



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)

University Examinations 2013/2014

DEPARTMENT IN BUILDING AND CIVIL ENGINEERING

End of Term Examination for Mathematics and surveying II

MATHEMATICS

Date: 20/3/2014

Time: 8:30 – 11:30 am

Instructions:

1. This paper consist of 8 questions in 2 sections A and B
2. Answer any five questions choosing two questions in Section A, two questions from Section B and any other one question from either section
3. All questions carry equal marks.
4. You require the following for this examination
 - Answer booklet
 - Scientific Calculator

SECTION A:

Answer at least two questions from this section

1. (a) Differentiate the following function with respect to x, $y = 5x^3 - 3\sin 2x + 4$ (3 marks)
(b) If $y = (3 + 5)^4$, determine $\frac{dy}{dx}$ (5 marks)
(c) (i) Given that $y = 2e^{4x} \cos 5x$, prove that $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 41y = 0$
(ii) Show that the derivative of $y = \sin\theta \cos\theta$ is $\cos 2\theta$ (5 marks)
2. (a) Investigate the stationary of the function $x^4 - 4x^3$ and distinguish between them.
(b) The area of a circle is increasing at the rate of $3\text{cm}^2/\text{sec}$. Find the rate of change of the circumference when the radius is 2cm. (10 marks)
3. (a) Evaluate $\tanh 1.27 = \frac{e^{1.27} - e^{-1.27}}{e^{1.27} + e^{-1.27}}$ (4 marks)
(b) Determine the value of x such that
(i) $\sinh x = 1.475$ (6 marks)

(ii) $\cosh x = 2.364$ (7 marks)

(c) Evaluate: $\int 4x^3 + \cos 2x - 7 dx$ (3 marks)

4. (a) Differentiate the following w.r.t. x and simplify

$$y = \frac{\sin^2 x \cos 2x}{e^{2x}} \quad (5 \text{ marks})$$

(b) (i) Evaluate: $\int \sec^2(3x + 1) dx$ (4 marks)

(ii) $\int_0^3 \frac{4x-8}{x^2-4x+5} dx$ (4 marks)

(c) (i) Find the gradient of the curve $y = 3x^2 + 5x - 1$ at the point $x=5$

(ii) Find the area enclosed by the curve $y = 3x^2 + 4$, the x-axis and the lines $x=1$ and $x=3$. (7 marks)

SECTION B: SURVEYING II

Answer at least TWO questions from this section.

5. (a) Using an elaborate sketch, describe the elements of a simple circular curve. (6 marks)

(b) Explain the procedure of setting out a simple circular horizontal curve using the method of offsets from chords produced. Use any relevant sketches. (6 marks)

(c) Tabulate data required for setting out a circular curve by deflection Angle method given the following:-

(i) Angle of intersection = 145°

(ii) Change of PI = 1180.00m

(iii) Degree of curve = 5°

(iv) Least count of theodolite = 20"

(v) Peg interval = 30m

6. (a) With an aid of neat sketches, describe 4 types of horizontal curves.

(b) (i) define the following terms as used in curves.

- Radius of curve

- Degree of curve

(2 marks)

(ii) Derive the expression for the relation between radius of curve and degree of curve.

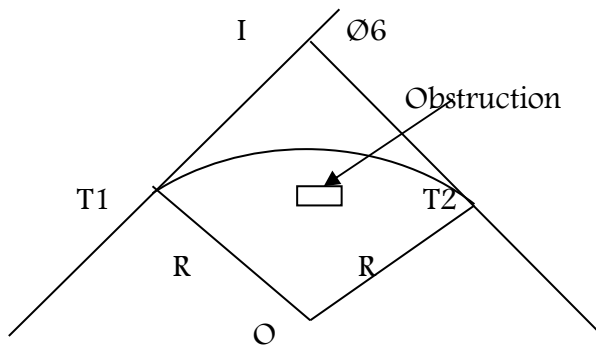
(4 marks)

(c) Two straight lines OP and PQ are to be connected by a 3° curve, interest at drainage 2160.00m. The WCB's of SP and PQ are $145^\circ 30'$ and $175^\circ 30'$ respectively. Calculate all necessary data for setting out the curve by the method of offsets from the long chord. Use chord lengths at 20m interval. (8 marks)

7. (a) State six problems encountered in field work when setting out circular curves. (6 marks)

- (b) Two tangents intersect at drainage 1190m, the deflection angle being 36° . Calculate all the necessary data to set out a curve of radius 300m by the method of deflection angles. Take peg intervals at 30m. (7 marks)
- (c) Two straight along the centerline of a 10m wide road is designed to deflect at an angle of 60° and is to be joined by 375m radius smooth curve. Calculate the necessary data for curve setting using the method of setting out by offsets from chords produced. The chainage at point of tangent intersection is 1250.50m. (7 marks)

8. (a) It is intended to set out the curve shown in figure 1 using one theodolite and a tape only, with the aid of a sketch, explain the procedure to be adopted to overcome the obstruction shown.



(10 marks)

- (b) Two straight PI and QI meet at I which is inaccessible. A point X was selected on the straight PI and a point Y on the straight QI with the distance XY being 60m. Angles PXY and QYX were measured as $155^\circ 30'$ and $158^\circ 44'$ respectively. If the radius of the curve joining the two straights is 425.0m;
 - (i) Sketch the layout
 - (ii) Determine the distance along the straight from X and Y to the tangent points. (10 marks)