UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Programme Name: M.Tech. Structural Engineering **Semester : II**

Course Name : Seismic Design of Structures **Time : 03 hrs**

Course Code : CIVL 7014 **Max. Marks : 100**

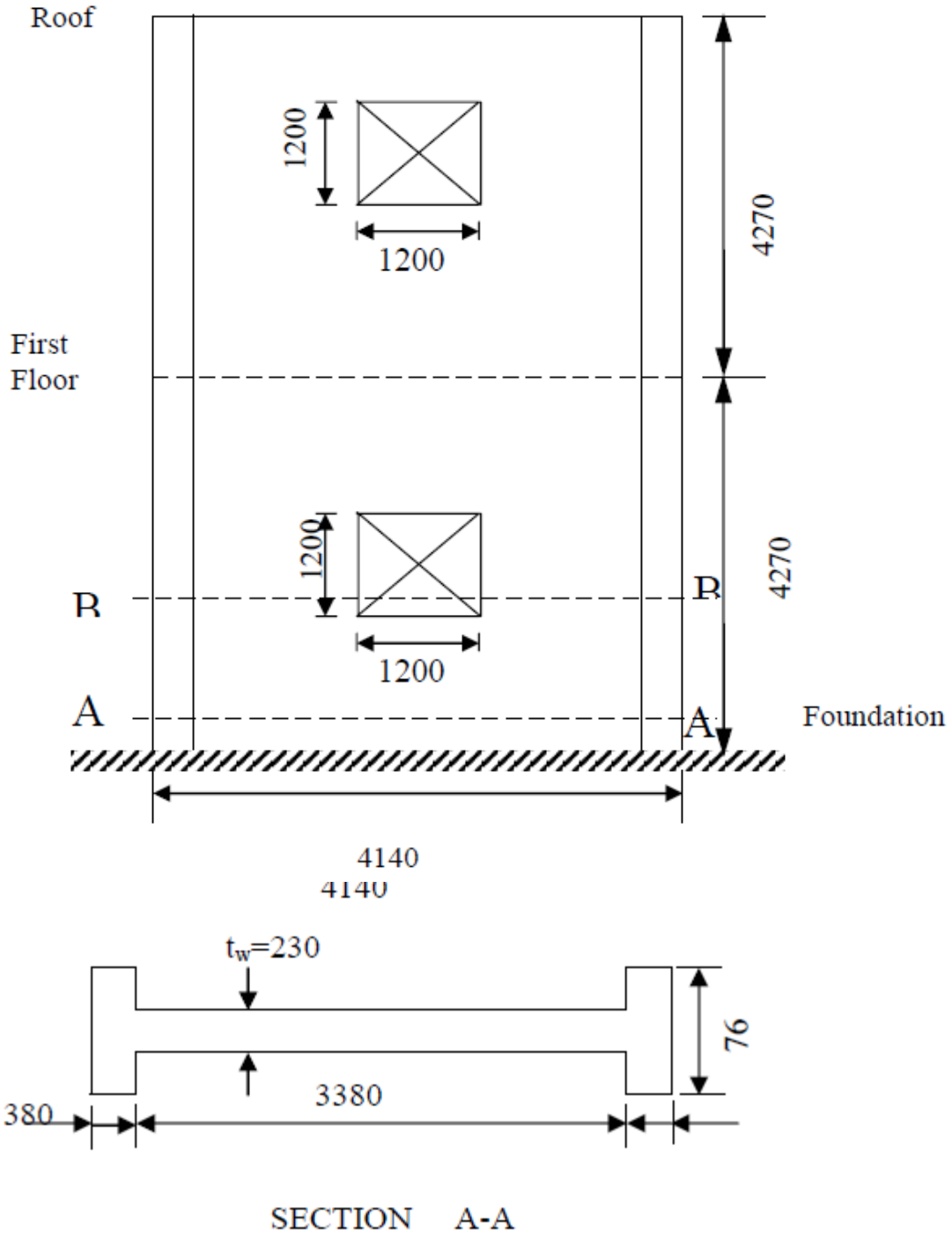
Nos. of page(s) : 2

Instructions: **Answer all questions of Section A, B & C**

IS 1893 is allowed

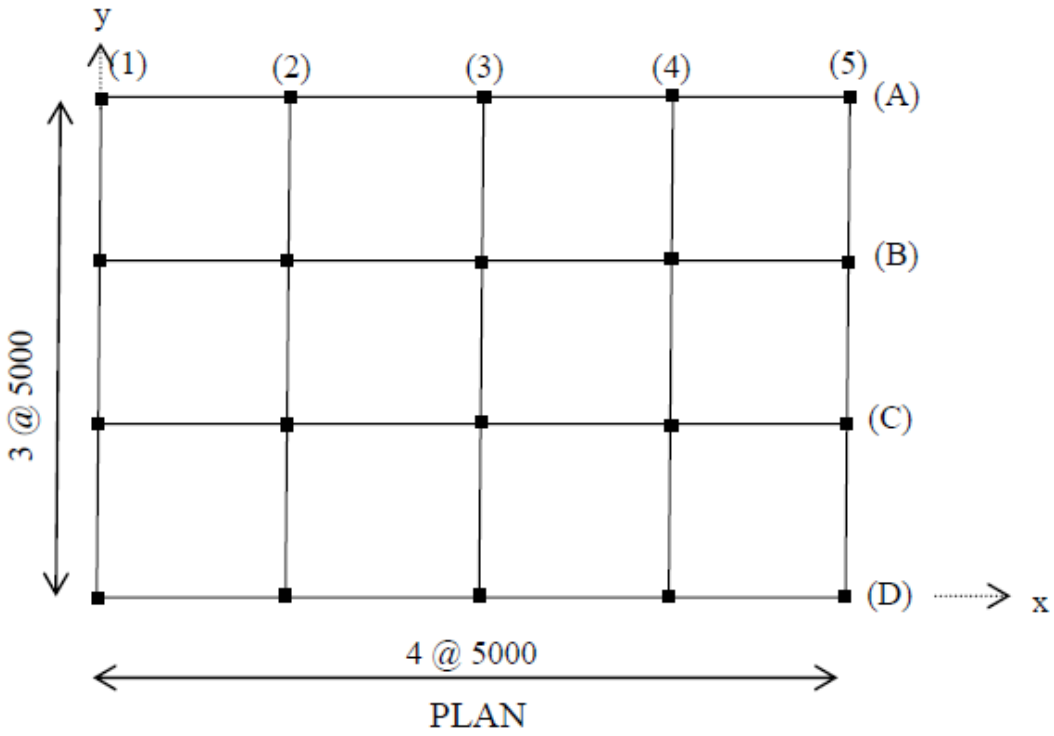
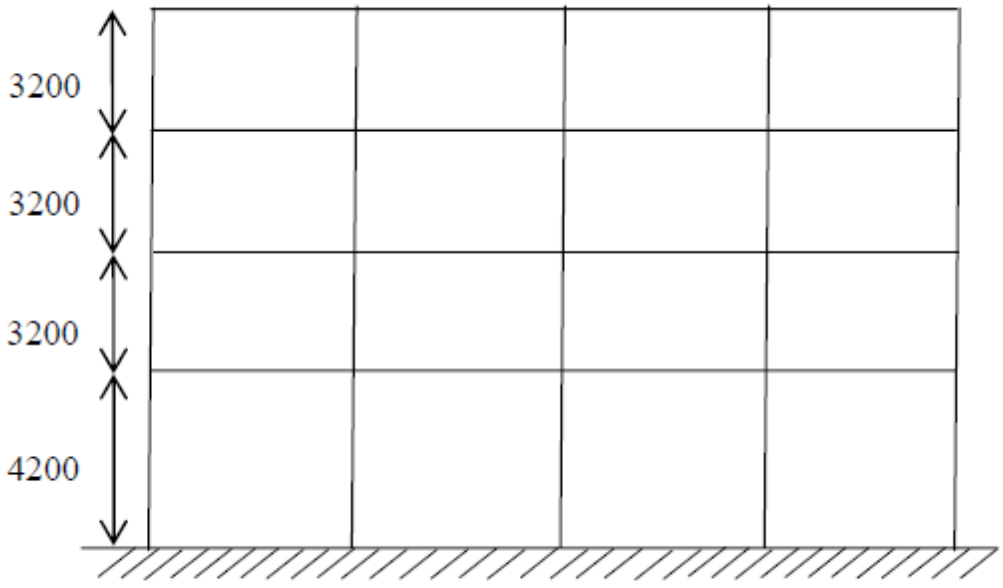
S. No.	SECTION A	Marks	CO
Q 1	What is the difference between Inter plate earthquakes and Intra plate earthquakes?	**5**	**CO1**
Q 2	What is the difference between shallow, intermediate and deep focus earthquake?	**5**	**CO1**
Q 3	What are the effects of Damping on soil – structure interaction?	**5**	**CO1**
Q 4	What are the basic concepts for ductile performance structures?	**5**	**CO1**
Q 5	Write a short note on Push over analysis.	**5**	**CO3**
Q 6	Write the IS 13920 provisions for flexural members.	**5**	**CO1**
	SECTION B		
Q 7	Explain ductility considerations for earthquake resistant beam design as per IS 13920.	**10**	**CO2**
Q 8	Explain ductility considerations for earthquake resistant Column design as per IS 13920.	**10**	**CO2**
Q 9	Explain Pushover ananlysis of a buildng with suitable examples.	**10**	**CO3**
Q 10	Design a shear wall for a two-storey building shown in (Figure 9.1).The materials are M20 concrete and Fe415 steel. The example shows design for load combination 1.2(DL + LL +EL) only. In practice, all other combinations should also be considered. The unfactored forces in the panel between the ground level and first floor are obtained by analysis as.	**10**	**CO3**

