



MURANG'A UNIVERSITY COLLEGE
(Constituent college of Jomo Kenyatta University of Agriculture and Technology)

SCHOOL OF ENGINEERING AND TECHNOLOGY
MRUC DIPLOMA IN MECHANICAL ENGINEERING
YEAR 2-SEMESTER I
UNIVERSITY EXAMINATIONS-2015

ENGINEERING MECHANICS –SEM 1201

DATE: 22ND APRIL 2015

TIME: 2HRS

Attempt Question One and ANY other Two Questions

QUESTION ONE(30MARKS)

- (a) (i) State the two main branches of mechanics (2marks)
(ii) Show clearly the difference between the two main branches (2 marks)
- (b) (i) State the three basic quantities in SI units in engineering mechanics (3marks)
(ii) Copy and complete the table below

Derived Unit	(SI Unit)
Density	
Power	
Stress	
Volume	
Angular Acceleration	
Velocity	
Moment of Inertia	
Moment of Force	

(4marks)

- (c) (i) Define the resultant of a force system (2marks)

(ii) Determine the resultant of two forces: 20N and 15N inclined at 30^0 to each other using the parallelogram of forces method, given that the 20N force is horizontal .(5 marks)

(d) The following forces act at a point

20N inclined at 30° to the horizontal,

20N inclined at 90° to the horizontal,

35N at 135° to the horizontal,

45N inclined at 240° to the horizontal; **(All angles measured anticlockwise)**

Determine the value of the resultant force and the direction it makes with the horizontal
(7marks)

(e) (i) Define the term efficiency of a machine

(1 mark)

(ii) A car lift has a velocity ratio of 6 and is used to lift an engine of weight 9000N by applying an effort of 2000N. Determine the efficiency of the machine.

(4 marks)

QUESTION TWO (20 marks)

(a) State what is meant by moment of a force

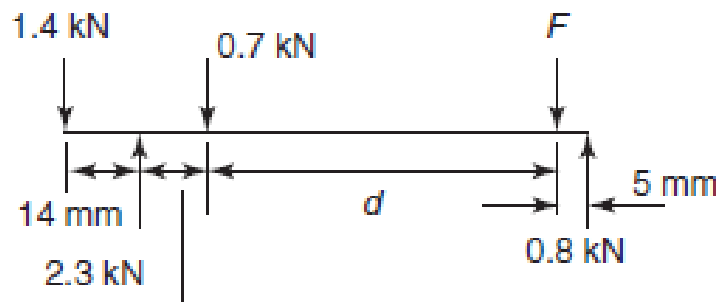
(1 marks)

(b)(i) State the principle of moments

(2 marks)

(ii) For the force system shown in figure below, find the values of F and d for the system to be in equilibrium.

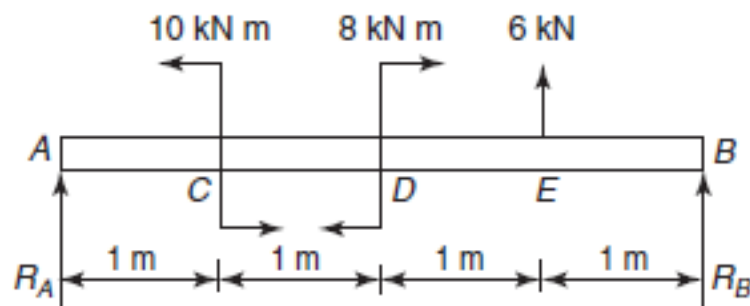
(8marks)



(c) Determine the torque developed by a force of 250N applied tangentially to a spanner at a distance of 350mm from centre of a nut (3 marks)

(d) Determine the reactions for the simply supported beam in the figure below

(6marks)



QUESTION THREE

(a) Define the following terms as applied to machines

- (i) Velocity ratio
- (ii) Mechanical advantage
- (iii) Efficiency

(6 Marks)

(b) A pulley system consists of two blocks. The upper block has two pulleys and the lower has three pulleys. An effort of 400N is required to raise a load of 1500N. Determine:

- (i) Mechanical advantage
- (ii) Velocity ratio
- (iii) Efficiency of the pulley system

(7 marks)

(c) A screw jack is being used to support the axle of a car, the load on it being 2.4kN. The screw jack has an effort of effective radius of 200mm and a double start square thread having a pitch of 5mm. Determine the efficiency of the jack if an effort of 60N is required to raise the car axle.

(7 marks)

QUESTION FOUR

(a) Find the speed of a shaft driven with the belt by an engine running at 600 **revolutions per min.** The thickness of the belt is 2cm and the diameter of the engine pulley is 100cm and that of the shaft is 60cm

(4marks)

(b) A belt drives a pulley of 200mm diameter such that the ratio of tensions in the tight and slack sides is 1.2. If the maximum tension is not to exceed 240kN, find the safe power transmitted by the pulley at a speed of 60 **revolutions per min (8marks)**

(c) A belt is running over a pulley of 1.5m diameter at 250 **revolutions per min.** The angle of contact is 120° and the coefficient of friction is 0.3. If the maximum tension in the belt is 400N, find the power transmitted by the belt

(8 marks)