

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	: 2024/25
Date	: 14 February 2026 (Saturday)
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 single dry plate clutch transmits 7.5 kW at 900 r.p.m. The axial pressure is limited to 0.07 N/mm². If the coefficient of friction is 0.25, calculate the following
- i. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4.
 - ii. Outer and inner radii of the clutch plate.

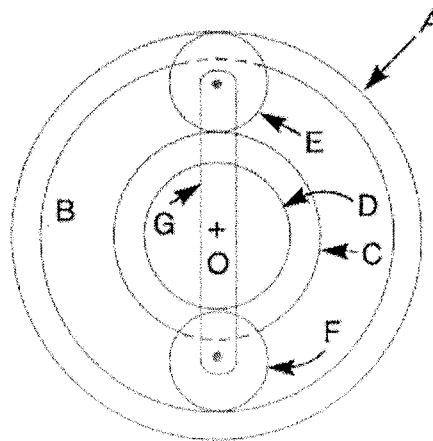
(10 marks)

- b) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semicone angle is 20° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed 0.25 N/mm², find the dimensions of the conical bearing surface and the axial load required.

(10 marks)

Question No.02:

- a) In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. Planetary wheel E engage with A and C. Planetary wheel F engage with B and D. All the wheels have the same module and the number of teeth are : $T_C = 28$; $T_D = 26$; $T_E = T_F = 18$.
- Find the number of teeth A and B
 - If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of B
 - If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counterclockwise; find the speed of wheel B.



(20 marks)

Fig.Q2

Question No.03:

- a) What are the conditions for achieving static and dynamic balance in a system of rotating masses?
- b) A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190° , both being measured in the same direction. The axial distance between planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine
- The magnitude of the masses at A and D.
 - The distance between planes A and D
 - The angular position of the mass at D.

(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 petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 Nm ; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm². The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.

(12 marks)

Question No.05:

- a) State and prove the belt friction formula for a flat belt drive with negligible mass (Use the standard notations).

(08 marks)

- b) Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 r.p.m. The diameter of the driving pulley of the motor is 300 mm. The driven pulley runs at 300 r.p.m. and the distance between the center of two pulleys is 3 m. The density of the leather is 1000 kg/m³. The maximum allowable stress in the leather is 2.5 MPa. The coefficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt.

(12 marks)

END OF QUESTION PAPER