

The Open University of Sri Lanka  
Faculty of Engineering Technology



Study Programme	: Bachelor of Science Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: <b>DMX4204 Machine Dynamics</b>
Academic Year	: 2022/23
Date	: 2 <sup>nd</sup> February 2024
Time	: 1400hrs – 1700hrs
Duration	: 3 hours

**General instructions**

1. Read instructions given below carefully before answering the questions.
  2. This question paper consists of five (05) questions. Answer all questions.
  3. All questions carry equal marks.
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**Question No.01:**

- a) Why is balancing of rotating parts absolutely essential for high-speed engine?
- b) A shaft carries four masses P,Q,R and S of magnitude 100 kg, 150 kg, 200 kg and 100 kg, and revolving at radii 160 mm, 140 mm, 120 mm and 160 mm respectively. The planes Q, R and S measured from the plane of P are 300 mm, 400 mm and 700 mm respectively. The angles between the cranks measured anticlockwise are P to Q  $45^\circ$ , Q to R  $70^\circ$  and R to S  $120^\circ$ . The balancing masses are to be placed in planes X and Y. The distance between the planes P and X is 100 mm, between X and Y is 400 mm, and between Y and S is 200 mm. If the balancing masses revolve at radius of 100 mm, find their magnitudes and angular positions.

**Question No.02:**

The turning moment diagram shown in Fig.Q2 repeats in 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<sup>2</sup>.

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 1,200 rpm.

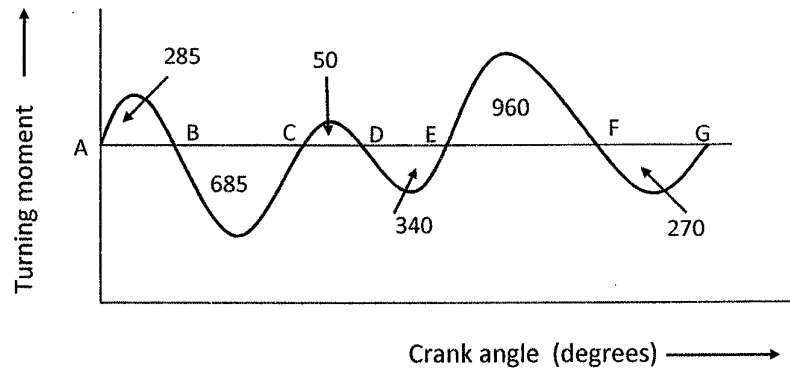


Fig.Q2

*Scales: Turning moment, 1mm  $\equiv$  6 Nm; Crank angle, 1 mm  $\equiv$  1<sup>o</sup>*

**Question No.03:**

- a) A block of weight  $W$  lies on a plane inclined at an angle  $\alpha$  to the horizontal. Prove that the magnitude of horizontal force  $H$  required to slide the block directly up the plane without acceleration is

$$H = W \tan (\alpha + \lambda) \quad \text{where } \lambda \text{ is the friction angle between the block and the plane.}$$

- b) A conical pivot bearing supports a vertical shaft of 300 mm diameter. It is subjected to a vertical load of 50 kN. The angle of the cone is 120<sup>o</sup> and the coefficient of friction is 0.03. Find the power lost in friction when the speed is 150 r.p.m., subject to each of the following conditions.
- Uniform pressure
  - Uniform wear.

**Question No.04:**

- a) Explain with a neat sketch the “sun and planet wheel” of the simplest epicyclic gear system.
- b)

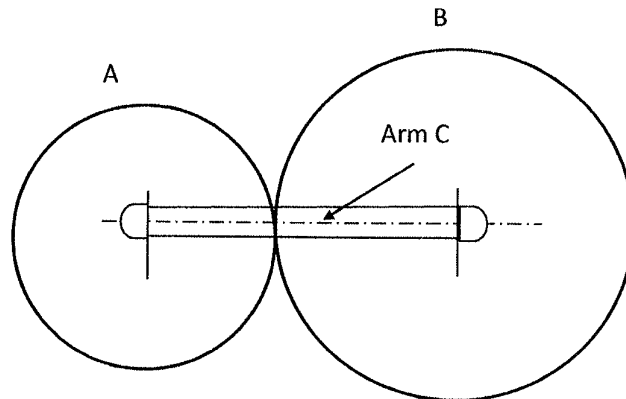


Fig.Q4

In an epicyclic gear train shown in Fig.Q4, the arm C carries two gears **A** and **B** having 24 and 32 teeth respectively. If the arm rotates at 160 rev/min. in the anticlockwise direction about the center of gear **A**, which is fixed, determine the speed of rotation of gear **B**.

- c) Of the problem b), instead of the gear **A** being fixed, it is made to rotated at 320 rev/min in the clockwise direction, what will be the speed of rotation of gear **B**?

**Question No.05:**

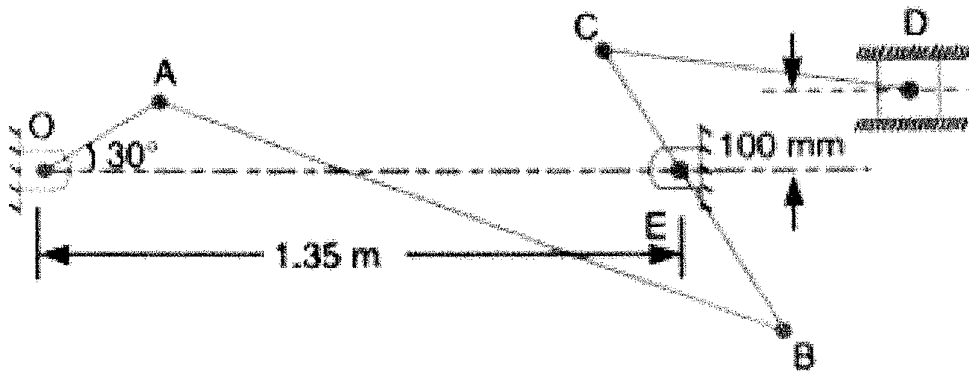


Fig.Q5

The link mechanism shown in Fig.Q5 has the following dimensions:

OA = 200 mm; AB = 1.5 m; BC = 600 mm; CD = 500 mm; OE = 1.35 m and BE = 400 mm.

If crank OA rotates uniformly at 120 r.p.m. clockwise, find

- the velocity of points B, C and D
- the angular velocity of the links AB, BC and CD.

Use graphical method.

**END OF QUESTION PAPER**