

**B. Construction Engineering 4<sup>th</sup> Year 2<sup>nd</sup> Semester Examination 2018****STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING**

Time : Three Hours

Full Marks : 100

Assume any relevant data not provided, IS: 1893(Pt-I), 2016 is allowed in the Hall

**Answer any Four Questions**

- 1 a) Describe Dynamic Equilibrium of a SDOF structural system and discuss dynamic parameters in the light of D' Alembert's principle. 6[CO1]  
 b) Discuss Critical Damping & Critical Damping Ratio 6[CO1]  
**OR**  
 c) Discuss the significance of Free Vibration Analysis and Natural Frequency 6[CO2]  
 d) Calculate the natural frequency & time period of the simple supported beam as shown in Fig.1. Neglect the mass of the beam 8[CO2]

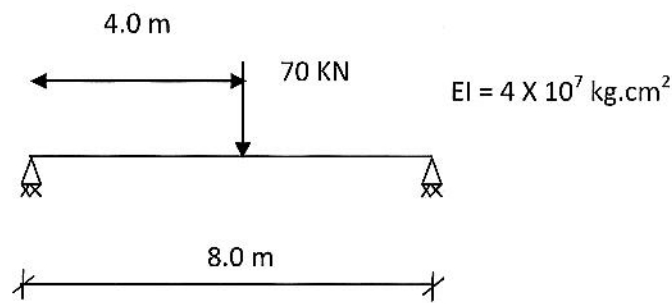


Fig.1

- e) If a springs having spring constant of 5 kg/cm is placed just below the load (at centre of the beam), compute the change in the circular frequency of the system. 5[CO2]
- 2 a) Derive the solution of a SDOF system considering free vibration with damped condition. Give the expression of time period of the system . 15[CO3]  
 b) Deduce Logarithmic Decrement Method for evaluating damping. 10[CO3]
- 3 a) Discuss transient phase & Steady state motion in forced vibration? 4[CO4]  
 b) Derive the solution for Steady State Motion of the SDOF system under Forced Vibration of  $M\ddot{x} + C\dot{x} + Kx = F_f \sin w_f t$ . 12[CO4]  
 c) Deduce the expression of Dynamic Load Factor from the above solution 5[CO4]  
 d) Discuss the significance of Tuning Factor & Critical Damping Ratio 4 [CO4]  
**OR**  
 e) Evaluate the D.L.F for tuning factor 0.98 and damping ratio is 5 %. 4 [CO4]

[ Turn over

- 4 a) What are the important characteristics of Earthquakes? 5 [CO5]  
 b) Compare between Near Field & Far Field effects of Earthquake 6 [CO5]  
 c) Discuss on favourable structural configuration with respect to better seismic resisting features. 6 [CO5]  
 d) Discuss Response Spectrum Method for Dynamic Analysis of structures 8[CO5]
- 5 A Four Storied RCC frame office building located in Jaynagar, South 24 Parganas, WB. The plan of the building is shown below in Fig 2.

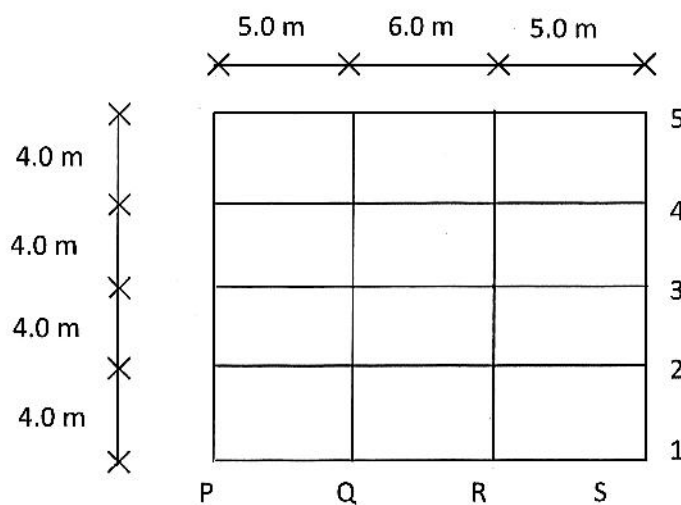


Fig. 2

The soil condition is medium stiff and supported on Raft foundation. The RC frames are in-filled with brick-masonry. The lump weight due to DL is  $12.5 \text{ KN/m}^2$  on floors and  $10.5 \text{ KN/m}^2$  on roof. The Live load on floors is  $4 \text{ KN/m}^2$ . Determine the Design seismic Force of the frame 4/P-Q-R-S by **dynamic analysis** method. The free vibration analysis dynamic properties are given below.

Natural Period (S)	Mode 1	Mode 2	Mode 3
		1.20	0.765
Floor	Mode Shape		
Roof	1.000	1.000	0.765
3 <sup>rd</sup> Floor	0.876	0.344	-0.824
2 <sup>nd</sup> Floor	0.612	-0.578	-0.566
1 <sup>st</sup> Floor	0.388	-0.786	1.000