S.No	Load Case	Bending Moment	Axial Force	Shear Force
1.	(DL+LL)	-577.5	1922.9	19.7
2.	Earthquake	4830.9	255.7	699.1



Q 11	Explain retrofitting of masonry buildings. **OR** Explain seismic retrofitting of RC building with jacketing and Shear walls	**10**	**CO4**

SECTION-C

Q 12	Consider a four-storey reinforced concrete office building shown in Figure. The building is located in Shillong (seismic zone V). The soil conditions are medium stiff and the entire building is supported on a raft foundation. The R. C. frames are infilled with brick-masonry. The lumped weight due to dead loads is 12 kN/m2 on floors and 10 kN/m2 on the roof. The floors are to cater for a live load of 4 kN/m2 on floors and 1.5 kN/m2 on the roof. Determine design seismic load on the structure as per new code.  PLAN  ELEVATION **OR**	**20**	**CO2**

For the above building of Example, the dynamic properties (natural periods, and mode shapes) for vibration in the X-direction have been obtained by carrying out a free vibration analysis (Table). Obtain the design seismic force in the X-direction by the dynamic analysis and distribute it with building height.

Free Vibration Properties of the building for vibration in the X-Direction

Natural Period (sec)	Mode 1	Mode 2	Mode 3
	0.860	0.265	0.145
	Mode Shape		
Roof	1.000	1.000	1.000
3rd Floor	0.904	0.216	-0.831
2nd Floor	0.716	-0.701	-0.574
1st Floor	0.441	-0.921	1.016