Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: X61902 Date: 28/12/2012

Subject Name: Dynamics of Machinery

Time: 10.30 am - 01.00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Differentiate between static balancing and dynamic balancing. **07**

(b) Why reciprocating masses are partially balanced? Explain the any one effect of partial balancing in reciprocating masses. **07**

Q.2 **(a)** Define and write the equation of terms: **07**

i) Natural frequency, ii) Damping factor,

ii) coefficient of damping, iv) magnification factor,

(b) Find the natural frequency of vibration of the system shown in figure 2.1. **07**

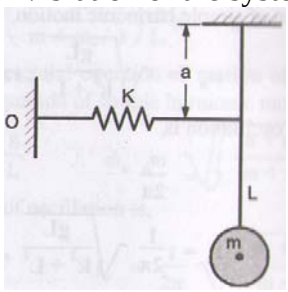

Figure 2.1

OR

(b) Find the natural frequency of vibration of the system shown in figure 2.2. **07**

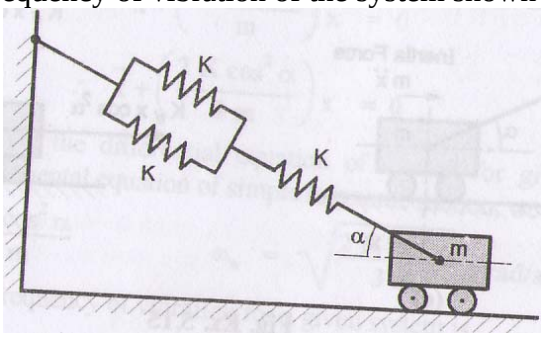

Figure 2.2

Q.3 **(a)** Derive an expression for logarithmic decrement. What is the significance of logarithmic decrement in vibrations? **07**

(b) In a single degree viscously damped vibrating system, the suspended mass of 16 Kg makes 45 oscillations in 27 seconds. The amplitude of natural vibration decreases to one fourth of the initial value after 5 oscillations. Determine; **07**

a) The logarithmic decrement b) damping coefficient

c) The stiffness of the spring

OR

Q.3 **(a)** Write a short note on “Force Transmissibility”. **07**

(b) An electric motor weighs 25 kg and is mounted on a rubber pad which **07**

deflects by 1 mm due to motor weight. The rotor weight is 5 kg and has an eccentricity of 0.1 mm and rotates at 1500 rpm. Find the amplitude of vibration of the motor and the force transmitted to the foundation under the following conditions;
i) there is no damping, ii) damping factor is 0.1.

Q.4 **(a)** Four masses P, Q, R and S are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm. **07**

(b) Explain the 'direct and reverse crank' method for determining unbalanced forces in radial engines. **07**

OR

Q.4 **(a)** A four stroke five cylinder in-line engine has a firing order of 1-4-5-3-2-1. The centres lines of cylinders are spaced at equal intervals of 15 cm, the reciprocating parts per cylinder have a mass of 1.5 kg, the piston stroke is 10 cm and the connecting rods are 17.5 cm long. The engine rotates at 600 rpm. Discuss the primary and secondary balancing, values of maximum unbalanced forces and couples about the central plane. **07**

Q.4 **(b)** The following date refers to an outside cylinder locomotive. **07**

Weight of rotating parts / cylinder	= 300 kg
Weight of reciprocating parts / per cylinder	= 270 kg
Angle between cranks	= 90^{0}
Crank radius	= 300 mm
Cylinder centres	= 1750 mm
Wheel centers	= 1550 mm
Radius of balancing weight	= 700 mm

If whole of the rotating unbalance and two third of reciprocating parts are balanced in the planes of driving wheels, find; i) Magnitude and angular position of balancing masses. ii) Swaying couple at the speed of 300 rpm.

Q.5 **(a)** Derive an expression for critical speed of a shaft carrying rotor and having damping. **07**

(b) Derive an expression for the length of an torsionally equivalent shaft for two rotor system **07**

OR

Q.5 **(a)** A rotor has a mass of 12 Kg and is mounted on a 24 mm diameter shaft supported at its ends by two ball bearings. The bearings are 1 meter apart. The shaft rotates at 2400 rpm if the center of mass of rotor is 0.11 mm away from the geometric axis of the rotor, due to manufacturing defects. Find the amplitude of the steady state vibrations and the dynamic force transmitted to the bearings. Assume $E = 200 \times 10^{9}$ N/m^{2}. **07**

(b) Write a short note on vibration measuring instruments. **07**

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