



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR DIPLOMA IN
MECHANICAL ENGINEERING
STRENGTH OF MATERIALS I

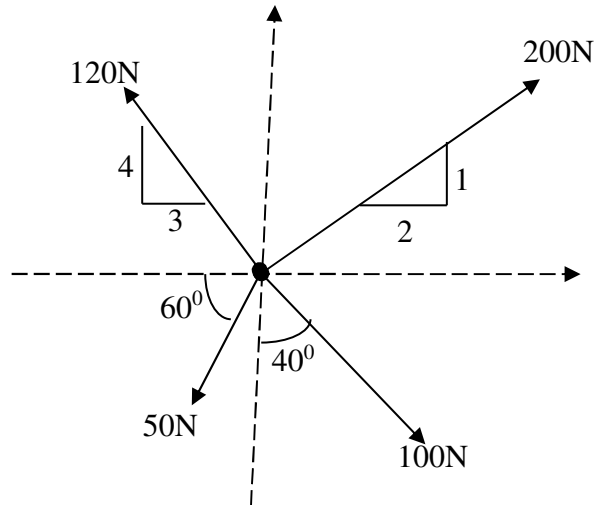
DATE: 5/6/2017

TIME: 8:30 – 10:30 AM

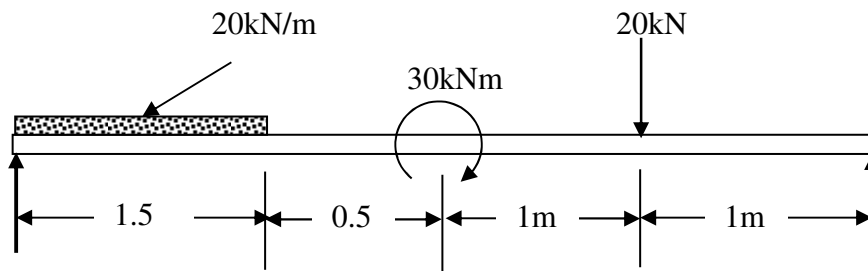
INSTRUCTIONS

Answer Question One and Any Other Two Questions

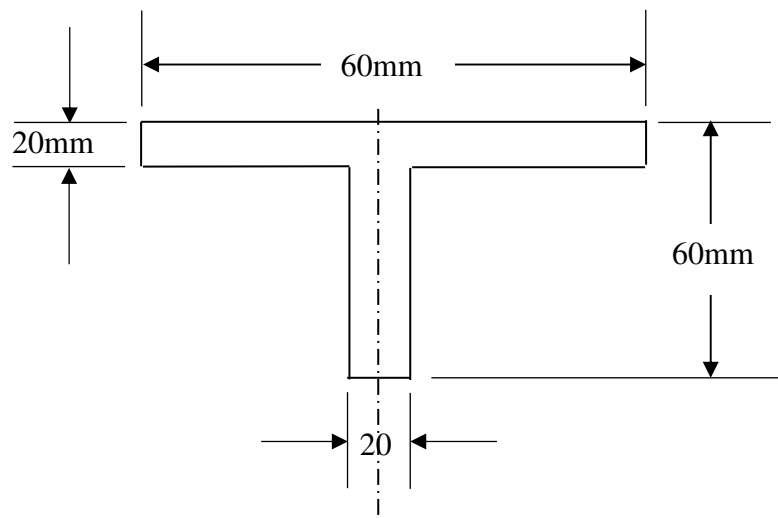
1. a) Define the following terms
 - i. Moment
 - ii. Couple
 - iii. Torque
 - iv. Parallelogram law of forces
 - v. Resultant force
 - vi. System of forces (9 marks)
- b) The resultant of two forces, one of which is double the other is 260N. If the direction of the larger force is reversed and the other remains unaltered, the resultant reduces to 180N. Determine the magnitude of the forces and the angle between the forces. (11marks)
- c) A system of four forces acting at a point on a body is as shown below. Determine the resultant force. (10 marks)



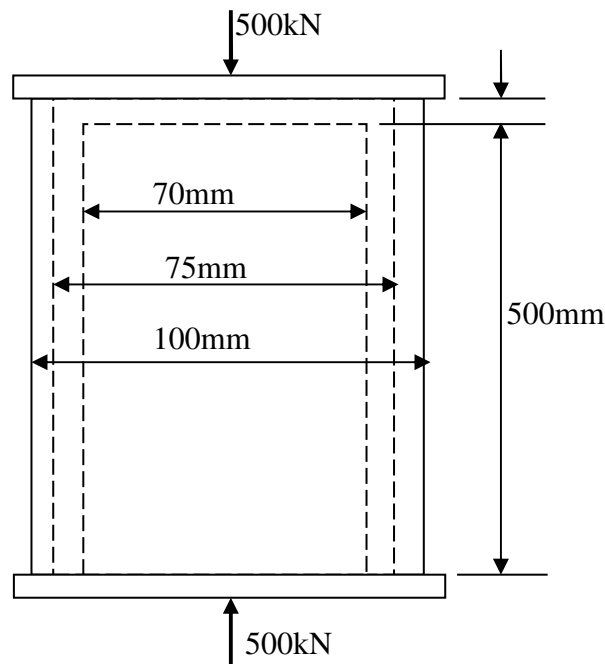
2. The figure below shows a beam AB of length 4m acted upon by the forces and moments. Draw the bending moment and shear force diagrams. (20 marks)



3. a) State and prove the theorems of parallel axis (10 marks)
 b) Calculate the moment of inertia about horizontal and vertical gravity axes (I_{XX} and I_{YY}) of the section below. (10 marks)



4. a) State sign conventions for stress, strain and temperature (3 marks)
- b) A solid steel cylinder 500mm long and 70mm diameter is placed inside an aluminium cylinder having 75mm inside diameter and 100mm outside diameter. The aluminium cylinder is 0.16mm longer than the steel cylinder. An axial load of 500kN is applied to the bar and cylinder through rigid cover plates as shown. Find the stresses developed in the steel cylinder and aluminium tube. Assume for steel, $E = 220\text{GN/m}^2$ and aluminium, $E = 70\text{GN/m}^2$ (17 marks)



5. The figure below shows a loaded beam.
- a) Sketch the BM and SF diagrams giving the important numerical values.
- b) Calculate the maximum bending moment and the point at which it occurs. (20 marks)

