TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSME Y3S1

EMG 2304 : MECHANICS OF MACHINES II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 17 May 2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
-scientific calculator
-Drawing instruments

This paper consists of **FIVE** questions. Attempt any THREE questions.
Do not write on the question paper.

Question ONE

An electric motor is to drive a centrifuge, running at four times the motor speed, through a spur gear and pinion. The steel shaft from motor to gear wheel is 54 mm diameter and L long; the shaft from pinion to centrifuges is 40 mm diameter and 0.4 long. The masses and radii of gyration of motor and centrifuge are respectively 35 kg, 100mm and 27 kg , 140 mm the inertia effect of the gears may be neglected .

By establishing each formula used, calculate:

  (a) the value of L if the gears are to be at the node for torsional vibration of the system,
  (b) the frequency of the torsional vibration

(20 marks)

Question TWO

A strip of steel 10 mm wide and 0.8 mm thick rests on knife-edged supports 200mm apart and a body of mass 0.15 kg is fixed to the strip at mid-span. If the greatest bending stress in the strip during vibration is $100MN/m^2$ and neglecting the mass of the strip, determine:

(a) the natural time of vibration of the strip,
(b) amplitude of movement of the body,
(c) the least pressure on each support.

(20 marks)

Question THREE

A mass of 3 kg is supported by an elastic structure and causes a static extension of 60 mm. The mass is acted upon by a simple harmonic disturbing force having a maximum value of 10 N and a frequency of 1.5 Hz. The system experiences a damping force proportional to the velocity of motion and equal to 36 N at a velocity of 1 m/s.

(a) Determine the amplitude of steady motion of the forced vibration,
(b) Show that this is approximately the maximum value to which the system is subject whatever the value of the frequency of the disturbing force.

(20 marks)

Question FOUR

A shaft is supported in two bearing 2.4m apart and project 0.6 beyond the bearings at each end. The shaft carries three pulleys, one at each end and one at the middle of its length. The end pulleys have masses of 90kg and 50 kg and their centres of gravity are at 3.75 and 5 mm respectively from the shaft axis. The centre pulley has a mass of 70 kg and its centre of gravity is 6.25 mm from the shaft axis. If the pulleys are arranged so as to give static balance, determine the dynamics forces produced on the bearings when the shaft rotates at 300 rev/min.

(20 marks)

Question FIVE

A machine of mass 70 kg is mounted on springs and is fitted with a dash-pot to damp out vibrations. There are three springs each of stiffness 9 kN/m and it is found that the amplitude of the vibration diminishes from 36 mm to 6 mm in two complete vibrations. Assuming that the damping force varies directly as the velocity,

(i)   Determine the resistance of the dash-pot at unit velocity

(ii)   Compare the frequency of the damped vibrations with the frequency when the dash-pot is not in operation.