Sanjay Ghodawat University, Kolhapur

2018-19
EXM/P/09/00

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School of Technology **Department** – Civil Engineering

F.Y. M.Tech.
(Structural Engg.)
Course Code – CSE506

Course Title: Earthquake resistant design of structures

Semester – II

Date: Friday 24-05-2019

Examination: ESE

Time: 2.30 to 5.30 pm. **Max Marks: 100**

Instructions:

1) Use of non-programmable calculators are allowed
2) Figures to the right indicates full marks
3) Use if IS1893-2016 and IS13020-2016 is permitted
4) Assume suitable if necessary and mention clearly

Q.1	a)	Differentiate between magnitude and intensity of earthquake. How the magnitude of earthquake can be related with energy released?	05	L2	CO1
	b)	Explain with neat diagrams movement of different tectonic plates. What is plate tectonic theory? On what evidences does this theory is based?	10	L2	CO1
		OR			
	b)	Starting from first principles and with suitable mathematical expressions explain the terms "displacement spectra", "Pseudo velocity spectra", and "Pseudo acceleration spectra" of an earthquake.	10	L2	CO1
Q.2	a)	Explain with sketch *P-Δ* effect. In what way it affects on seismic design?	07	L2	CO2
	b)	A simple one-story building having two shear walls in each direction is shown in Fig.1. Locate center of mass and center of rigidity and also obtain design eccentricity as per torsion provision in IS1893-2016.	08	L4	CO2
Q.3		A two storied residential building with story height 3m is shown in Fig.2.The building is analyzed using IS1893-2016 method and base shear is obtained as 207 kN. The center of mass at each floor is offset by 1.5m in both directions. The interior frame has the stiffness double than exterior frame. Find design forces for each of the four frames if earthquake force is acting along Y- direction of these frames using the torsion provision in IS1893-2016.	15	L4	CO3

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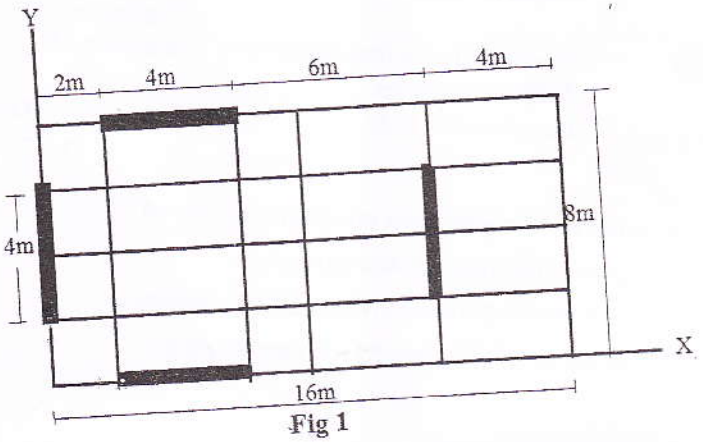

Fig 1

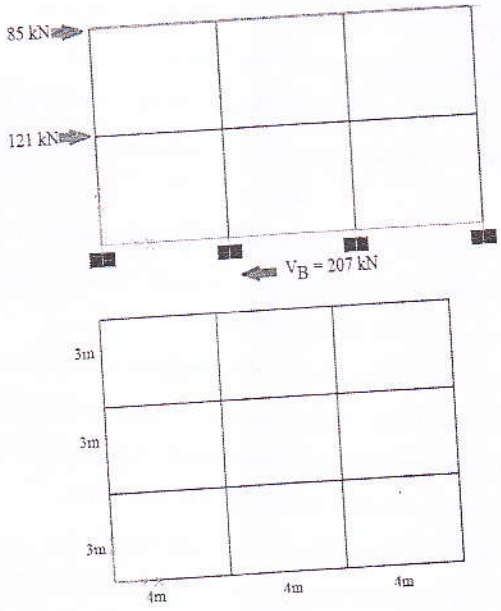

Fig.2

Q.4 A column 300 X 300 mm is subjected to the forces shown in table 1 at the end of the analysis. Find the design values of all the forces considering the relevant load combinations. If the column is provided with 8-16mm diameter bars, find the design shear force as per IS13920-2016.The sagging and hogging BM in the beam framing in to the column are 110 kN-m and 140 kN-m respectively. Also show a sketch showing the detailing of the column confinement reinforcement as per the code. Assume M20 grade 15 L5 CO4

concrete and Fe415 reinforcing steel. Assume stress in compression steel as 0.94 *fy*. Height of column is 3m.

Table 1

Loads	Axial force (kN)	BM (kN-m)	SF (kN)
DL	150	10	6
LL	100	07	4
EL	60	80	50

Q.5 a) Identify the different kinds of non-linearities to be assign to various structural elements of RC building to perform nonlinear seismic analysis? Explain flexural and shear non-linear modelling with the help of backbone curve as per FEMA356-2000. 10 L4 CO5

b) Demonstrate with the help of diagram, how design forces on shear wall is estimated? What are the guide lines for design of shear wall as per IS13920-2016? 10 L4 CO5

OR

a) Point out seismic deficiency of an old RC building situated in sever seismic zone by pushover method. How the method is useful for strengthening and retrofitting of existing buildings. 10 L4 CO5

b) Demonstrate with the help of diagram, the design approach of shear reinforcement in RC beam as per IS13920-2016. Sketch the shear reinforcement confinement detailing in beam. 10 L4 CO5

Q.6 Solve any **two**

a) Explain the concept of '*base isolation*'. Discuss the conditions under which base isolation is not suitable. 10 L2 CO6

b) Demonstrate with sketch the effectiveness of '*tune mass damper*'. under seismic loading. 10 L3 CO6

c) Differentiate '*active, semi active and passive vibration control system*' with respect to working principle. 10 L4 CO6

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