Total No. of Questions : 8]

SEAT No. :

P4132

[Total No. of Pages : 3

[4760] - 1068

M.E.(Mechanical Design Engineering)

ADVANCED MECHANICAL VIBRATION

(2013 Pattern)

Time :3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Answer any five questions.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Assume suitable data if necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of non-programmable electronic calculator is allowed.***

Q1) Estimate fundamental frequency of the lateral vibration of a shaft carrying three rotors (masses), as shown in Fig.1 with m_1 = 20kg, m_2 = 50 kg, m_3 = 40kg, l_1 = 1m.l_2 =3m,l_3 = 4m and l_4 = 2m. The shaft is made of steel (E = 2.07 x 10^{11} N/m^2) with solid circular cross section of diameter 10cm. **[10]**

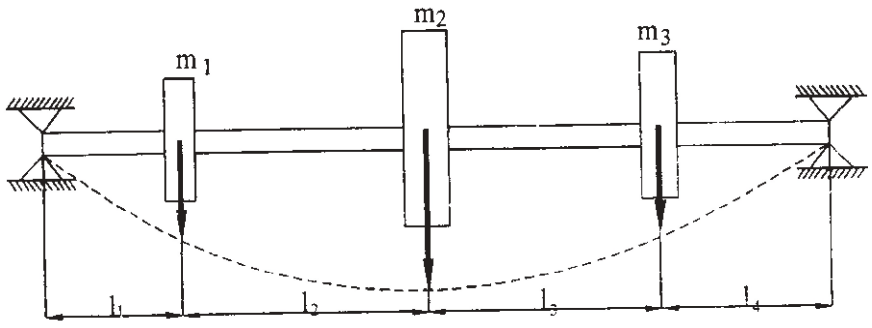

Fig.1

Q2) A bar fixed at one end is pulled at the other end with a force P. The force is suddenly released. Derive an expression for logitudinal vibration of the bar. **[10]**

P.T.O.

Q3) Find the response of the compacting machine shown in Fig.2 (a) when it is subjected to the force shown in Fig.(b). **[10]**

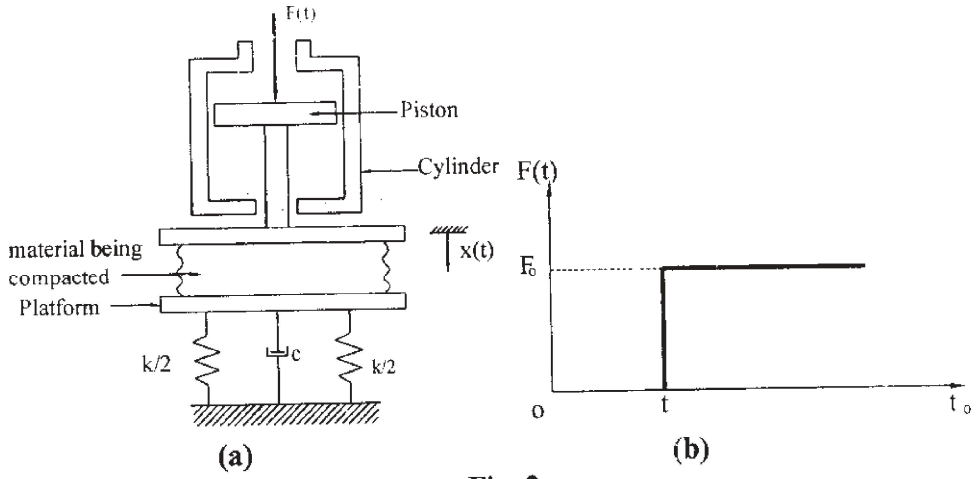

Fig. 2

Q4) a) Explain single plane balancing of rotating machines using vibration analyzer? **[4]**

b) A 200 kg machine is attached to a spring of stiffness 4×10^5 N/m. During operation the machine is subjected to a harmonic excitation of mass 500kg and frequency 50 rad/sec. Design an undamped vibration absorber such that the steady state amplitude of the primary mass is zero and the steady state amplitude of the absorber mass is less than 2mm. What are the natural frequencies of the system with absorber in place. **[6]**

Q5) a) What are various condition monitoring techniques? Explain time domain techniques in detail. **[6]**

b) Explain basic vibration measurement scheme with neat block diagram. **[4]**

Q6) a) Explain wide band and narrow band random vibrations. **[6]**

b) Explain power spectrum and power spectral density with suitable example. **[4]**

Q7) a) A single DOF system with natural frequency $\omega_n = \sqrt{\frac{k}{m}}$ and damping $\xi = 0.20$ is excited by the force; **[5]**

$$F(t) = F\cos\frac{1}{2}\omega_n t + F\cos\omega_n t + F\cos\frac{3}{2}\omega_n t$$
$$= \sum_{m=1/2,1,3,/2} F\cos m\ \omega_n t$$

Determine the mean square response and compare the output spectrum with that of the input.

b) Determine the flexibility influence coefficient for the system shown in Fig.3. Take E = 2.1 x 10 ^{11} N/m^2. **[5]**

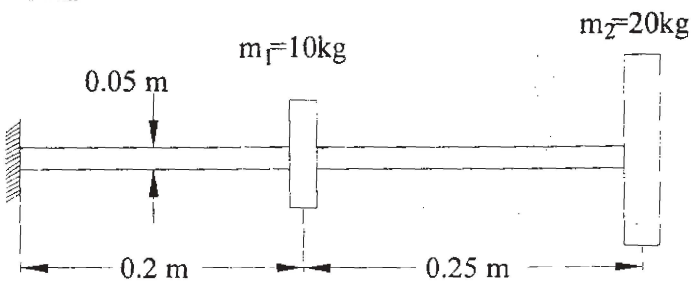

Fig.3

Q8) a) Explain phase plain method to solve transient vibration problems in detail. **[4]**

b) Write a short note on in - situ balancing of rotors. **[3]**

c) Explain experimental modal analysis? **[3]**