



10

KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER
SUPPLEMENTARY EXAMINATIONS**

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

COURSE CODE: REN 212

COURSE TITLE: MECHANICS OF MACHINES

DATE: 5/02/2024 TIME: 11:00 - 1:00 PM

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) Explain the term kinematic link and give the classification of kinematic link. (4 marks)
- b) Differentiate a mechanism from a machine. (2 marks)
- c) What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism? (4 marks)
- d) Explain Grubler's criterion for determining degree of freedom for mechanisms. (4 marks)
- e) Explain the various types of friction. (4 marks)
- f) Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them. (4 marks)
- g) List the causes and effects of vibrations? (4 marks)
- h) Explain the following terms as used in vibratory motion. (4 marks)
- i. free vibrations,
 - ii. forced vibrations
 - iii. damped vibrations.

Question two

- a) An effort of 1500 N is required to just move a certain body up an inclined plane of angle 12° , force acting parallel to the plane. If the angle of inclination is increased to 15° , then the effort required is 1720 N. Find the weight of the body and the coefficient of friction. (10 marks)
- b) A 150 mm diameter valve, against which a steam pressure of 2 MN/m^2 is acting, is closed by means of a square threaded screw 50 mm in external diameter with 6 mm pitch. If the coefficient of friction is 0.12; find the torque required to turn the handle. (10 marks)

Question three

Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60° , 135° and 270° from the

mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm. (20 marks)

Question four

- a) Why is balancing of rotating parts necessary for high speed engines? (6 marks)
- b) 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° . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. (14 marks)

Question five

- a) Explain three types of vibratory motion. (6 marks)
- b) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GN/m^2 . Determine the frequency of longitudinal and transverse vibrations of the shaft. (14 marks)