



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY**

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

**BACHELOR OF EDUCATION TECHNOLOGY (MECHANICAL
ENGINEERING OPTION)**

COURSE CODE: TEM 442

COURSE TITLE: MECHANICS OF MACHINES II

DATE: 13/04/2023

TIME: 3:00 PM – 5:00 PM

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **FOUR** questions
2. Answer Question **ONE (Compulsory)** and any other **TWO** Questions
3. All symbols have their usual meaning

TIME: 2 Hours

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over

QUESTION ONE**[30 marks]**

- a) Define the terms: mechanism, machine, link, kinematic chain and kinematic pair. (5 Marks)
- b) State THREE advantages of gear drive over the belt and rope drives. (3 marks)
- c) What is a reverted gear train? Where is it used? (3 marks)
- d) Explain the following terms as used in gearing
- (i) Module (1 marks)
 - (ii) Diametral pitch (1 marks)
 - (iii) Base circle (1 marks)
- e) List any FOUR applications of 'cam' and 'follower'. (4 marks)
- f) With the aid of sketches, name three types of instantaneous centres. (3 marks)
- g) Define the Coriolis component of acceleration and give its formula. (2 marks)
- h) With the aid of a well-labelled diagram, describe the working principle of a Geneva wheel mechanism (5 marks)
- i) Explain TWO ways in which interference can be avoided in gears. (2 marks)

QUESTION TWO**[20 marks]**

- a) Fig Q2a shows a pin-jointed four bar linkage having the following dimensions:

Fixed link AD = 4m;

Driving link AB = 1.5 m

Driven link CD = 2.5m;

Connecting link BC = 3 m

Angle BAD = 60°

Link AB revolves at 25 r.p.m. Using the Instantaneous Centre method, determine:

- i. Angular velocity of link BC and (8 marks)
- ii. Angular velocity of link CD (2 marks)

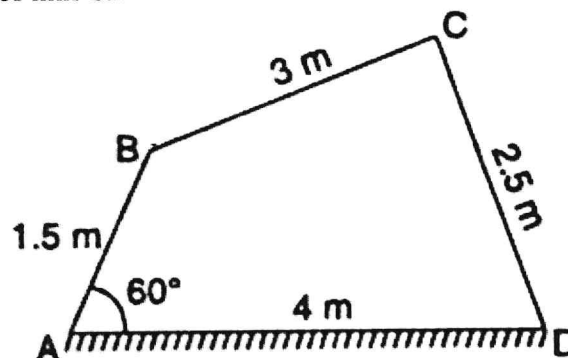


Figure Q 2a

- b) In a four bar chain ABCD shown in Fig Q2b, AD is fixed and is 15cm long. The crank AB is 4 cm long and rotates at 120 r.p.m. clockwise, while the link CD (=8cm) oscillates about D. BC and AD are of equal length. Using the relative velocity method, find the angular velocity of link CD when angle $BAD = 60^\circ$

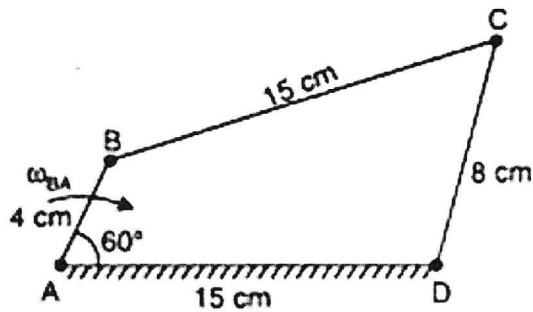
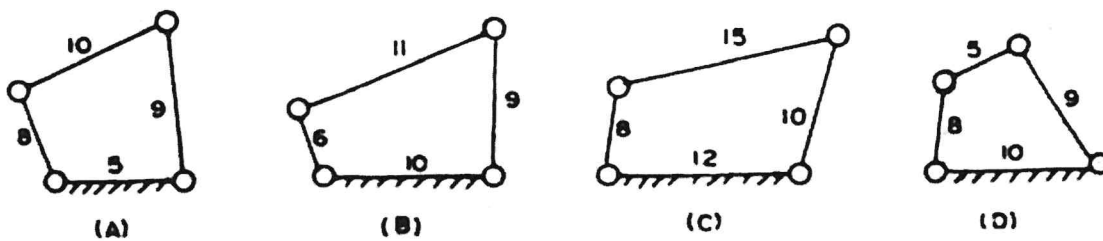


Figure Q 2b

QUESTION THREE

[20 marks]

- a) Some four-bar linkages are shown in Fig 3a where the number indicate the respective link lengths in cm. Identify the nature of each mechanism, i.e. whether (i) double crank, (ii) crank rocker or (iii) double rocker. Give reasons in brief. (14 marks)



- b) Explain the three types of gear classified according to the position of shafts (6 marks)

QUESTION FOUR**[20 marks]**

- a) State Aronhold Kennedy's theorem. **(2 marks)**
- b) Determine the number of teeth and speed of the driver if the driven gear has teeth of 8mm module and rotates at 240 r.p.m. The two gears have a velocity ratio of $\frac{1}{4}$. Also calculate the pitch line velocities (linear velocities at the pitch circle). **(6marks)**
- c) The crankpin circle radius of a horizontal engine is 150 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 45° from I.D.C., the difference between the driving and the back pressure is 0.35 N/mm^2 . The connecting rod length between centres is 0.6 m and the cylinder bore is 0.25 m. If the engine runs at 300 r.p.m. and if the effect of piston rod diameter is neglected, calculate:
- i. Pressure in the slide bars
 - ii. Thrust in the connecting rod
 - iii. Tangential force on the crankpin
 - iv. Turning moment on the crankshaft. **(12 marks)**