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 II : KINEMATIC AND DYNAMIC – TCW 1201

INSTRUCTIONS
Answer Any Five Questions   Total Marks   100
                                                                   Time   3 hours
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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]**
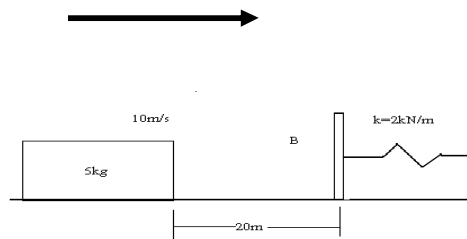
Figure Q4

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

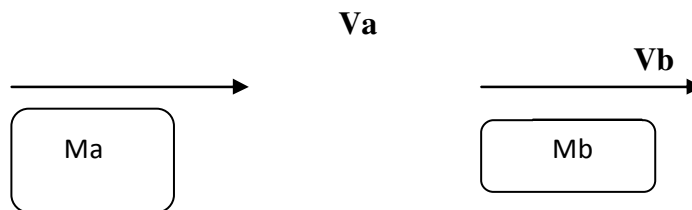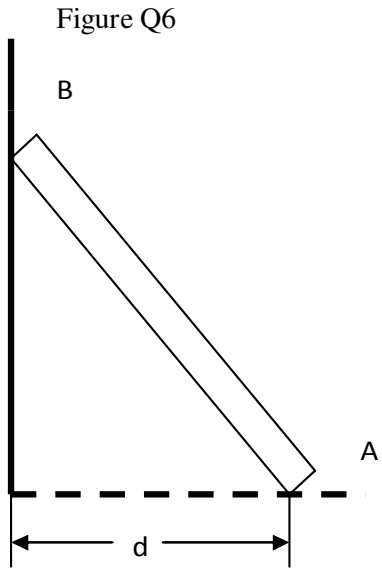| mA	vA	mB	vB	e
10kg	5m/s	5kg	2m/s	0.4

Va

Vb

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 $u_s = 0.32$

Figure Q6

B

A

d

End of examination !!!