MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

UNIVERSITY EXAMINATIONS 2010/2011

THIRD YEAR SECOND SEMESTER SUPPLEMENTARY EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG2304: MECHANICS OF MACHINES II

DATE: APRIL 2011
TIME: 2 HOURS

INSTRUCTIONS:
This paper contains FIVE questions
Answer any THREE
All questions carry equal marks

QUESTION ONE

(a) Differentiate simple harmonic motion from natural vibrations and show that when a mass supported
by spring is slightly displaced from equilibrium, the resultant motion is simple harmonic motion.

(b) On a packaging machine mechanism a crosshead moves in a straight guide with simple harmonic motion. At distances 250 and 400 mm from the mean position the crosshead has velocities of 12 and 6 m/s respectively. Determine:
(i) The amplitude of the motion
(ii) The maximum velocity
(iii) Maximum acceleration
(iv) The maximum power dissipated if the crosshead has a mass of 2kg

QUESTION TWO

(a) Obtain an expression for the moment of inertia of a body as obtained by trifiliar suspension method.

(b) A connecting rod of mass 15.6 kg is placed on a horizontal platform which is suspended by three equal wires, each 1.2 m long, from a rigid support. The wires are equally spaced round the circumference of a circle of 125 mm radius. When the c.g of the connecting rod coincides with the axis of the circle, the platform makes 10 angular oscillations in 30 seconds. Determine the moment of inertia of the connecting rod.
The steel sheet platform has a mass of 1.5 kg and makes 10 angular oscillations in 35 seconds.

QUESTION THREE

A body of mass 10 kg is suspended from a spring of stiffness 1800N/m. The motion of the body is opposed by a viscous resistance of 120Ns/m. The body is acted upon by a force of 100coswt N, the frequency being variable. Determine:

(i) The frequency of the applied force for which the amplitude is maximum
(ii) The amplitude of this maximum motion
(iii) The amplitude of the motion when the applied frequency is equal to the natural frequency of the undamped motion

QUESTION FOUR

A motor drives a pump through gearing, the pump speed being 1/5 of the motor speed. The shaft from the motor to the pinion has a torsion stiffness of 50 kN-m/ radian and the motor has a second moment of inertia of 30 kgm^2. The impeller has a torsion stiffness of 800kNm/radian and a second moment of inertia of 160 kgm^2. Neglecting the inertia of the gears and the shaft, determine the natural frequency of torsion vibration of the system.

QUESTION FIVE

A large shaft which was being checked for outbalance masses was found to have unbalanced masses equivalent to three rotating masses, P= 14 kg, Q=11 kg and R=21 kg with centers of gravity 275 mm,400 mm, and 1`50 mm respectively from the shaft axis. The angular positions of Q and R are 60^0 and 135^0 respectively from P measured in the same direction. The distances between the planes of rotation of P and Q is 1.35 m and between those of P and R is 3.6m, Q and R being in the same side of P. Two balance masses are to be fitted each with its centre of gravity 225 mm from the shaft axis in planes midway between those of P and Q and Q and R

Determine the magnitude of the balance masses and their angular positions with respect to P