

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	: DMX4204 Machine Dynamics
Academic Year	: 2023/24
Date	: 21 st February 2025
Time	: 0930 – 1230 hrs
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.

Question No.01:

- a) A conical clutch consists of a conical driven member engaged by a conical driving member with an angle of the cone $\alpha=12^\circ$. The clutch has an inner diameter of 120 mm and an outer diameter of 180 mm. The coefficient of friction $\mu = 0.28$, and the working pressure is limited to 160 kN/m^2 . Assuming the pressure is uniformly distributed, calculate the power that can be transmitted at 1500 rev/min.

(10 marks)

- b) If the friction surfaces wear such that the intensity of pressure becomes inversely proportional to the radius, and the total axial force remains unchanged, calculate the power that can be transmitted at 1500 rev/min and the maximum intensity of pressure on the clutch surface.

(10 marks)

Question No.02:

- a) Give three advantages of epicyclic (planetary) gear systems over other gear systems.

(05 marks)

- b) An epicyclic gear train consists of three gears: A, B, and C. Gear A has 72 internal teeth, and gear C has 30 external teeth. Gear B meshes with both A and C and is mounted on an

arm that rotates at 30 rev/min about the axis of gear A. If gear A is held stationary, determine the speeds of gears B and C.

(15 marks)

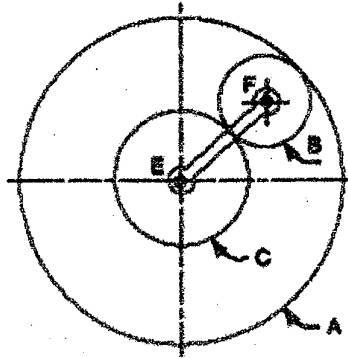


Fig.Q2

Question No.03:

- a) What are the conditions for achieving static and dynamic balance in a system of rotating masses?

(05 marks)

- b) A, B, C, and D are four masses attached to a rotating shaft at radii 120 mm, 150 mm, 180 mm, and 160 mm, respectively. The masses of B, C, and D are 12 kg, 8 kg, and 6 kg, respectively. The distances between the planes of rotation are 500 mm. Find the required mass of A and the angular positions of the masses for complete balance of the system.

(15 marks)

Question No.04:

- a) Discuss the significance of a turning moment diagram in analyzing the performance of an engine. How does the turning moment diagram help in determining the fluctuation of energy and the coefficient of fluctuation of speed in an engine?

(08 marks)

- b) The turning moment diagram for a single cylinder engine repeats in every half revolution of the crankshaft. The areas above and below the mean turning moment line, taken in order, are +300, -700, +60, -350, +950, and -260 mm². The rotating parts of the engine are equivalent to a mass of 45 kg at a radius of gyration of 160 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1,300 rpm.

(12 marks)

Question No.05:

- a) State and prove the belt friction formula for a V-belt with negligible mass.

(08 marks)

- b) A V-belt 5 mm thick and 60 mm wide is used to transmit power between two parallel shafts. The distance between the shafts is 3 m. The diameter of the driving pulley is 800 mm, and it rotates at a speed of 300 rev/min. The speed ratio between the driving and driven pulleys is 2. The belt material has a linear density of 2.2 kg/m and a permissible stress of 5 N/mm². The coefficient of friction between the belt and pulley is 0.25.

Determine:

- i) The angle of lap on the smaller pulley.

- ii) The maximum power that can be transmitted through the belt drive if the initial tension has been adjusted to 1000 N.

(12 marks)

END OF QUESTION PAPER