



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

- COURSE NAME : MECHANIC OF MACHINES
- COURSE CODE : BDA 20303
- PROGRAMME CODE : BDD
- EXAMINATION DATE : JULY/AUGUST 2023
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER FIVE (5) QUESTIONS ONLY
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTIONS PAPER CONSISTS OF SIX (6) PAGES

TERBUKA

Q1 (a) Gear drive system is one of mechanical power transmission. Determine what is bevel gear and spur gear.

(6 marks)

(b) An electric motor is accelerating a 250 kg load with acceleration of 1.2 m/s^2 through a gear box as shown **Figure Q1(b)**. The rope carries the load and encircled on a pulley with diameter of 1.2m. Gear Box 1 ratio is 0.1 and efficiency is 90%. Gear Box 2 ratio is 1 and efficiency is 100 %, while gear box equivalent moment of inertia is 5.55 kgm^2 . Neglect friction effect in this drive system. Calculate the torque of the motor needed to bring up the load with acceleration 1.2 m/s^2 .

(14 marks)

Q2 (a) What is belt tension in belt drive system and why it is important?

(4 marks)

(b) A flat belt is 250 mm wide and 8 mm thick. The mass of the belt is 1.9 kg/m of belt length. The modulus of elasticity and maximum allowable tension of the belt is 300 MN/m^2 and 600N, respectively. The belt connects 400 mm in diameter of the driver pulley to another 900 mm in diameter pulley using open belt type arrangement. The center distance between the two pulleys is 5 m. The coefficient of friction of the drive is 0.28.

- (i) Calculate the belt length and the angles of wrap.
- (ii) If the driver pulley (400 mm in diameter) is rotating with speed of 400 rpm, find the maximum tension for the belt.
- (iii) Find the power transmitted by the belt.

(16 marks)

TERBUKA

Q3 (a) The uneven distribution of mass about a rotor’s rotating centerline may contribute to severe mechanical failure. Briefly explain the phenomenon.

(3 marks)

(b) A rotor has the following properties as below table. If the shaft is balanced by two counter masses m_P and m_Q , located at 100 mm radius and revolving in planes midway of planes A and B, and midway of C and D, determine the magnitude of the masses and their respective angular positions.

Mass	Magnitude (kg)	Radius (mm)	Angle (θ)	Axial distance from first mass A (mm)
A	9	100	0°	0
P	m_P	100	θ_P	l_P
B	7	120	60°	160
C	8	140	135°	320
Q	m_Q	100	θ_Q	l_Q
D	6	120	270°	560

(17 marks)

Q4 (a) Explain the main advantage of friction clutches.

(4 marks)

(b) A multiple plate clutch has more number of clutch plates. A typical clutch consists of the following important components which are drive (friction) plates and driven (steel) plates. If a multiple plate clutch with an effective diameter of 250 mm and 150 mm are able to transmit 60 kW at 1200 rpm, also the end thrust is given as 4.5 kN and coefficient of friction is 0.13.

(i) Determine the torque to be carry by friction clutch.

(2 marks)

(ii) Compare the number of plates required between uniform wear and uniform pressure theory.

TERBUKA

(14 marks)

Q5 **Figure Q5** shows a lift mechanism. The 0.5 m link on the mechanism rotates counter clockwise at constant rate of 10 rpm. At the instant when $\theta = 45^\circ$, graphically determine.

- (a) the velocity of point X. (4 marks)
- (b) the angular velocity of 2.0 m link. (4 marks)
- (c) the angular acceleration of the 2.0 m link. (6 marks)
- (d) the linear acceleration of point X. (6 marks)

Q6 (a) A four bar or 4 bar linkage is one of the most simple linkage mechanisms. Describe four bar linkage. (6 marks)

- (b) A simple mechanism system for four bar linkage A, B, C and D is shown in **Figure Q6 (b)**. Length of crank AB is 3 m and has an angular velocity of 2 rad/s rotate counter clockwise. Connecting link BC is 3 m and follower CD is 4 m. At the position of crank AB is 60° and follower CD is 45° refer to horizontal, determine angular velocities of connecting link BC and follower link CD. (14 marks)

