Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (CIVIL ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2018
SUBJECT: ELEMENTS OF EARTHQUAKE ENGINEERING [CIE 3105]
REVISED CREDIT SYSTEM
(30 /11 /2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed
- Usage of IS 893:2002 and IS 13920: 1993 is allowed

1A.	Write a short note on, (i) Rayleigh waves, (ii) Elastic rebound theory, (iii) Short column effect in structures.	**(06)**	**CO1**
1B.	Derive the expression for free vibration response of a critically damped SDOF system.	**(04)**	**CO2**
2A.	Determine the displacement and velocity after 2.0 sec for the system shown in **Fig. Q2A,** if initial displacement is 25 mm, initial velocity is 60 mm/sec and damping of 15%. Take E = 200 GPa and I= 1.8 x 10^6 mm^4.	**(06)**	**CO2**
2B.	Define dynamic magnification factor, and derive the expression for maximum dynamic magnification factor.	**(04)**	**CO3**
3A.	A frame shown in Fig.Q3A supports a rotating machine, which exerts a horizontal" force at the girder level of F(t) = 250 sin 15t N. Assuming 5% of critical damping, determine steady-state amplitude of vibration and the maximum dynamic bending stress in the column Take E = 200 kN/mm^2 , I = 4x 10^5 mm^4 and Z = 2000 mm^3.	**(06)**	**CO3**
3B.	An electric motor weighing 1000 N and operating at 500 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	**(04)**	**CO3**
4.	Draw storey force and storey shear diagrams parallel to longer plan dimension for the structure shown in Fig.Q4 using equivalent static load method. The structure is an ordinary residential building, built by ductile detailed special RC frames on medium strength soil in Bangalore. Brick wall panels of 230mm thickness and 20kN/m^3 density are present on all beams in the building. The beam dimension is 230x400mm, columns are 230x500mm and slab is 125 mm thick. Live load on slab is 4kN/m^2 and Floor finish load is IkN/m^2.	**(10)**	**CO4**
5A.	Explain beam jacketing with figure	**(04)**	**CO5**
5B.	i) Explain with neat figure, the ductile detailing requirements for beam column joint region and discuss technical reason behind the clauses. ii) Positive steel at joint face must be at least equal to half the negative steel at that face. Discuss the reason behind this clause.	**(04)**	**CO5**
5C.	Determine design shear force for column of height 4m, if the limiting moment capacity of beams on the right of joint is 100kNm and that of beam on the left of joint is 120kNm.	**(02)**	**CO5**

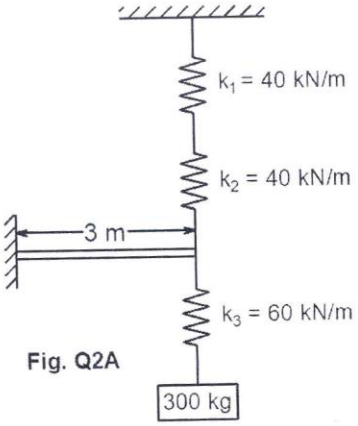


Fig. Q2A

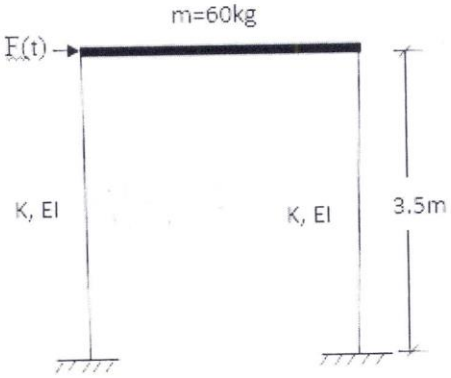
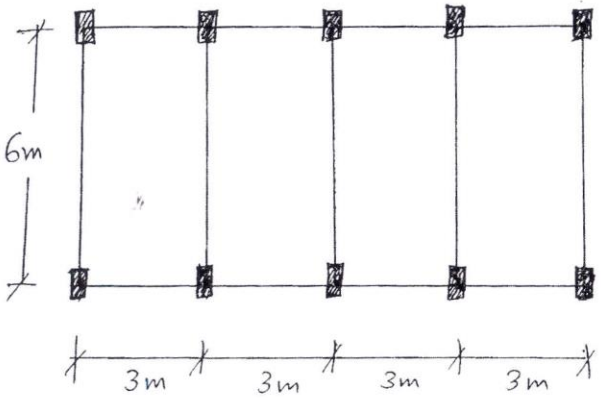


Fig. Q 3A.



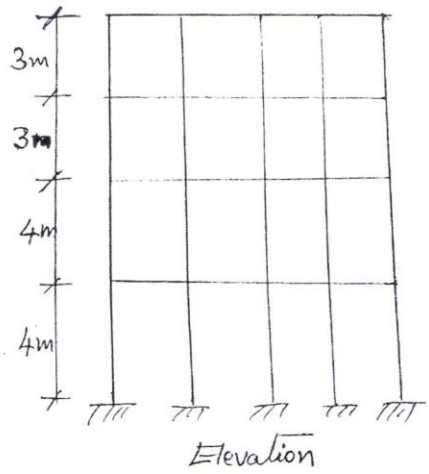


Fig. Q4