



# **KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER  
MAIN EXAMINATIONS**

**FOR THE DEGREE OF B.SC (RENEWABLE ENERGY AND BIOFUELS  
TECHNOLOGY)**

**COURSE CODE:** REN 212

**COURSE TITLE:** MECHANICS OF MACHINES

**DATE:** 16/12/2022

**TIME:** 9:00-11:00AM

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## **INSTRUCTIONS TO CANDIDATES**

TIME: 2 Hours

**Answer question ONE and any TWO of the remaining**

KIBU observes ZERO tolerance to examination cheating

### Question One (Compulsory)

- a) Define the following terms as used in the theory of machines (3 marks)
- i. Kinematics
  - ii. Dynamics
  - iii. Statics
- b) Differentiate between a machine and a structure. (4 marks)
- c) Explain THREE types of constrained motion. (3 marks)
- d) Give the expression for Grubler's criterion for plane mechanisms. (4 marks)
- e) Discuss briefly the various types of friction experienced by a body. (4 marks)
- f) Explain clearly the terms "static balancing" and "dynamic balancing". (4 marks)
- g) Explain three types of vibratory motion. (3 marks)
- h) Discuss briefly longitudinal, transverse and torsional free vibrations. (3 marks)
- i) Why is balancing of rotating parts necessary for high speed engines? (2 marks)

### Question Two

A crank and slotted lever mechanism used in a shaper has a center distance of 300 mm between the center of oscillation of the slotted lever and the center of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke. (20 marks)

### Question Three

- a) Explain the following terms: (6 marks)
- i) Limiting friction
  - ii) Limiting angle of friction
  - iii) Coefficient of friction
- b) A body, resting on a rough horizontal plane required a pull of 180 N inclined at  $30^\circ$  to the plane just to move it. It was found that a push of 220 N inclined at  $30^\circ$  to the plane just moved the body. Determine the weight of the body and the coefficient of friction. (14 marks)

#### Question Four

Four masses  $m_1, m_2, m_3,$  and  $m_4$  are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are  $45^\circ, 75^\circ$  and  $135^\circ$ . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. (20 marks)

#### Question five

- a) Define the following terms; (6 marks)
- i) free vibrations,
  - ii) forced vibrations
  - iii) damped vibrations.
- b) A shaft of length 0.75 m, supported freely at the ends, is carrying a body of mass 90 kg at 0.25 m from one end. Find the natural frequency of transverse vibration. Assume  $E = 200 \text{ GN/m}^2$  and shaft diameter = 50 mm. (14 marks)