-END OF QUESTION-

TERBUKA

FINAL EXAMINATION

SEMESTER/SESSION : II 2022/2023

PROGRAMME CODE : BDD

COURSE NAME : MECHANIC OF MACHINES

COURSE CODE : BDA 20303

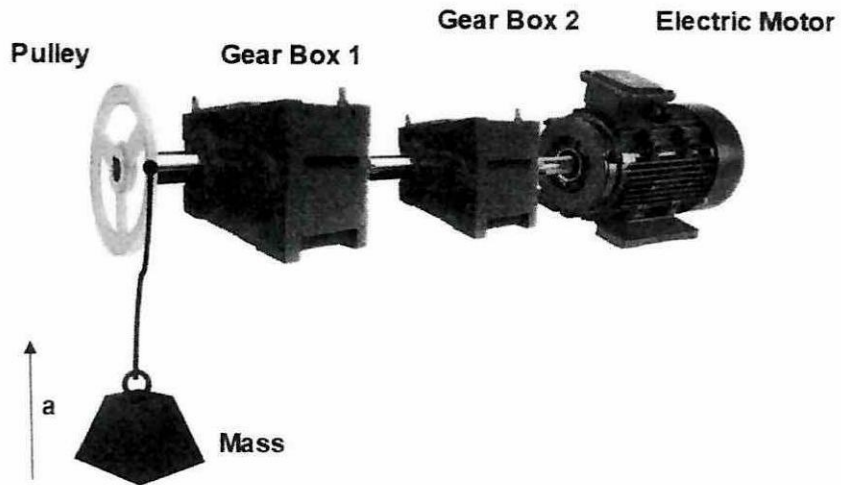


Figure Q1(b)

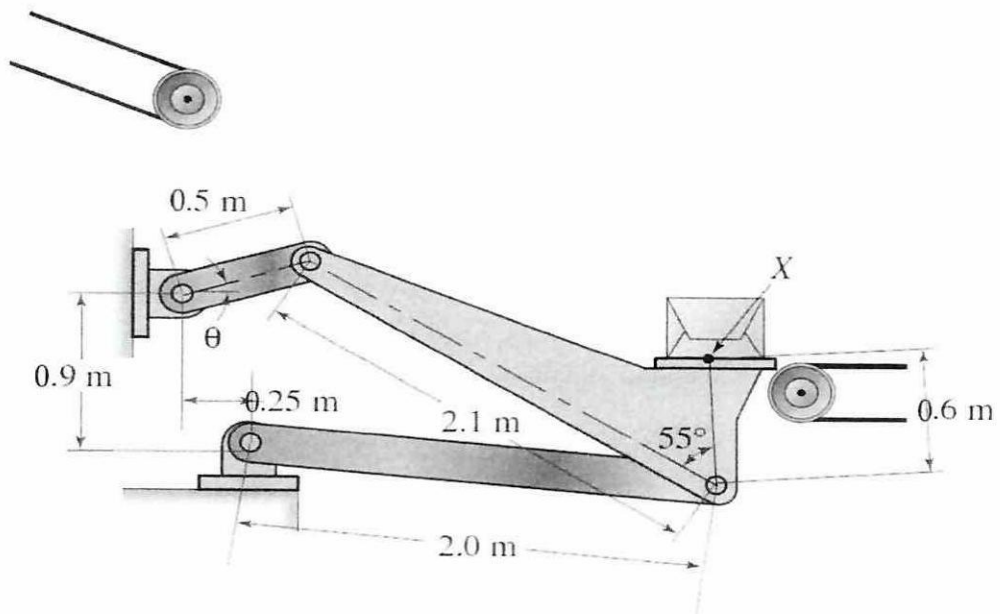


Figure Q5

TERBUKA

FINAL EXAMINATION

SEMESTER/SESSION : II 2022/2023

PROGRAMME CODE : BDD

COURSE NAME : MECHANIC OF MACHINES

COURSE CODE : BDA 20303

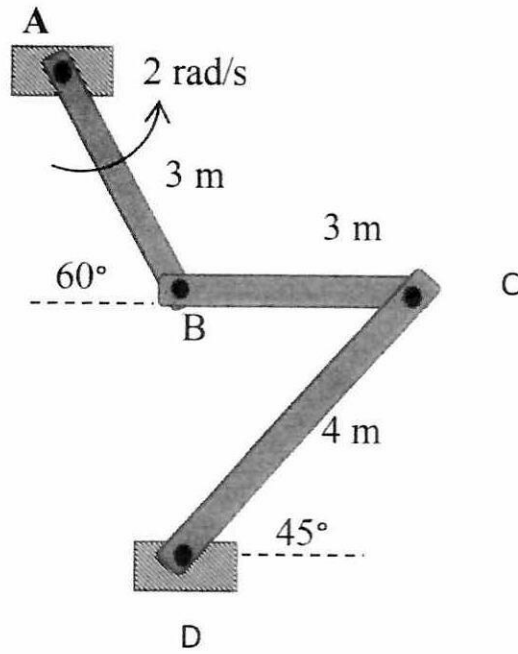


Figure Q6(b)

TERBUKA