BIRLA INSTITUE OF TECNOLOGY AND SCIENCE, PILANI
SECOND SEMESTER, 2022-2023
CE G615 EARTHQUAKE ENGINEERING, MIDSEM Examination (Closed Book)
Time: 90 min. Date:17-03-2023 Maximum Marks:25

IS codes and formula sheets are allowed

Q1. A steel shear building has the properties shown in Table below. Determine using the response spectrum modal method the base shear using IS1893-part1(2016). Apply all checks. Building is in Delhi on sandy soil having shear wave velocity values V_s=250 m/sec for top 10m and Vs=400 m/s from 10 m onwards to 100 m depth from ground level. Cantilever steel tower is modelled as five lumped masses. Weights are W1=W2=W3=W4=445 kN, W5=4 kN. Where W1, W2, W3, W4, W5 are weights respectively from first floor to top floor. Lateral load resisting system is Moment frame system with SMRF and tower is for ordinary use. [7 **M**]

Time Period (sec)	2	1.873	0.671	0.439	0.358
Mode Shape	13.985	13.798	-0.156	-0.046	0.016
	0.913	-0.910	1.135	0.842	-0.448
	0.794	-0.810	0.001	-1.134	1.134
	0.585	-0.606	-1.134	-0.448	-1.29
	0.310	-0.324	-1.134	1.290	0.842

Q2. A 10 m high retaining wall is with vertical back and retains a horizontal dry backfill. Backfill properties are γ = 16 kN/m3, ϕ= 30°, c=12kPa. A surcharge of 15 kPa is applied due to traffic load. Find static and seismic earth pressure with point of application. Assume A_h=0.15. Draw neat sketches showing all components with point of application. Use IS1893-(Part3) 2014. **[6M]**

Q3. Design a reinforced concrete lintel band having a span of 8 m for a single storey masonry building located in BITS, Pilani for children play centre. Give neat sketches (cross section and plan at corner junction) showing details of reinforcement and all other dimensions and mention grade of concrete and steel to be used. If span is 10m, what will be the changes in design and reinforcement detailing as per data given in IS4326-2013. **[3M]**

Q4.A RCC (M40 grade) Chimney 60m high has a uniform cross section Ac = 6 m^2 and Moment of Inertia, I = 70 m^4. Evaluate shear and moment at 20 m from top of chimney under earthquake as per IS 1893-part4-2015. The structure is located in Pilani and supported on raft foundation of diameter 8m. The soil is having a shear wave velocity Vs=800m/sec, unit weight of soil is 19 kN/m^3 and Poisons Ratio, $\nu = 0.35$**. [3M]**

Q5. Soil/ site classification A, B, C and Type I, II, III are respectively same or different given in IS 1893-1:2016 and why? What is the need/ application of these soil/ site classification, explain and justify your answer? **[2 M]**

Q6. IS:1893 Part 1: 2016 specifies 5% damping ratio for concrete, steel, or masonry buildings. But Steel as a material exhibits lower damping (2% in other parts of IS1893) than concrete/ masonry and therefore, different damping should be specified for three types of building materials as specified in IS 1893-part 2, 4. However, as per IS 16700-2017, article 6.2.2.4 (page 6) "the damping ratio considered shall not be greater than 2 percent of critical for concrete buildings". Other IS codes are recommending 2% for steel structure. Which one is correct? Are these codes contradicting each other? Explain. Can we have less than 1% damping ratio for all type of structure during earthquake analysis, if yes provide details/ explain? Can we have damping of concrete structures more than 5%, explain? **[3 marks]**

Q7. Do you think screening criterion for liquefaction given in IS1893-part1-2016 and IRC-SP-114-2018 are appropriate? Discuss. If not, what would be the suggested modification according to the international code of practices and recent developments, explain? **[3 Marks]**

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