

Roll No. ....

**22242**

**M. Tech. 3rd Sem. Mechanical Engg.  
(Machine Design)**

**Examination – December, 2013**

**Mechanical vibrations**

**Paper : M-823-A**

*Time : Three hours ]*

*[ Maximum Marks : 100*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

**Note:** Attempt any *five* questions.

**1.** Write short note on :

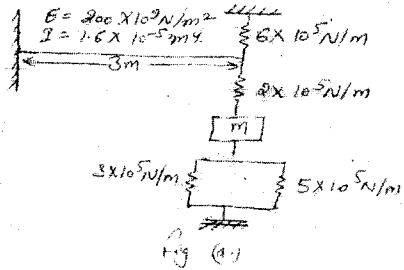
(i) Euler equation for beams: 20

(ii) Duhamel 's integral impulse response function.

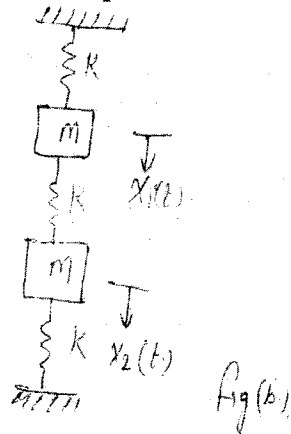
**2.** Determine the equivalent spring stiffness of the system shown in fig (a.) Using the displacement of the block as the generalized coordinate. 20

22242- 250 -(P-3)(Q-8) (13)

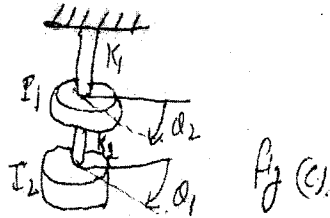
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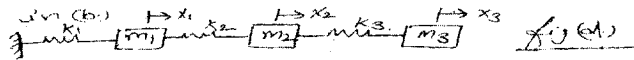
3. Determine the torsional stiffness of a solid aluminium shaft of length 2 m and radius 30 cm. The Shear Modulus of rigidity for aluminium is  $41 \times 10^3 \text{ N/m}^2$  20
4. For the two degree of freedom undamped spring-mass system shown in fig (b) determine : (a) The frequency equation. (b) The natural frequencies. (c) The normal mode shapes. 20



5. Determine the natural frequencies and mode shapes for the torsional system shown in fig (c) for  $I_1 = I_0$ ,  $I_2 = 2J$  and  $K_1 = K_2 = K_0$  20



6. For the three degree of freedom system shown in Fig (d.)
- Write the differential equations of motion in matrix form. 20
  - Obtain the principle modes of vibration for  $K_1 = 3K$ ,  $K_2 = K_3 = K$ ,  $m_1 = 3m$ ,  $m_2 = m_3 = m$
  - Establish the orthogonality relation for the principle modes obtained in (b).



7. A string of length  $l$  fixed at both ends is plucked at its mid point and then released as shown in fig (e) determine its subsequent motion. 20



8. Write short note on following :
- Vibration monitoring & Diagonos. 20
  - Vibration test and analysis.