



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

CEPE 2

EEA 1102

ENGINEERING MATHS II

SEMESTER EXAMINATION

SERIES: FEBRUARY 2011 SERIES

TIME: 2 HOURS

Instructions to Candidates:

1. You are required to have the following for this examination;
 - Answer booklet
 - A calculator
 - Mathematical table
 - Graph paper
 - Geometrical set
 - Ruler
2. Answer Question **ONE (COMPULSORY)** and any other **TWO** Questions. Maximum marks are shown against respective Questions.

(COMPULSORY)

Question ONE

i) Convert:

- a) 119° to radians
- b) $73.33'$ to radians
- c) 2681 radians to degrees
- d) $\frac{3\pi}{7}$ radians to degrees. (4 marks)

- ii) a) Find the length of arc of a circle of radius 4.23cm when the angle subtended at the centre is 1.46 radians.
- b) Show that the triangle with sides 9m, 40m, and 41m is a right angled triangle.
- c) Given $\sec \theta = 1.4723$, where θ is an acute angle, determine $\operatorname{cosec} \theta$ and $\cos \theta$.

d) Prove the following trigonometric identities:

- I) $\sin \theta \cos \theta = \frac{\sin^2 \theta}{\tan \theta}$
- II) $\sin \theta \sec \theta = \tan \theta$ (12marks)

iii) a) The velocity of a body was measured at various times and the results obtained were:

Velocity(ms^{-1})	V	7.7	10.5	13.3	15.5	16.3	20.5	23
Time (S)	t	1	2	3	4	5	6	7

If the law connecting velocity and time is of the form $V = \mu t + at$ where μ and a are constants; Graphically verify the law and determine approximate values for μ and a .

- b) The volume of a sphere radius 'r' is to be twice that of a cone having the same base radius. Find an equation relating the cone height 'h' to the base radius 'r'. (8 marks)

iv) a) Express the following in partial fractions

- I) $\frac{8x-28}{x^2-6x+8}$
- II) $\frac{x^2+3x-10}{x^2-2x-3}$

b) The masses of 50 castings gave the following frequency distribution:

Mass x (kg)	10 – 12	13 – 15	16 – 18	19 – 21	22 – 24	25 – 27	28 – 30
Frequency (f)	3	7	16	10	8	5	1

Using central values as the midpoints of the bases of the rectangles, draw the histogram to represent the data. (6 marks)

(ANSWER ANY OTHER TWO QUESTIONS)

Question TWO

- a) Given the equation $x^2 + y^3 = y$
- Transpose the equation to make T the subject of the transposed equation.
 - Construct ordered pairs (co-ordinates) of numbers corresponding to the integer values of x where $-5 \leq x \leq 5$.
 - Plot the ordered pairs of numbers on a cartesian graph and join the points plotted with a continuous curve.
 - Plot the graph of $y = 4x^3 - 4x^2 - 15x + 8$ for values of x between $x = -3$ and $x = 3$. Hence determine the roots of the equation $4x^3 - 4x^2 - 15x + 18 = 0$. (10marks)
- b) Verify each of the following identities:
- $1 - \frac{\sin \theta \tan \theta}{\sec \theta} = \cos \theta$
 - $\sin \theta + \sin \phi = 2 \sin \frac{\theta + \phi}{2} \cos \frac{\theta - \phi}{2}$
 - I) Convert the angle 52.505^0 to degrees, minutes and seconds.
II) Show that $\tan 15 = \frac{\sqrt{3}-1}{\sqrt{3}+1}$ (10marks)

Question THREE

- a) Express the following in partial fractions. (10marks)
- $\frac{x+7}{x^2 - 7x + 10}$
 - $\frac{2x^2 + 6x - 35}{x^2 - x - 12}$
 - $\frac{7x^2 - 18x - 7}{(x-4)(2x^2 - 6x + 3)}$
 - $\frac{35x - 14}{(7x - 2)^2}$

b) Expressing the trigonometric ratios in their fraction form e.g. $\sin 60^\circ = \frac{\sqrt{3}}{2} = \cos 30^\circ$ etc and indicating quadrant of which they lie, show that the relationships:

i) $\cos^2 \theta + \sin^2 \theta = 1$

ii) $1 + \tan^2 \theta = \sec^2 \theta$

iii) $\cot^2 \theta + 1 = \operatorname{cosec}^2 \theta$

are valid in the following values of θ (1) 120° (2) 210° (3) 315°

Note: Working must show the use of the trigonometric identities as asked. (10marks)

Question FOUR

- a) i) Define Simpson's rule as a method used to find area of an irregular plane surface.
 ii) An indicator diagram of a steam engine is 9.00cm long. Seven evenly spaced ordinates including the end ordinates are measured with the following results: 5.10, 4.60, 3.20, 2.70, 2.32, 2.18, 2.06cm. Find the area of the diagram and the mean pressure in the cylinder, if the pressure scale is 100KNM^2 to 1cm and given that:

$$\text{mean pressure} = \frac{\text{area of diagram}}{\text{base}} \quad (10\text{marks})$$

b) Using diagrams, find:

- i) The volume of a sphere of radius 'r'
 ii) The volume of a cone of radius 'r' and height 'h' by using the prismoidal rule.

(10marks)

Question FIVE

a) Solve triangle JKL, given $\angle J = 123^\circ 17'$, JK = 72mm and JL = 43mm.

A quadrilateral plot of ground ABDC has the dimensions AB = 60m, BD = 130m DC = 145m and CA = 124m. The angle BAC = 64° . Determine BC and the angle BDC.

(10marks)

b) Find the volume and the total surface area of a frustum of a cone if the diameters of the ends are 5.0cm and 3.0cm and the perpendicular height is 3.20cm.