Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH CIVIL ENGINEERING END SEMESTER EXAMINATIONS

NOVEMBER-2022

SUBJECT: ELEMENTS OF EARTHQUAKE ENGINEERING [CIE 4078]

Date of Exam: Time of Exam: Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed
- Usage of IS 1893:2016 and IS 13920:2016 is allowed

No.	Question	Marks	CO	BL
1A.	Write a short note on H.F Reid's theory.	**(3)**	**CO1**	**2**
1B.	Explain discontinuities in load transfer path with neat sketch.	**(4)**	**CO1**	**2**
1C.	Determine natural frequency for the system shown in **Fig.Q1**. Take k1 = 60 N/mm, k2 = 40 N/mm, k3 = 120 N/mm, k4 = 160 N/mm. Take EI = 4.2×10^{11} N-mm^2.	**(3)**	**CO2**	**4**
2A.	Derive the expression for free vibration response of an over damped SDOF system with the following initial boundary condition, at t = 0 displacement is initial displacement and velocity is initial velocity.	**(5)**	**CO2**	**2**
2B.	In a SDOF system, the spring deflects 4 cm when the weight of 1.5kN is supported on it. And a damper of resistance 600 N-s/m is provided for the system. Determine, a) Natural frequency, b) damped frequency, c) Damping ratio, d) logarithmic decrement.	**(2)**	**CO2**	**4**
2C.	An electric motor weighing 1300 N and operating at 600 rpm is mounted on 4 parallel springs of stiffness 4000 N/m each. Determine the maximum permissible unbalance in order to limit the steady state amplitude of 4mm and assume damping as 10% of critical damping.	**(3)**	**CO3**	**4**
3A.	Derive the steady state response of an underdamped SDOF system subjected to force due to rotational unbalance.	**(4)**	**CO3**	**2**
3B.	The undamped SDOF system shown in **Fig.Q3**, has a total mass of the motor is 50 kg. The system has a rotating unbalance of 1.2 kg-m operating at 1000 rpm. Determine the minimum value of K such that the steady state resonant amplitude doesn't exceed 4mm.	**(4)**	**CO3**	**4**
3C.	Explain springs in series and parallel system with neat sketch	**(2)**	**CO2**	**2**
4A.	A frame shown in **Fig. Q4**, supports a motor of mass 100 kg. The mass of floor on which the motor is mounted is 5000kg. The motor has an unbalanced force of 15 kg-m and operates at 1000 rpm. Determine the maximum amplitude of displacement and maximum bending moments in each column. Assume 15% damping and take EI=4000 kN-m^2.	**(5)**	**CO3**	**4**
4B.	The static deflection of a washing machine of mass 650 kg supported by a system of four parallel springs is found to be 50 mm. If the washing machine has a rotating unbalance of 0.2 kg-m, determine the amplitude of vibration at 1200 rpm	**(3)**	**CO3**	**4**

4C.	Explain slab strengthening with neat sketches.	**(2)**	**CO5**	**2**
5A.	Determine base shear and its distribution for all the floors using equivalent static load method for the **Fig.Q5**. The structure is a residential apartment with more than 200 occupants, built by ordinary RC frames on hard strength soil in Mangalore. Wall panels are not present in the building. The beam dimension is 230×450mm, columns are 230×650mm and slab is 125 mm thick. Live load on slab is 3.5 kN/m^2.	**(8)**	**CO4**	**5**
5B	Draw storey force and storey shear diagrams for the **5A**. question	**(2)**	**CO4**	**4**

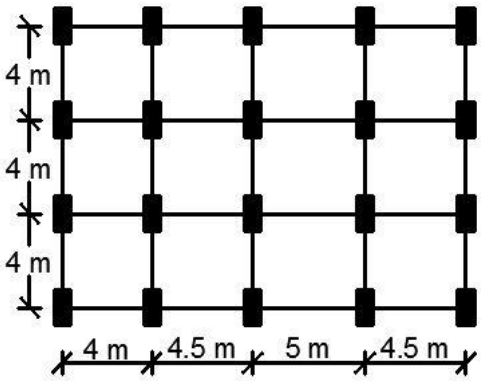
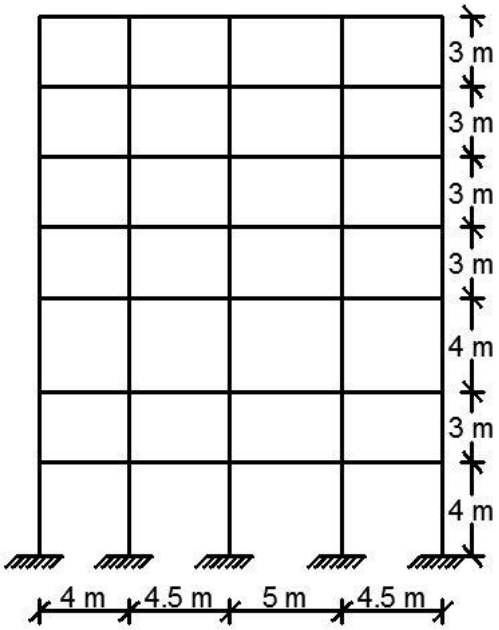


Fig. Q5



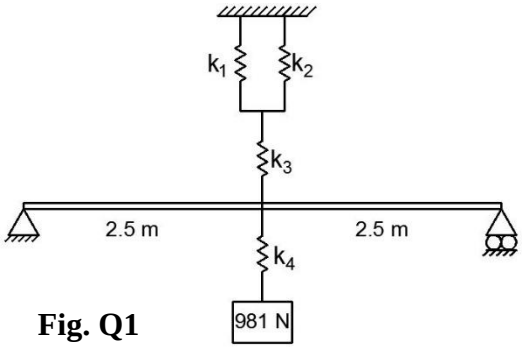


Fig. Q1

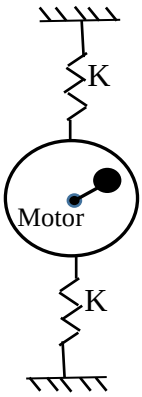


Fig.Q3

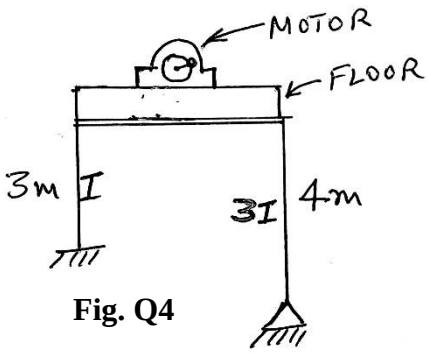


Fig. Q4