THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
DIPLOMA IN TECHNOLOGY – LEVEL 03
FINAL EXAMINATION 2011/2012
MEX3230 – MECHANICS OF MACHINES
DATE :29TH FEBRUARY 2012
TIME :0930 HRS - 1230 HRS
DURATION :03 HOURS

Answer any FIVE (05). All questions carry equal marks.

Question 01:

a) For a spur gear obtain an expression for the path of contact in terms of addendum circle radius, pitch circle radius and pressure angle.

(08 marks)

b) Two gears having 50 and 60 involute teeth are in mesh. Their pressure angle (Φ) and module (m) are 20^0 and 10 mm respectively. The line of contact on each side of the pitch point is half the maximum possible length. Find the height of addendum for each gear wheel and the length of the arc of contact.

(12 marks)

Question 02:

a) For a flat belt, prove that $\frac{T_1}{T_2} = e^{\mu\theta}$,

Where T_1 = Tension in the tight side of the belt,
T_2 = Tension in the slack side of the belt
μ = Coefficient of friction between the belt and the pulley, and
θ = Angle of contact between the belt and the pulley (in radians)

(08 marks)

b) In a flat belt drive the initial tension is 2,000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of contact between the belt and the smaller pulley is 150^0. The smaller pulley has a radius of 200 mm and rotates at 500 r.p.m. Find the power in kW transmitted by the belt.

(12 marks)

Question 03:

A turn buckle, with right hand single start threads at one end and left hand single start threads at the other end of the power screw, is used to couple two wagons. Its thread pitch is 12 mm and mean diameter 40 mm. The coefficient of friction between the nut and screw is 0.16. Determine the work done in drawing the wagons together a distance of 240 mm, against a steady load of 2,500N. Assume square threads.

Question 04:

a) If I is the moment of inertia and Ω is the mean speed of the flywheel, prove that the maximum fluctuation of energy can be expressed as

$$E_{max} = \frac{K_s I \Omega^2}{100}$$

Where K_s is the coefficient of fluctuation of speed expressed as a percentage.

(08 marks)

b) A two-stroke twin–cylinder engine with single acting has its cranks set at right angles and it runs at 1500 rev/min. The torque angle diagram is a triangle for the power stroke with a maximum torque of 200 Nm at 60^0 after top dead center of the corresponding crank. The torque on the return stroke is negligible. Sketch the torque-crank angle diagram and hence find

(i) the power developed

(ii) the torque on the load

(12 marks)

Question 05:

A single plate clutch, effective on both sides, is required to transmit 25 kW at 3,000 r.p.m. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.25, the ratio of radii is 1.25 and the maximum pressure is not exceed 0.1 N/mm^2. Also, determine the axial thrust to be provided by springs. Assume uniform wear.

(20 marks)

Question 06

The dimensions of the mechanism, as shown in Fig.Q6, are as follows:
$AB = 0.45$m ; $BD = 1.5$ m; $BC = CE = 0.9$ m

The crank ***AB*** turns uniformly at 180 r.p.m. in the clockwise direction and the blocks at ***D*** and ***E*** are working in frictionless guides.
For the configuration shown in the figure draw the velocity diagram for the mechanism and find the velocities of the sliders ***D*** and ***E*** in their guides. Also determine the turning moment at ***A*** if a force of 500N acts on ***D*** in the direction of arrow ***X*** and a force of 750 N acts on ***E*** in the direction of arrow ***Y***.

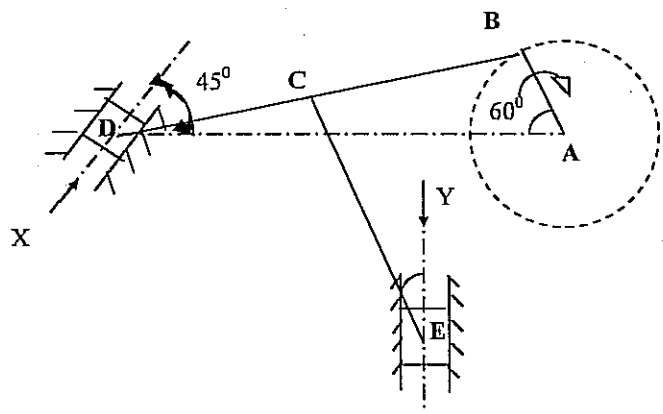


Fig.Q6

Question 07:

a) Write the difference between static balance and dynamic balance of a vehicle wheel.
(05 marks)

c) A line shaft carries four rotors ***A, B, C*** and ***D*** each 200 mm apart from one another. Out of balance forces produced by the rotors ***A, B*** and ***C*** are 600N, 1000N and 500N respectively at the shaft speed of 500 rev/min. If the shaft is dynamically balanced find the directions of the out of balance forces of rotors ***B, C*** and ***D*** relative to the rotor ***A***. Also determine the magnitude of the out of balance force produced by rotor ***D***.

(15 marks)

Question 08:

The turning moment diagram for a petrol engine is drawn as Fig.Q8 to the following scales:

turning moment 1mm = 6 Nm; ***crank angle 1 mm = 1^0.***

The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taking in order, are +285, -685, +50, -340, +960, -270 mm^2.

The rotating parts are equivalent to a mass of 40 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1200 r.p.m.

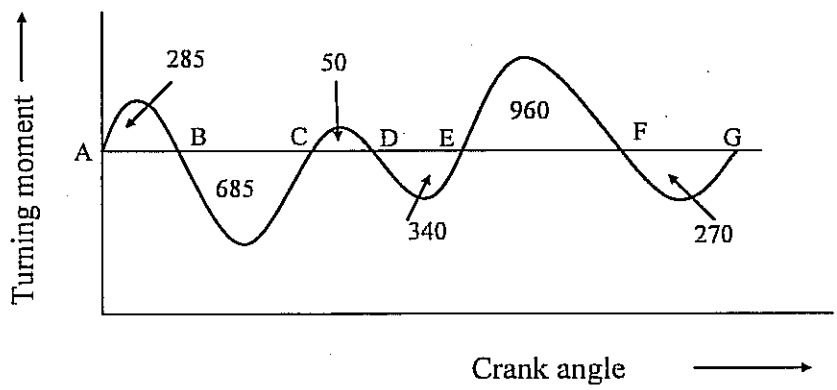


Fig.Q8

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