T.E -sem-VI - Mechanical - old

MV

22/5/15

(5)

(OLD COURSE)

QP Code : 4245

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No.1 is compulsory.
(2) Attempt any four questions from remaining six questions.
(3) Assume suitable data wherever required with justification.
(4) Figure to the right indicate full marks.

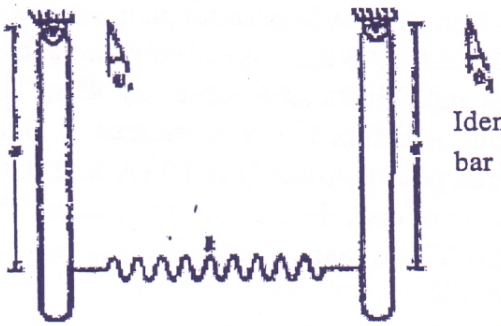
1. (a) Answer any three : **12**
(i) Differentiate between viscous and coulomb damping.
(ii) What do you mean by static and dynamic balancing?
(iii) Explain logarithmic decrement for spring mass underdamped system.
(iv) Explain vibration measuring instruments in brief.

(b) Find the natural frequency of oscillation of homogeneous cylinder which rolls on ground without slipping. **8**

2. (a) A 500 kg tumbler has an unbalance of 1.26 kg, 50 cm from its axis of rotation. For what stiffnesses of an elastic mounting of damping ratio 0.06 will the tumbler's steady-state amplitude be less than 2 mm at all speed between 200 and 600 rev / min? **10**

(b) A machine of 100 kg mass has a 20 kg rotor with 0.5 mm eccentricity. The mounting spring have $K = 85 \times 10^3$ N/m . $\xi = 0.02$ (damping ratio). The operating speed of machine is 600 rpm and unit is constrained to move vertically. Find (i) Amplitude of machine (ii) Force transmitted to the support. **10**

3. (a) Use Lagrange's equations to derive the differential equations governing the motion of the system shown in figure using θ_1 and θ_2 as generalised coordinates. **12**



(b) A vibratory system in a vehicle is to be designed with the following parameters K = 100 N/m, C = 2 Ns/m, m = 1 kg. Calculate the decrease of amplitude from it's starting value after three complete oscillations and the frequency of oscillation. 8

4. (a) A vehicle of mass 1200 kg is travelling on a road surface of which varies sinusoidally with amplitude of 0.05 m and wave length of 6 m. The suspension system has a spring constant of 400 kN/m and damping ratio of 0.50. If the vehicle speed is 100 km/hr. Find the amplitude of the vehicle. 8

(b) 20 N at 20 cm, 10 N at 40 cm, 30 N at 60 cm from the fixed end are the loading conditions on cantilever beam. The deflection under 30 N load due to all loads is 4 mm. Find the natural frequency of the system. What would be the natural frequency if 10 N is added at 40 cm from fix end. The deflection at section 'i' due to unit load at section 'j' is given by 12

$$U_{ij} = \frac{S_i^2\left(3s_j - s_i\right)}{\text{constant}} \text{ for } S_i \not> S_j \text{ and } U_{ij} = U_{ji}$$

where S is the distance of section from fixed end.

5. (a) Find eigen values and eigen vectors of the system shown in figure. 10

(b) A door 2 m high, 1 m wide, 40 mm thick and weighting 350 N is lifted with an automatic door closer. The door opens against a spring with a modulus of 0.1 Nm/rad. If the door is opened 90° and released, how long will it take the door to be with in 2^0 of closing ? Assume the return spring of the door to be critically damped. 10

6 (a) A shaft carries four masses in parallel planes A,B,C and D. The masses at B and C are 18 kg and 12.5 kg respectively and each has an eccentricity of 3 cm. The mass A and D have an eccentricity 4cm. The angle between masses B and C is 100° and that between masses at Band A is 100°. The axial distance between planes A and B is 10 cm and that between B and C is 20 cm. If the shaft is in complete dynamic balance. Determine (i) The masses at A and D. (ii) The distance between planes C and D (iii) The angular position of mass D. 10

(b) A vibrometer has an undamped natural frequency of 10 Hz and damped natural frequency of 8 Hz. Find the lowest frequency in the range to infinity at which the amplitude can be directly read from the vibrometer with less than 2 percent error. 10

7 (a) The reciprocating mass per cylinder in a 60° V Twin engine is 1.2 kg. The stroke and the connecting rod length are 10cm and 25cm respectively. If the engine runs at 2000 rpm, determine maximum and minimum values of the primary and secondary forces. Also find out the crank positions corresponding to these values. 10

(b) A vertical spring of stiffness 9800 N/m supports a mass of 40 kg. The mass will have a vertical displacement whether upward or downwards in the vertical guideways. These guideways provide a friction force of 49 N. The mass is released from a position in which the total extension of the spring (including stastic deflection) is 12.6 cm. Determine the final extension of the spring in the position in which system comes to rest. 10

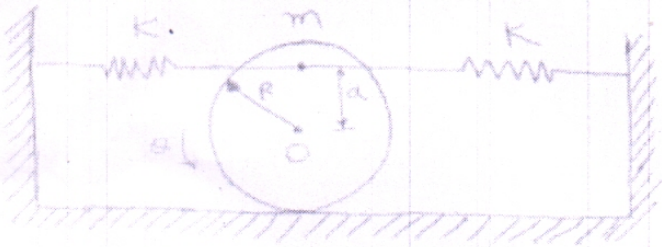
Course: T.E. (SEM.-VI)(OLD) (MECHANICAL ENGG.) COMMON WITH (AUTOMOBILE ENGG.)(prog-570 TO 584)

Q.P Code: 4245

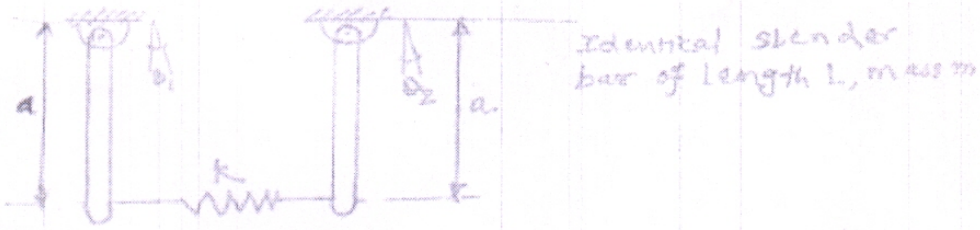
Correction:

Q P Code: 4245

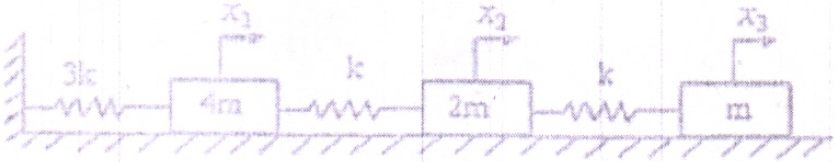
Q 1(b)



Q 3(c)



Q 5(c)



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Note; Take Printouts and distribute them to concerned students