Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 level 1st Semester Examination –July /Aug. 2016
SCT 366-2 Mechanics Of Machines

Uva Wellassa University

All symbols have their usual meaning, unless defined.
Scientific Calculators are allowed.
Duration: Two (02) hours
Number of questions: Four (04) Esseys
Mark allocation: 100
Answer all the questions

1. In the mechanism shown in Figure 01 below, the link AB rotates with a uniform angular velocity of 30 rads^{-1}. Determine the velocity of point G, if AB= 100 mm, BC= 300 mm, BD= 150 mm, DE= 250 mm, EF= 200 mm, DG= 167 mm, and angle CAB= 30°. (20 mark)

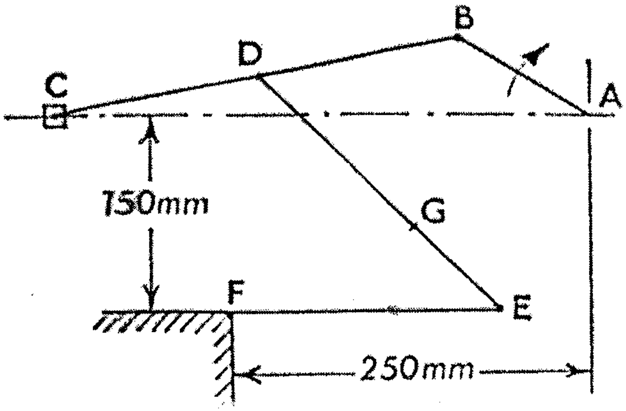


Figure 01

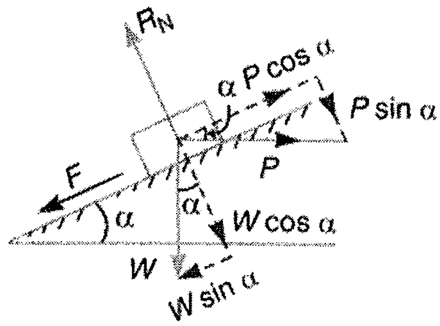


Figure 02

2.

a. Write down the equation for the inclination of the tread with the horizontal, tan α interms of pitch of the screw (p), mean diameter of the screw (d), and number of threads in one lead (n). (5 mark)

b. Derive the equation for force required at the circumference of the screw to lift the load of a screw jack, P= W tan (α + φ) using Figure 02, where W is the load to be lifted and φ is the friction angle. (10 mark)

c. Hense, obtain an expression for torque required to overcome the friction between screw and nut, if d is the mean diameter of the screw (neglect the torque required to overcome the friction at the collar). (5 mark)

d. A 150 mm diameter valve, against which a steam pressure of 2 MN/m^2 is acting, is closed by means of a square threaded screw 50 mm in external diameter with 6 mm pitch. If the coefficient of friction is 0.12, find the torque required to turn the handle. (10 mark)

3.

a. Show that the maximum fluctuation of energy of the flywheel, $\Delta E = mk^2\omega^2 C_S$.

(5 mark)

b. The turning moment diagram for a petrol engine is drawn to the following scales: turning moment, 1 mm = 5 Nm; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.

(20 mark)

4.

a. Show that the natural frequency of transverse vibrations, $f_n = \frac{1}{2\pi}\sqrt{\frac{s}{m}} = \frac{1}{2\pi}\sqrt{\frac{g}{\delta}}$ using Figure 03, where **s** is the stiffness of the constraint, **m** is the mass of the body, **W** is the weight of the body, **δ** is the static deflection of the constraint and **x** is the displacement given to the body.

(10 mark)

b. In the Figure 04, a simply supported shaft of length 800 mm caries a mass of 60 kg placed 250 mm from one end. If Young's modulus (E) is 200 GN/m^2 and diameter of sharft is 50 mm, then find the natural frequency of transvers vibrations (Use Table 01 shown in page 3 for value of static deflection, δ).

(15 mark)

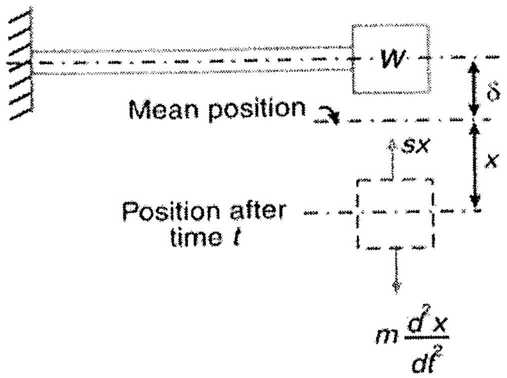


Figure 03

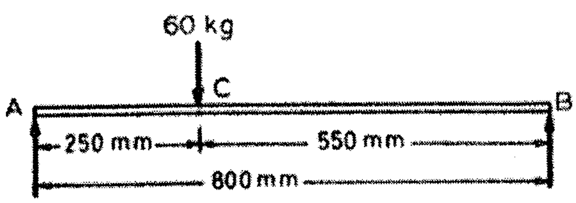
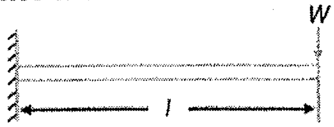
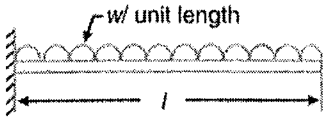
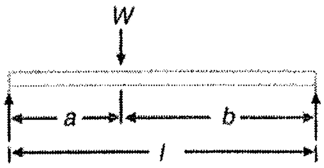
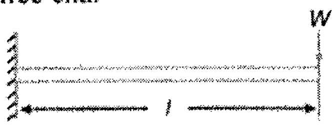
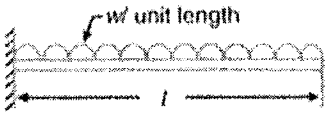
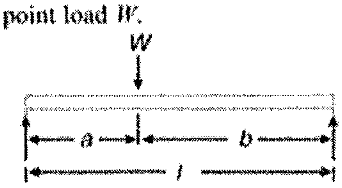


Figure 04

Table 01: Values of static deflection (**δ**) for the various types of beams and under various load conditions

S.No.	*Type of beam*	*Deflection* (**δ**)
1.	Cantilever beam with a point load W at the free end. 	$\delta = \frac{Wl^3}{3EI}$ (at the free end)
2.	Cantilever beam with a uniformly distributed load of w per unit length. 	$\delta = \frac{wl^4}{8EI}$ (at the free end)
3.	Simply supported beam with an eccentric point load W. 	$\delta = \frac{Wa^2b^2}{3EIl}$ (at the point load)

1.	Cantilever beam with a point load W at the free end. 	$\delta = \frac{Wl^3}{3EI}$ (at the free end)
2.	Cantilever beam with a uniformly distributed load of w per unit length. 	$\delta = \frac{wl^4}{8EI}$ (at the free end)
3.	Simply supported beam with an eccentric point load W. 	$\delta = \frac{Wa^2b^2}{3EIl}$ (at the point load)