

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

# II SEMESTER M.TECH. (STRUCTURAL ENGINEERING) END SEMESTER EXAMINATIONS, April/May 2017

## SUBJECT: EARTHQUAKE RESISTANT DESIGN OF STRUCTURES (CIE- 5255)

### REVISED CREDIT SYSTEM ( 29/04/ 2017)

#### Time: 3 Hours

#### MAX. MARKS: 50

#### Instructions to Candidates:

✤ Answer ALL the questions.

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- ✤ Missing data may be suitable assumed.
- ♦ Use of IS -1893 2002, IS -1893 1984, SP:16 & IS 456-2000 is permitted

| 1A. | What is the difference between Magnitude and Intensity of an earthquake?   |   |  |  | 2    |
|-----|--|---|--|--|------|
| 18  | The mass of a 3 stor<br>shape and frequencies<br>for $\zeta = 5\%$ and<br>(displacement, elastis<br>subjected to ground a<br>$\omega = \begin{cases} 10\\ 20\\ 35 \end{cases}$<br>m = $\begin{pmatrix} 1.5\\ 0 & 3\\ 0 & 0 \end{cases}$  | rey shear building tog<br>s are shown below. Us<br>for soft soil (refer IS<br>c force vector, base<br>acceleration of 0.25 g. 1<br>rad/sec $\Phi =$<br>$0 \qquad 0 \qquad 0 \qquad 10^3 \text{ kg}$ | gether with its undating acceleration res<br>S -1893 – 2002) of<br>shear and overtu<br>Height of each store<br>1 	 1<br>0.8 	 -0.6<br>0.6 	 -0.9 | amped vibration mode<br>ponse spectrum values<br>calculate the response<br>rning moment) when<br>ey is $3.5 \text{ m}$ .<br>1<br>-1.5<br>1.2 | 10.5 |
| 2A. | In the case of SDOF system subjected to earthquake ground motion show that,<br>$S_{d}(\xi,\omega) = [S_{pv}(\xi,\omega)] / \omega$ and $S_{pa}(\xi,\omega) = \omega [S_{pv}(\xi,\omega)]$  |   |  |  | 5    |
| 2B. | Design the reinforcement for a column of size 450 mm × 450 mm, subjected to the<br>following forces. The column has an unsupported length of 3 m and is braced against<br>side sway in both directions. Use M -25 grade concrete and Fe415 steel.Dead LoadLive LoadSeismic LoadAxial Load (kN)1000800550Moment (kN-m)5040100 |   |  |  | 7.5  |

Reg. No.



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A Constituent Institution of Manipal University A one storey residential building with plan shown in Fig. Q3 is to be constructed in Nainital on medium soil. Each wall is 200 mm thick and is constructed of brick 12.5 masonry. The roof consists of a 150 mm thick RC slab. The walls are 4 m height except wall A which is 5 m high. Calculate design earthquake force for each of the walls. Take I = 1 and R = 1.5. An elevated water tank has a capacity of 520 m<sup>3</sup>. The tank is circular with an internal diameter of 12 m and height of 7 m. It is supported on a concrete staging consisting of 8 columns located on circumference of a circle of 11 m diameter. The height of staging is 24 m and horizontal bracings are provided at 6 m spacing. The circular columns are 70 cm in diameter. Diagonal steel bracing in the form of 3 cm diameter 12.5 is provided in all bays. The structure is located in Varanasi and founded on soft type of soil. The footing consists of an angular circular raft. The mass of the empty tank is 2800 kN. The weight of the staging is 1700 kN. The mass of water in the tank when it is full is 4200 kN. Evaluate earthquake forces on this water tank. Take  $\text{Ec} = 2 \times 10^7 \text{ kN/m^2}$ ,  $\text{Es} = 2.1 \times 10^8 \text{ kN/m^2}$ , I = 1.5 and R = 3. (Fig. Q4).

