Sanjay Ghodawat University, Kolhapur

2020-21

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

EXM/P/09/00

Year and Program: 2020-21	**School of Technology**	**Department: Civil**
Course Code: CET402	**Course Title: Earthquake Engineering**	**Semester : VII**
Day : Tuesday **Date: 02.03.2021**	**End Semester Examination**	**Time :2 Hrs.** **Max Marks:50**

Instructions: 1) All Questions are compulsory.
2)Assume any suitable data whenever necessary.
3) Use of non-programmable calculator and
4) IS 1893 - 2016 (Part I) and IS 13920 – 2016 are allowed.

Q.1	**Answer the following (any Two)**–	**Marks**	**Bloom's Level**	**CO**
a)	What is mean by plate boundaries? Explain in details.	8	4	CO1
b)	Derive the equation of motion and its solution for free damped vibration system.	8	4	CO2
c)	A SDOF system consists of 5 m high column of 450 mm diameter which supports the heavy mass of 20 tonne at its top. The system is subjected to a harmonic force of 200 Sin 40t kN. Consider 20% damping & E = 2.1 x 10^5 N/mm^2. Calculate the maximum dynamic amplitude. Also, state whether system will have resonance or not?	8	4	CO2

Q.2	**Answer the following (any two)** –			
a)	Find the natural frequency and natural period for the building frame shown in the fig.1. During test the frame is given 40 mm initial lateral displacement and released from the rest to vibrate freely. Find the displacement after 4 seconds and number of cycles when amplitude reduced to 1/20 of maximum. Consider 10% damping. Take $EI_{Column} = 1.5 \times 10^{12}\ N.mm^2, EI_{Beam} = \infty$.	8	5	CO2
b)	Calculate base shear in the critical direction only for BSNL office in Pune with following data by seismic coefficient method. (a) No. of storey = 4 (b) No. of bay in x direction = 3 (c) No. of bay in y direction = 1 (d) storey height = 3 m (e) Width of each bay = 5 m (f) Total DL on roof = 12 kN/m^2 (g) Total DL on floor = 10 kN/m^2 (h) LL = 4 kN/m^2 (i) Thickness of slab = 120 mm All columns having their longer side in X direction. Neglect weight of infill walls. Assume suitable data if required. Write all your assumptions & clauses of IS 1893 (2016). Building is provided with additional viscous dampers which will increase damping by 10%.	8	5	CO3

	c)	Determine the story level earthquake force on the structure by equivalent static analysis for above problem (2. b).	8	5	CO3

Q.3 **Answer the following (any two) –**

	a)	Explain ductile detailing of beam as per IS 13920	9	3	CO3
	b)	Explain Tuned Liquid Dampers with its working principal?	9	3	CO4
	c)	Explain Friction Dampers?	9	3	CO4