NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

Bachelor of Engineering Honours Degree in Civil and Water Engineering

PART I SECOND SEMESTER EXAMINATIONS MAY 2011

ENGINEERING MECHANICS– TCW 1201

INSTRUCTIONS

Answer Any Five Questions

Total Marks 100

Time 3 hours

Question One

Rectilinear motion is motion along a straight line. Determine the position, velocity and the acceleration given;

(a) The position as a function of time. **[2 marks]**

(b) Velocity as a function of time. **[2 marks]**

(c) Acceleration as a function of time. **[2 marks]**

(d) Acceleration as a function of position. **[4 marks]**

(e) Acceleration as a function of velocity. **[4 marks]**

(f) Acceleration as a constant. **[6 marks]**

Question two

(a)Describe the development of thermodynamics as a field of study. **[6 marks]**

(b) With the aid of diagrams write short notes on:

(i) Relative motion along a line. **[4 marks]**

(ii) Plane curvilinear motion. **[4 marks]**

(iii) Space curvilinear motion. **[6 marks]**

Question three

A 10kg projectile is fired horizontally with an initial velocity of 200m/s form the hilltop 100m above the ground. Determine the range **R** of the projectile (horizontal distance travelled) and the elapsed time before it strikes the ground. Neglect air resistance.

[20 marks]

Question four

For the diagram shown in figure Q4 the 5kg block slides along a horizontal floor and strikes bumper B. The coefficient of friction between the block and the floor is $u_k = 0.45$, and the mass of the bumper is 2kg. If the speed of the block is 10m/s when it is 20 m from the bumper, determine:

(a) the speed v of the block at the instant it strikes the bumper **[10 marks]**

(b) The maximum deflection of the spring due to the motion of the block. **[10 marks]**

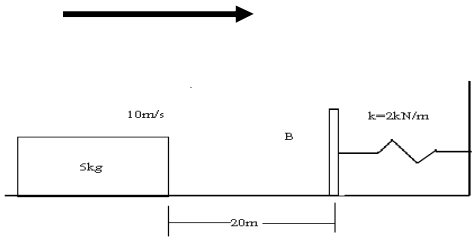


Figure Q4

Question five

The bars shown in figure Q5 are sliding freely on a horizontal rod.. For the conditions specified in table Q5, determine:

(a) The final velocity of both beads. **[8marks]**

(b) The percentage of the initial kinetic energy lost as a result of the collision of the two bars. **[6 marks]**

(c) The average interaction force between the beads if the duration of impact is 0.001s. **[6 marks]**

Table Q5

mA	vA	mB	vB	e
10kg	5m/s	5kg	2m/s	0.4

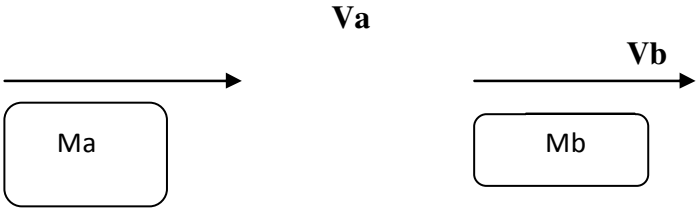


Figure Q5

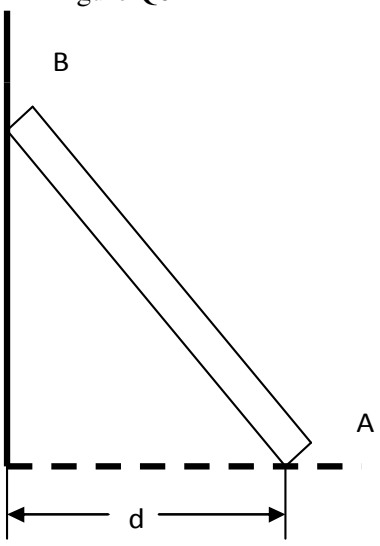
Question six

(a) Mention the applications of friction where there is need to minimize it and some where these effects are essential. **[6 marks]**

(b) Distinguish between the coefficient of static friction and the coefficient of kinetic friction. **[4 marks]**

Determine the maximum distance d it can be placed from the smooth wall and not slip. The coefficient of static friction between the floor and the pole is u_s = o.32

Figure Q6



End of examination !!!