Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: ELEMENTS OF EARTHQUAKE ENGINEERING [CIE 3105]

REVISED CREDIT SYSTEM
(27/11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Use of **IS-1893:2002** and **IS-13920:1993** is permitted.
- Missing data may be suitably assumed.

1A.	Explain with neat sketches of P and S wave shadow zone.	**4m**
1B.	Derive the expression for free vibration response of an over damped SDOF system with the following initial boundary conditions, i) at t = 0 displacement is initial displacement and velocity is initial velocity. ii) at t = 0 displacement is initial displacement and velocity is zero.	**6m**
2A.	Determine the displacement and velocity after 4.0 sec for the system shown in **Fig. Q2A**, if initial displacement is 42 mm, initial velocity is 80 mm/sec and damping of 15%.	**6m**
2B.	Define Dynamic Magnification Factor (DMF) and write the expression for the same. Determine the stiffness of a SDOF system of which DMF is found to be 4, under the action of harmonic force of 500N operating at 1000 rpm. Observed steady state amplitude is 3mm.	**4m**
3A.	A machine of total mass 100kg is mounted on spring of stiffness 1×10^5 N/m with a damping factor of 30%. A rotary shaft within the machine has unbalanced mass of 2kg at an eccentricity of 2cm. Operating speed of rotary shaft is 3000rpm. Determine, (i) Steady state displacement amplitude of the machine. (ii) Speed of rotor in rpm, at which damped resonance will occur and (ii) Resonant displacement amplitude.	**6m**
3B.	Explain the terms (i) Irregularity in plan (ii) Floating Column. Give any one method each to overcome the ill-effects of the same on the structure.	**4m**
4	A seven storied (G+6) RCC framed regular building without infill panels is to be constructed in Chennai. **Fig.Q4** shows plan and elevation of the structure. Work out seismic forces along the longer edge of the structure. All beams and columns may be assumed to be 230 mm × 450 mm and 230 × 550 mm respectively. The roof and floor slabs may be assumed to be 150 mm thick. Take floor finish to be 1 kN/m^2. Live load of 3.5 kN/m^2 may be assumed on floor slabs. The soil below the foundation is assumed to be medium soil. Draw storey force and seismic shear force diagram.	**10m**
5A.	Derive equation of motion for the system shown in **Fig.Q5A**. All beams and columns may be assumed to be 300 mm x 500 mm and 600 x 600 mm respectively. Modulus of Elasticity of concrete is 27400 N/mm^2	**5**

5B.	Determine the design shear force for the beam shown in **Fig.Q5B**. Un-factored load of 24kN/m (inclusive of DL and LL) is acting on the beam as shown. Sagging and hogging limiting moments of section can be taken as 150 kN.m and 90 kN.m respectively.	**3**
5C	Explain the reason behind the clause *"The Positive steel at a joint face must be atleast equal to half the negative steel at that face."*	**2**

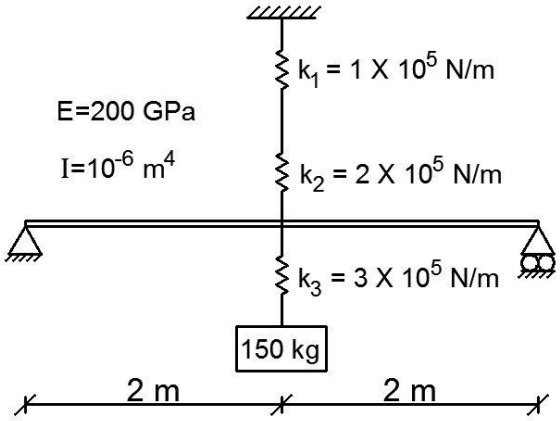


Fig.Q2A

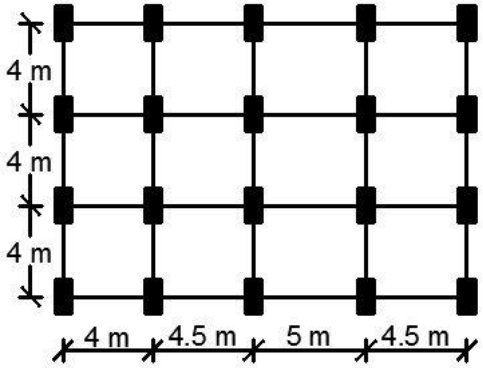
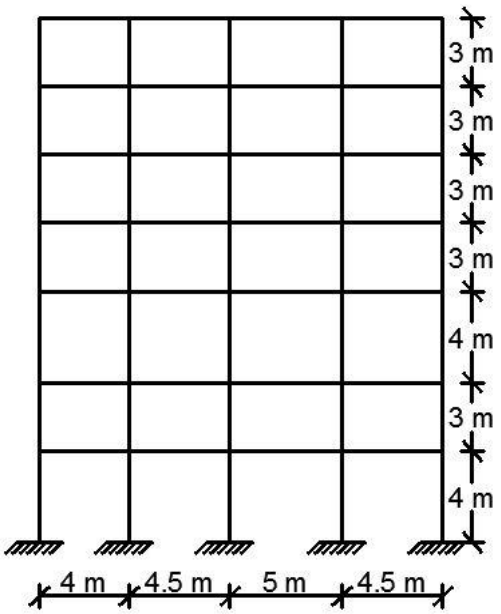


Fig.Q4



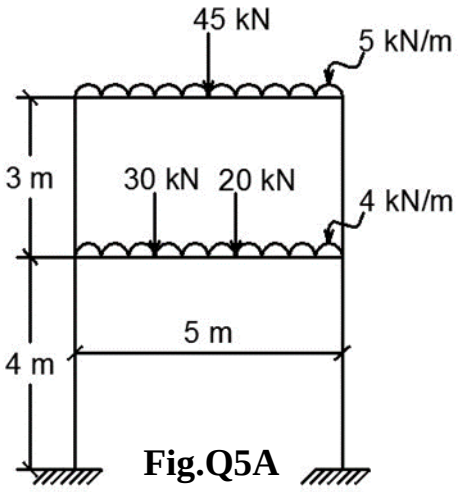


Fig.Q5A

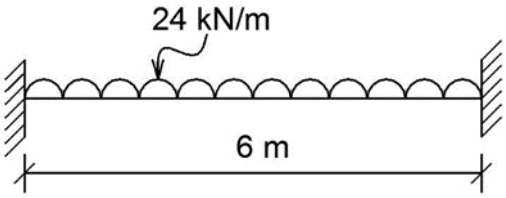


Fig.Q5B