INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2018**
Programme	:	Diploma in Mechanical Engineering (DMEN)
Course	:	**EGM2160 : Mechanics of Machines**
Date of Examination	:	December 7, 2018 (Friday)
Time	:	11:00 am – 1:00 pm Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner (s)	:	**Soo Swee Yoong** and Phua Chin Lai
Moderator	:	Assoc.Professor Dr. Seyed Amirmostafa Jourabchi

*This paper consists of **6** printed pages, including the cover page.*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGM2160: MECHANICS OF MACHINE
FINAL EXAMNINATION: AUGUST 2018 SESSION

Instructions: This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) A plate clutch has 3 discs on the driving shaft and 2 discs on the driven shaft, providing four pairs of contact surfaces, each of 240 mm external diameter and 120 mm internal diameter. Assuming uniform pressure,

(i) Find the total spring load pressing the plates together to transmit 25 kW at 1575 rpm. Take coefficient of friction, $\mu = 0.3$.

(11 marks)

(ii) If there are 6 spring each of stiffness 13 kN/m and each of the contact surfaces has worn away 1.25 mm, what is the maximum power that can be transmitted at the same rpm, assuming uniform wear and the same coefficient of friction?

(4 marks)

(b) In a cone clutch the contact surfaces have an effective diameter of 75 mm. The semi-angle of the cone is 15° and $\mu = 0.3$.

(i) Find the torque required to produce slipping of the clutch if the axial force applied is 180 N.

(2 marks)

(ii) This clutch is employed to connect an electric motor, running uniformly at 1000 rpm, with a flywheel which is initially stationary. The flywheel has a mass of 13.5 kg and its radius of gyration is 150 mm. Calculate the time required for the flywheel to attain full speed.

(8 marks)

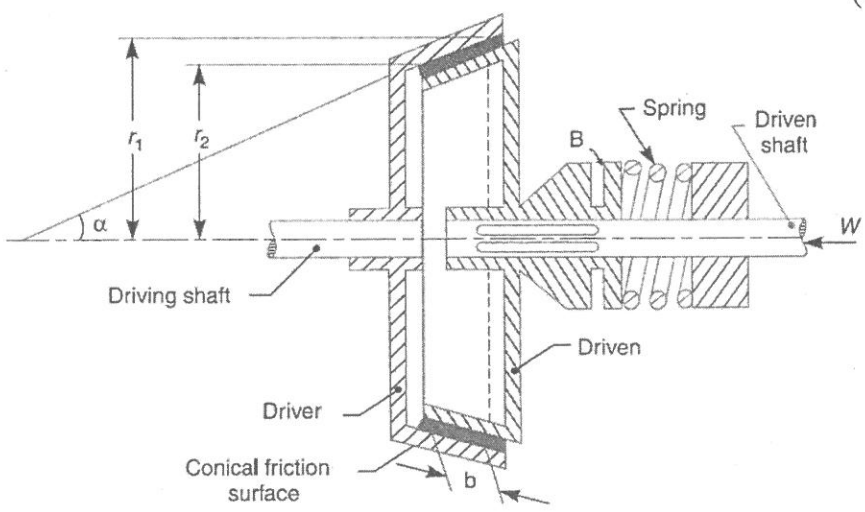


Figure Q1 (b)

Question 2

(a) Two pulleys, one 450 mm diameter and the other 200 mm diameter, are parallel shafts 1.95 mm apart, and are connected by a crossed belt.

(i) Find the length of the belt required and the angle of contact between the belt and each pulley.

(8 marks)

(ii) What power can be transmitted by the belt when the larger pulley rotates at 200 rpm if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between belt and pulley is 0.25?

(7 marks)

(b) A pulley is driven by a flat belt, the angle of the lap being 120°. The belt is 100 mm wide by 6 mm thick and desity 1000 kg/m^3. If the coefficient of driction is 0.3 and the maximum stress in the belt is not to exceed 3 MPa, find the greatest power which the belt can transmitt and the corresponding speed of the belt

(10 marks)

Question 3

An epicyclic train has a sun-wheel with 30 teeth and two planet wheels of 50 teeth (as shown in Figure Q3), the latter meshing with the internal teeth of a fixed annulus. The input shaft, carrying the sun-wheel, transmitts 4 kW at 300 rpm. The output shaft is connected to an arm which carries the planet wheels.

(i) What is the speed of the output shaft and the torque transmitted if the overall efficientcy is 95%?

(16 marks)

(ii) If the annulus is rotated independently, what should be its speed in order to make the output shaft at 10 rpm.

