



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMM 208: ENGINEERING MECHANICS II

DATE: 26/7/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

1.
 - a) Describe Newtons laws of motion (6 marks)
 - b) Define the following terms as used in engineering mechanics;
 - i. kinematics
 - ii. kinetics
 - iii. space
 - iv. particle (8marks)
 - c) A sphere of mass 200g moving at a speed of 4.3m/s collides with another of mass 120g moving at 1.5m/s in the opposite direction. If the co-efficient of restitution is 0.6, determine the velocity and direction of each sphere immediately after the collision. (8 marks)
 - d) In a car racing competition, car **A** starts from rest and accelerates at 0.6ms^{-2} . 4 seconds later, car **B** starting from rest at the same point, accelerates at 0.9ms^{-2} and follows the same path as car **A**.
Determine:
 - i) the time taken for car **B** to overtake **A**
 - ii) the distance travelled when car **B** overtakes **A** (8 marks)

2. a) Distinguish between the following:
- i) centripetal and centrifugal forces
 - ii) Inertial force and inertial couple (4 marks)
- b) A small pendulum bob of mass 250g is suspended by a string of length 0.5m. The bob rotates in a horizontal circle of radius 0.4m and whose centre is vertically below the point of suspension. Determine:
- i. the tension in the string
 - ii. the speed of rotation of the bob in m/s
 - iii. the time taken to complete one cycle of rotation (10 marks)
- c) A step up pulley comprises a larger and smaller wheel of diameters 2.3m and 1.4m respectively. Two blocks A and B are attached to the pulley by two cables wound on the bigger and smaller wheel respectively such that they move in opposite directions. If the pulley starts from rest and accelerates clockwise at 3 rad/sec^2 , Determine:
- i. the time required for block A to move up 25m
 - ii. the velocity of blocks A and B at that time. (6 marks)
3. a) i) Define the term **Friction**.
- ii) State **three** laws of dry friction
 - iii) Describe **three** applications of friction
 - iv) Explain three methods of reducing friction (11 marks)
- b) A **pull** of 180 N applied upwards at an angle of 30° to a rough inclined plane was required to just move a wooden block resting on the plane while a **push** of 220 N applied along the same line of action was required to just move the same block backwards.
- Determine:
- i. the weight of the block
 - ii. the coefficient of friction. (9 marks)
4. a) Describe the two theorems of moment of inertia (6 marks)
- b) Determine the area moment of inertia of the symmetrical I-section shown in **Fig.4c** about the centroidal axis parallel to the base.

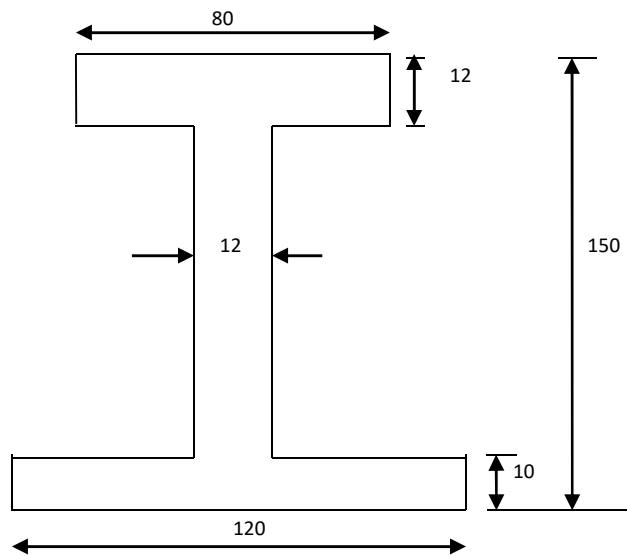


Fig.4c: All dimensions are in mm

(8 marks)

- c) A vehicle of mass 500kg starting at a speed of 50km/h moves down an incline of 1 in 15 and comes to a halt over a distance of 30m. If the frictional resistance to this motion was 150N. Determine the required braking force. (8 marks)
5. a) Define the following terms as used in angular motion
- angular displacement
 - angular velocity
 - angular acceleration (6 marks)
- b) An engine shaft is uniformly accelerated from 10 rpm to 18 rpm in 4 sec. The shaft continues to accelerate at this rate for the next 8 sec. Thereafter, the shaft rotates with uniform speed. Find the total time taken to complete 400 revolutions. (6 marks)