UNIVERSITY EXAMINATIONS
2022/2023 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: 2/8/2023 **TIME:** 11:00-1:00PM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

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) Highlight the Grubler's criterion for determining degree of freedom for mechanisms. (4 marks)

e) Differentiate between static and dynamic friction. (4 marks)

f) Define the following terms. (2 marks)

g) State the necessary conditions to achieve static and dynamic balancing. (4 marks)

h) Define the following terms related to mechanical oscillations. (3 marks)

i) Define the following terms as used in vibratory motion. (3 marks)

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)

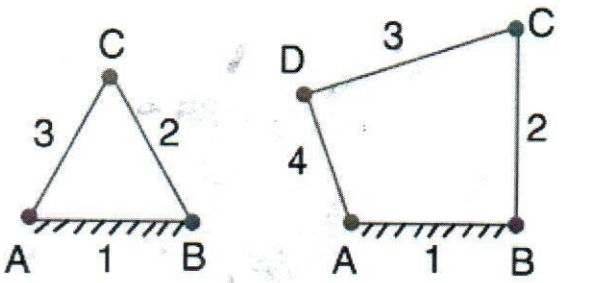
Question three

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) Explain the three types of constrained motion? (9 marks)

b) Determine the degrees of freedom for the simple mechanism having no higher pair shown in figure 1 using the Kutzbach criterion. (11 marks)



(*a*) Three-bar mechanism. (*b*) Four bar mechanism.

Figure 1

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)