(9 marks)

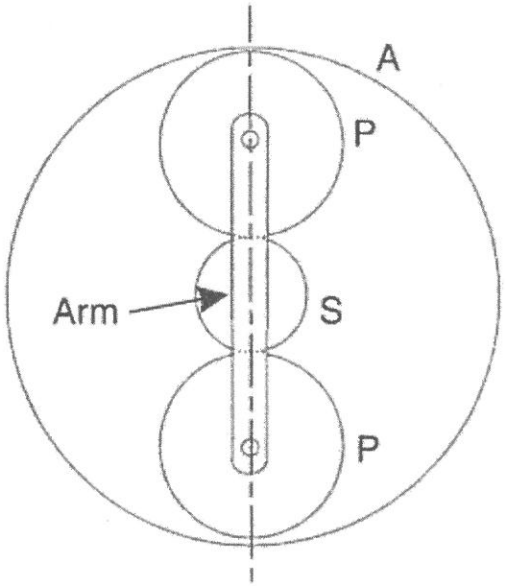


Figure Q3

Question 4

The mechanism, as shown in Figure Q4, has the dimensions of various links as follows:

AB = DE = 150 mm; BC = CD = 450 mm; EF = 375 mm.

The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 rpm. The lever DC oscillates about the fixed point D, which is connected to AB by the coupler BC.
The block F moves in the horizontal guides, being driven by the link EF. Determine:

(a) velocity of the block F,

(b) angular velocity of DC.

(25 marks)

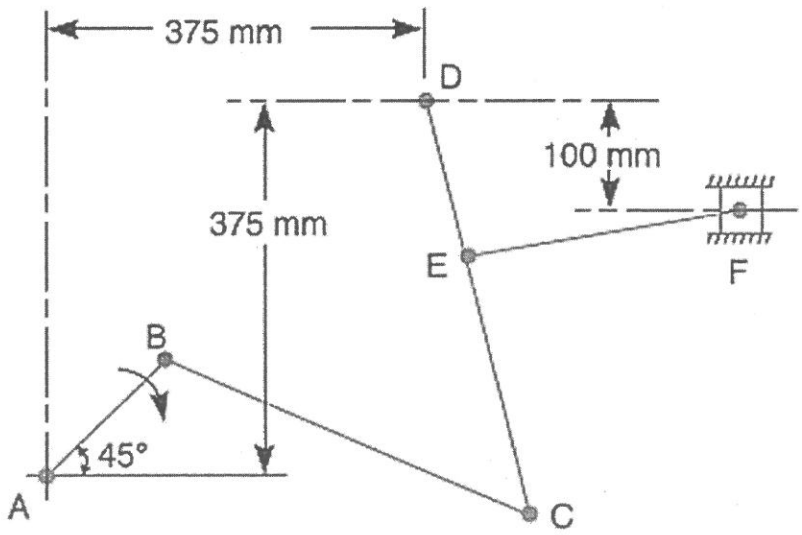


Figure Q4

Question 5

(a) In a Porter governor the upper and lower arms are each 200 mm long, and are each inclined at 30° to the vertical when the sleeve is in its lowest position. The points of suspension are each 36 mm from the axis of spindle. The mass of each rotating ball is 3 kg and that of the central load on the sleeve 20 kg. if the movement of the sleeve is 36 mm, find the range of speed of the governor in rev/min. (10 marks)

(b) Two similar discs, A and B, are mounted on a shaft with their centre planes 200 mm apart. Masses C, D and E are attached to the disc A in the position shown in the following Table Q5(b). Determine

(i) the unbalanced force on the shaft when its speed is 300 rpm.

(ii) the magnitude and angular position of a mass attached to disc B, at a radius of 150 mm that will make the resultant radial force zero.

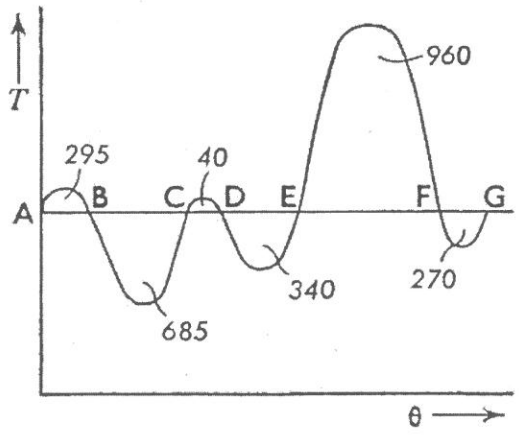
(15 marks)

Massess	Mass (kg)	Radius (mm)	Angular position (°)
C	2	100	0
D	1.5	125	60
E	3	87.5	135

Table Q5 (b)

Question 6

(a) The turning moment diagram shown in Figure Q6(a) for a petrol engine is drawn to the following scale: turning moment 1 mm = 5 Nm; crank angle 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of 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 fluctuation of speed when the engine runs at 1800 rpm.



(11 marks)

Figure 6(a)

(b) A spring of stiffness 2 kN/m is suspended vertically and two equal masses of 4 kg each are attached to the lower end. One of these masses is suddenly removed and the system oscillates. Determine:

(i) the amplitude and frequency of the vibration, (3 marks)

(ii) the velocity and acceleration of the mass when passing through the half amplitude position. (11 marks)

-THE END –

EGM2160(F)/Aug2018/formatted