



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING

BCE CD 112: APPLIED MATHEMATICS

DATE: 4/8/2016

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Answer QUESTION ONE and Any other TWO Questions

Question One

- a) Define the following terms
- i) Kinetic Energy
 - ii) Moment of force
 - iii) Resultant force
 - iv) Collision (4 marks)
- b) State the SI units of the following physical quantities
- i) Momentum
 - ii) Frequency
 - iii) Density
 - iv) Power (4 marks)
- c) Differentiate between elastic collision and inelastic collision (3 marks)
- d) Show that force is the rate of change of momentum if a body of mass (m) is acted upon by an average force (f) for time (t) (5 marks)

- e) State the three laws of motion. (6 marks)
- f) A shunting locomotive provides an impulse of 80kNs to set in motion a stationary 16tons wagon which then moves freely at a velocity of (u) against a track resistance of 120N/t and finally reaches a velocity of (v) after 40sec. Find the value of (u) and (v). (6 marks)
- g) Name the forces acting on the following bodies
- i) Mass suspended on a spring balance
 - ii) A moving car negotiating a corner (2 marks)

QUESTION TWO

- a) i) State two conditions of a simple harmonic motion as a periodic motion. (2 marks)
- ii) State the following terms as used in the simple harmonics motion
- Amplitude
 - Period
 - Frequency of oscillation (6 marks)
- b) A body with simple harmonic motion has a velocity of 3m/s when 375mm from the mid-position and an acceleration of 1m/s^2 when 250mm from the mid-position. Calculate the periodic time. (5 marks)
- c) A body performs simple harmonic motion in a straight line. Its velocity is 4m/s when the displacement is 150mm and 3m/s when the displacement is 100mm. The displacement being measured from the mid-position. Calculate the frequency and the amplitude of the motion. What is the acceleration when the displacement is 75mm? (7 marks)

QUESTION THREE

- a) Define the following terms
- i) Energy (1mark)
 - ii) Law of conservation of energy (2 marks)
- b) A man of mass 60kg dives vertically downwards into a swimming pool from a tower of the height of 20m. He was found to go down in the water by 2m and then started rising. Find the average resistance of the water. (7 marks)
- c) A truck of mass 20tonnes travelling at 1.6m/s impacts with a buffer spring which comprises 1.25mm per KN. Find the maximum compression of the spring. (7 marks)

QUESTION FOUR

- a) Define the term co-efficient of friction (4 marks)
- b) State the formulae for the coefficient of friction (2 marks)
- c) A body oscillates along a straight line with simple harmonic motion. The frequency is 0.8m/s and the amplitude is 60N/M. Find the displacement of the body 0.6s after leaving the position of maximum displacement. (8 marks)
- d) A composite spring has two close coiled springs A and B in series A has a stiffness $s_1=200\text{N/M}$ and B has a stiffness $s_2=800\text{N/M}$ the composite spring carries a mass weight 50N and oscillated freely in the vertical direction. Find the frequency. (6 marks)