MURANG'A UNIVERSITY COLLEGE

(Constituent college of Jomo Kenyatta University of Agriculture and Technology)

SCHOOL OF ENGINEERING AND TECHNOLOGY

DIPLOMA IN PRODUCTION ENGINEERING

YEAR 2-SEMESTER I

SUPPLEMENTARY EXAMINATIONS OCTOBER 2015

ENGINEERING MECHANICS

0TIME: 2HRS

Attempt Question ONE(**Compulsory)** and any other **TWO** Questions

QUESTION ONE

(a) (i) State the two main branches of mechanics and show clearly the differences between the two main branches **(4 marks)**

(b) (i) State the three basic quantities in SI systems in engineering mechanics **(3marks)**

(ii) Copy and complete the table below

Derived Unit	Notation**(SI Unit)**
Area	
Force	
Density	
Power	
Stress	
Volume	
Linear Acceleration	
Velocity	
Energy	
Moment of Force	
Torque	
Moment of Inertia	

(6 marks)

(c) (i) State what is meant by 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. The 20N force being horizontal. **(6 marks)**

(d)The following forces act at a point, all angles measured from the horizontal**.**

25N inclined at 30^0 to the horizontal..20N inclined at an angle of 90^0 to the horizontal.30N making an angle of -120^0 to the horizontal and 35N making an angle of -240^0 with the horizontal. Determine the value of the resultant force and the direction it makes with the horizontal.

(9marks)

QUESTION TWO (20 MARKS)

(a) A machine lifts a mass of weight 490.5N through a height of 12m when 7.85kJ of energy is supplied to it. Determine the efficiency of the machine **(4marks)**

(b) A lifting machine has a velocity ratio of 4 and can lift a load of 1000N when the effort applied is 327N.Determine the effort required to overcome friction **(4 marks)**

(c)A pulley system consists of two blocks, the upper block has three pulleys and lower block has two pulleys. An effort of 800N is required to raise a load of 2500N. Determine:

(i) Mechanical advantage
(ii) Velocity ratio
(iii) Efficiency of the pulley system **(6 marks)**

(d) 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 single start square thread having a lead of 5mm. Determine the efficiency of the jack if an effort of 60N is required to raise the car axle**.** **(6 marks)**

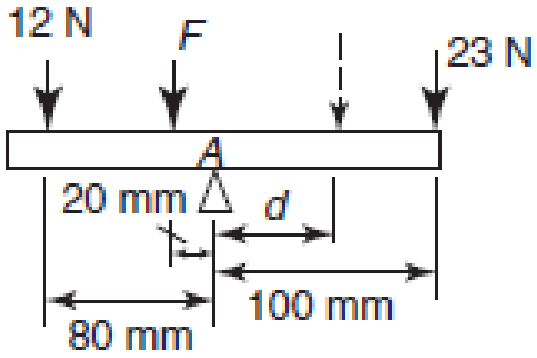
QUESTION THREE

(a) (i) State two conditions for equilibrium for system acted upon by a number of forces **(2 marks)**

(ii) The torque required to tighten a nut is 175Nm.The force to be applied in opening the nut is 230N.Calculate the length of spanner required. (**3 marks)**

(b) A beam is supported on its fulcrum at the point *A*, which is at mid-span, and forces act as shown in Figure below

.Calculate
(i) force *F* for the beam to be in equilibrium,
(ii) the new position of the 23 N force when *F* is decreased to 21 N, if equilibrium is to be maintained.**(6 marks)**



© A uniform beam 4m long is simply supported at two points A and B, point A being 0.5m from the left end and point B, 1.5m from the right hand end .The beam carries loads of 600N at the left hand end,1000N at its centre and 850N at the right hand end. Determine the magnitude of the support reactions A and B **(9 marks)**

QUESTION FOUR

(a) Find the speed of a shaft driven with the belt by an engine running at 600revs/min. The thickness of the belt is 2cm and the diameter of the engine pulley is 150cm and that of the shaft is 90cm **(4marks)**

(b) Find the power transmitted by a belt running over pulley of 600mm 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. The speed of the pulley is 200revs/min.
(7marks)

(c) A belt is running over a pulley of 1.5m diameter at a speed of 250revs/min. The angle of contact is 120^0 and the coefficient of friction is 0.3. If the maximum tension in the belt is 400N ,find the power transmitted by the belt **(9 marks)**