The Open University of Sri Lanka
Faculty of Engineering Technology

077

Study Programme	:	Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**DMX4204 Machine Dynamics**
Academic Year	:	2021/22
Date	:	23rd February 2023
Time	:	0930hrs – 1230hrs
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 6 questions.
3. Answer any 5 questions. All questions carry equal marks.

Question No.01:

A) Explain the concept of kinematic links and their importance in mechanical engineering.

(08 marks)

B) Of the link mechanism shown in Fig.Q1, the crank AB, rotates clockwise about A at 120 rpm,. The connecting rod CB is 400 mm, and rod CD is 180 mm long, which is fixed to the frame D. AB = 60 mm.The distance between A and D is 360 mm and $D\hat{A}B = 90^0$.

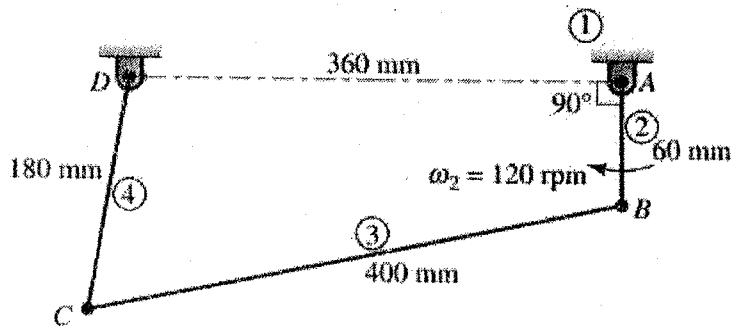

Fig.Q1

a) Draw the velocity polygon for the mechanism considering the configuration shown in the figure (Fig.Q1).

b) Determine,

i) the velocity of the input point B and C

ii) the velocity and the direction of point C relative to the point B

iii) the angular velocities of links 3 and 4.

(12 marks)

Question No.02:

A) What are the applications of epicyclic gear train in automobiles?

(05 marks)

B) In an epicyclic gear train (Fig.Q2), the carrier (link 2) serves as the input of the train. Gear1 is the fixed gear and has 30 teeth. The gear 3, has 35 teeth. The gear 4, serves as the output of the train and has 100 teeth.

Determine the rotational velocity of the all members (sun, planet & ring) of this gear train when the input shaft rotates at 1200 rpm clockwise.

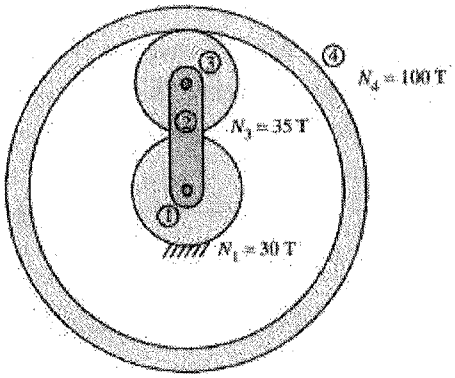

Fig.Q2

(15 marks)

Question No.03:

A) Explain the conditions for static and dynamic balancing and with suitable application/s in mechanical engineering as example/s. Why are static and dynamic balancing important?

(08 marks)

B) A, B, C and D are four masses carried by a rotating shaft at radii 100,125,200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the mass of B, C and D are 10kg, 5kg, and 4kg respectively.

i) Draw the force and couple polygons.

(08 marks)

Hence find for the complete balance,

ii) the relative angular settings of the four masses.

(02 marks)

iii) the required mass for A

(02 marks)

Question No.04:

A) Describe the concept of energy fluctuation in a turning moment diagram and how it is determined.

(05 marks)

B)

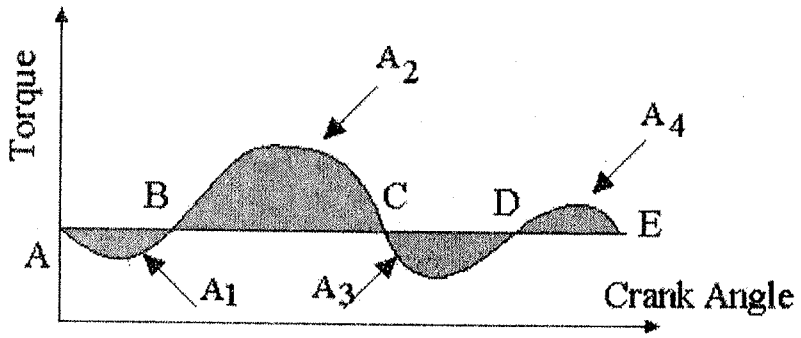

Fig.Q4

Fig.Q4 shows the turning moment diagram of an engine with fluctuation of energy below and above the mean turning moment with the areas taking in the order of A_1, A_2, A_3 and A_4 as -400, +800, -550, +150 J respectively.

i) Determine the maximum fluctuation of energy.

(04 marks)

ii) If the flywheel keeps the speed within the range 410 to 416 rev/min, calculate the coefficient of fluctuation of speed.

(04 marks)

iii) Find the moment of inertia of the flywheel.

(04 marks)

iv) If the radius of gyration of the flywheel is 0.5 m, find the mass of the flywheel.

(03 marks)

Question No.05:

A) Explain the purpose of a clutch in a power transmission system and identify three types of clutches with the relevant applications.

(06 marks)

B) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000r.p.m.
Assume the theory of uniform wear.
Determine,

(i) the transmitted torque

(04 marks)

(ii) the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2.

(06 marks)

(iii) the axial thrust to be provided by springs.

(04 marks)

Question No.06:

A) What is the concept behind belt drives when they are used in power transmission?

(04 marks)

B) Discuss the advantages and disadvantages of belt drives in comparison to other types of drives in mechanical power transmission systems.

(05 marks)

C) An open-belt drives transmits 2.5 kW of power. The linear velocity of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165°. The coefficient of friction is 0.3.

(i) Find the initial tension of the belt

(04 marks)

D) Determine the effect on power transmission in the following cases:

(i) Initial tension in the belt is **increased** by 8%.

(02 marks)

(ii) Initial tension in the belt is **decreased** by 8%.

(02 marks)

(iii) Angle of lap of the idler pulley is increased by 8% using an idler pulley, for the same speed and the tension on the tight side as in the Part C of the question.

(02 marks)

END