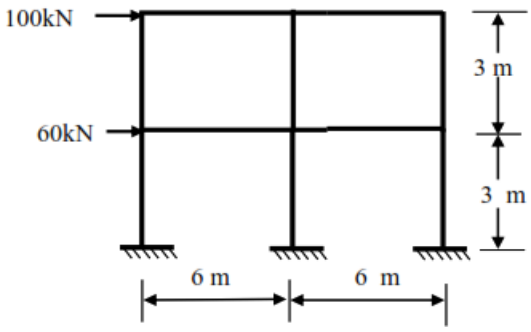
Subject Code: 3160621	Name of Subject: Earthquake Engineering
Assignment No: 04	Date of Submission: 27/04/2023

Lateral Loads on Buildings

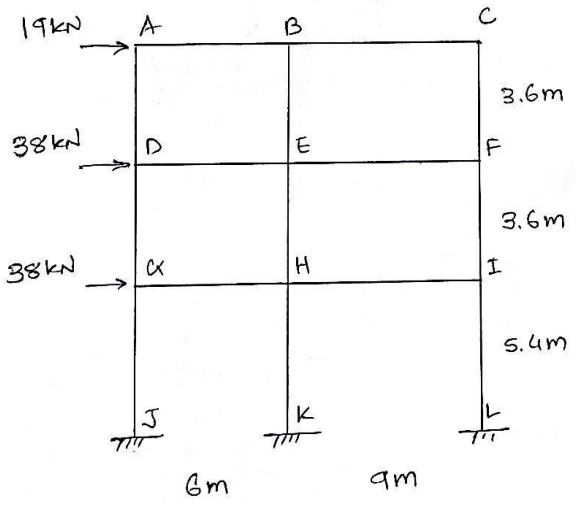
#	Questions
1	Explain 'rigid diaphragm' and 'Flexible diaphragm'.
2	Distinguish between 'Centre of mass' and 'Centre or stiffness'.
3	Explain the procedure for design eccentricity calculation as per IS : 1893 (I) - 2016
4	Differentiate between torsionally coupled and torsionally uncoupled system
5	For a rigid floor as shown in fig below: (i) Locate centre mass, centre of stiffness and find design eccentricity. (ii) Find lateral loads on columns Columns C1 and C2 are of 3000 x 500 mm c/s C3 & C4 are 300x300 mm square. Mass is uniformly distributed.



6	Analyse the building frame shown in figure by portal method and Draw SFD, BMD and AFD



7 Analyse the building frame shown in figure by cantilever method and Draw SFD, BMD and AFD.



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B.E. (Civil Engineering) Semester – 6th

Subject Code: 3160621	**Name of Subject: Earthquake Engineering**
Assignment No: 05	**Date of Submission: 11/05/2023**

(A) Ductile Detailing

#	Questions
1	Explain ductile detailing of column as per IS 13920 – 2016. Also give limitation of this code.
2	Discuss in detail the concepts of the ductile detailing in Beams.
3	Do as directed: (i) Sketch the reinforcement details for c/s of RCC column 400 x 400 mm, having 8 nos. 20 mm dia main bars as ductile requirement (ii) Sketch the qualitative L/S of 6 m long RCC beam of special moment resisting frame having cross section 300 mm wide 600 mm deep.

(B) Special Topics

#	Questions
1	Enlist the different methods of structural control and explain any one in detail.
2	Discuss the causes and effects of liquefaction? Write the preventative measures of liquefaction.
3	Explain Beam & Column jacketing with neat sketch.
4	Explain Repair, Restoration, Rehabilitation & Retrofitting.
5	Discuss various energy dissipation devices.