Q. Code:696343

Reg. No. | | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Seventh Semester

CE18703 – STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

(Civil Engineering)

(Regulation 2018 /2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

Note: Use of IS 1893 Part1- 2016, IS13920:2016, IS 4326-2013 and SP16 code books are permitted.

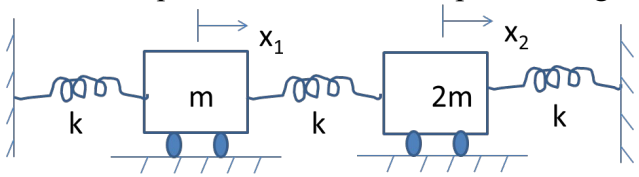
COURSE OUTCOMES		RBT LEVEL
CO 1	Students will be able to apply the knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system	**3**
CO 2	Develop the equations of motion for MDOF system and to evaluate the natural frequencies and mode shapes.	**3**
CO 3	Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.	**2**
CO 4	Identify the various causes and effects of earthquakes on structures due to past earthquakes.	**2**
CO 5	Analyze the structures subjected to dynamic loading and to design for seismic loading as per codal provisions.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	A mass of 20 kg when suspended from a spring causes a static deflection of 1 cm. Find natural frequency of the system.	**1**	**2**
2.	A displacement – time plot for a free vibration analysis of a SDOF system gives a displacement of 7.5 mm at time t1 and 1 mm after 7 cycles. Determine logarithmic decrement.	**1**	**2**
3.	Write the matrix form of equation of motion for a two storey building frame according to shear building concept.	**2**	**2**
4.	Write the equation of motion of undamped three storey building frame having same mass ‘m’ and same stiffness ‘k’ for all three floors.	**2**	**2**
5.	What is the basic difference between focus and epicenter?	**3**	**1**
6.	Explain briefly the plate tectonic theory.	**3**	**2**
7.	State the site conditions and soil type that are susceptible to liquefaction.	**4**	**1**
8.	Explain briefly with sketches about planning irregularities of a building.	**4**	**2**
9.	Draw the failure modes of RC beams against earthquake loading.	**5**	**1**
10.	What are all the causes of failure of RC structures?	**5**	**1**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)		A simply supported rectangular beam has a span of 1m. It is 100 mm wide and 10 mm deep. It is connected at mid- span of a beam by means of a linear spring having a stiffness of 100 kg/cm and a mass of 300 kg is attached at the other end of spring. Determine the natural frequency of the system. Take E= 2.1x 10^6 kg/cm^2.	**(14)**	**1**	**3**
		(OR)			
(b)		A portal frame supports a machine that exerts a sinusoidal force of 8.5 kN at a frequency of 1.75 Hz. The mass of the machine is 4000 kg and is added to that of the frame. The mass of the frame at the floor level is 5000 kg and lateral stiffness of the frame is 4x10^6 N/m. (a) Determine the steady state amplitude of vibration, if damping ratio is 4%. (b) What would be the steady state amplitude if the forcing frequency was in resonance with the supporting structure?	**(14)**	**1**	**3**
12. (a)		Determine the natural frequencies and mode shapes of the given system. 	**(14)**	**2**	**3**
		(OR)			
(b)		Obtain the natural frequencies and mode shapes for a single bay three storey shear frame. EI= 4.5 x 10^6 N-m^2 and height of all columns is 3 m. Mass of each floor is 5000 kg.	**(14)**	**2**	**3**
13. (a)	**(i)**	Explain the type of fault with neat sketches.	**(10)**	**3**	**2**
	(ii)	Explain the concept of elastic rebound theory in detail.	**(4)**	**3**	**2**
		(OR)			
(b)	**(i)**	Explain about various types of waves in earthquake engineering.	**(10)**	**3**	**2**
	(ii)	Explain the seismogram with neat sketch.	**(4)**	**3**	**2**
14. (a)	**(i)**	Describe the Bauchinger and Pinching effects of RC elements with neat sketches.	**(10)**	**4**	**2**

(ii)	Briefly describe the local damage mechanisms of masonry structures with neat sketches.	**(4)**	**4**	**2**

(OR)

(b)	Describe the methods to reduce liquefaction.	**(14)**	**4**	**2**

15. (a)	A 4-storey building having moment resistant frame with in-fill walls is located in Srinagar, J &K and has the following data:	**(14)**	**5**	**3**

Floor	Seismic Weight, kN	Storey Height, m
Roof	5500	3.25
3rd	7250	3.25
2nd	7800	3.25
1st	6500	3.75

Its plan dimensions are 15 x 20 m. Determine the base shear if it is located on soft soil and has a special ductile detailing. Also determine the lateral force acting at each floor.

(OR)

(b)	Design the column of a multi storeyed building for ductility with M25 and Fe415 subjected to an axial force of 1000 kN and bending moment of 91.67 kNm.	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A machine of 100 kg mass is supported on springs of total stiffness 700 kN/m and has an unbalanced rotating element, which results in a disturbing force of 350 N at a speed of 3000 rpm. Assuming a damping ratio of 0.20, determine (a) its amplitude of motion due to the unbalance, (b) the transmissibility, and (c) the transmitted force.	**(10)**	**1**	**3**

****