MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2014/2015

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

Examination for Diploma in Building Technology Module II
Diploma in Civil Engineering Module II

2705/201, 2707/201: MATHEMATICS II AND SURVEYING II

Date: 17/03/2015 **Time: 08:30 – 11:30 am**

Instructions:

- *You should have the following for this examination*
  - *Answer booklet*
  - *Scientific Calculator*
- *This paper comprises of* ***Eight*** *questions in* ***Two*** *sections* ***A*** *and* ***B***
- *Answer* ***Five*** *questions taking* ***at least Two*** *questions from each section. All questions carry equal marks*

SECTION A: MATHEMATICS II

Answer at least ***TWO*** *questions from this section*

1 (a) Simplify

(i) $\frac{(2-3j)(3+2j)}{4-3j}$ (3 marks)

(ii) $\frac{2+3j}{j(4-5j)} + \frac{2}{j}$ (4 marks)

(b) Find the two possible values of z that satisfied the equation

$3zz^* + 2(z - z^*)\ 39 + 12j$

` Where z^* is the complex conjugate of z. Where z = a + bj (5 marks)

(c) Using complex numbers, express $\sin^5\theta$ and 5θ in terms of $\sin n\theta$ (8 marks)

2 (a) (i) Determine the fifth roots of 2-5j giving the results in modulus form.

(8 marks)

(ii) Express the principal root in the form a + bj (2 marks)

(b) Express $\sin^6 x$ as a series of terms which are cosines of angles multiples of x.

(5 marks)

(c) If z = x + yj where x and y are real, show that the locus

$\left|\frac{z-2}{z+2}\right| = 2$ is a circle and determine the centre and its radius. (5 marks)

3 (a) Differentiate

(i) $y = \sin^2(3x^2 + 4)$ (5 marks)

(ii) $y = 3\frac{(4-x^2)}{\tan x}$ (5 marks)

(iii) $y = \frac{e^{-x}\,Sin\,3x}{x3}$ (5 marks)

(b) Given that $x^2 Sin\theta - 3x^2 = \sec\theta$, determine the value of $\frac{dx}{d\theta}$ when $\theta = \pi$.

4 (a) Given that $x = \cos 2\theta$, $y = 1 + \sin 2\theta$ find:-

(i) $\frac{dy}{dx}$

(ii) $\frac{d^2y}{dx^2}$ (8 marks)

(b) Solve the complex equation

$$\frac{12 \angle\frac{\pi}{2} \times \angle\frac{3\pi}{4}}{2 \angle\frac{\pi}{3}} = x + yj$$ (4 marks)

(c) Express the following in

(i) Polar form

2 + 3j -3-4j (4 marks)

(ii) Cartesian form

5 L 23.2°

3.41 L 45.9° (4 marks)

SECTION B: SURVEYING II

*Answer at least **TWO** questions from this section*

5 a) Using a neat and elaborate sketch outline the functions of six theodolite parts (12marks)

b) Determine the length of the long chord for a 300m radius curve connecting two straights deviating at 47°50′ (8 marks)

6 a) Derive an expression for calculating the length of the long chord in terms of the radius and the angle of deviation of the curve (6 marks)

b) In setting out a circular curve it is noted that the mid-point of the curve is 60 m from the intersection point at chainage 7360.45 m. if the deflection angle of the two straights is 48°, calculate;

i. The radius of the curve
ii. The chainage at the point of curve and point of tangency
iii. The first two deflection angles for setting out using 30 m chords on a through chainage basis

(14 marks)

7 a) Explain the significance of 'through chainage' concept in curve ranging (4 marks)

b) A 250m radius curve is to be set out to connect two straights deflecting at 39°30′40″. The chainage at the intersection is 497.50m and the pegs are to be placed at 25m intervals on through chainage basis. Compute and tabulate the setting out data using offsets from chords produced. (16 marks)

8 a) Explain the Collimation in Azimuth test under the following sub-headings;

i. Aim
ii. Test
iii. Adjustment (7 marks)

b) i) List three axes on which a theodolite is constructed (3 marks)

ii) Describe a procedure of testing for the correct axial relationship between any two of the axes listed in b (i) above (10 marks)