

TECHNICAL UNIVERSITY OF MOMBASA

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*Faculty of applied and health sciences*



*Department of mathematics and physic*

**UNIVERSITY EXAMINATION FOR:**

**DIPLOMA IN MARINE ENGINEERING**

**EMR 2117: ENGINEERING MATHEMATICS II**

**Special/supplementary EXAMINATION**

**SERIES:** MAY 2016

**TIME:** 2 HOURS

**DATE:** MAY 2016

**Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions

Answer question **ONE**(**COMPULSORY**) and any other **TWO** questions

**Do not write on the question paper.**

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### **QUESTION ONE:**

a) find the value of  $x$  given that the following matrix is singular;

$$\begin{pmatrix} x+7 & 4 \\ -3 & x \end{pmatrix} \quad (3 \text{ mks})$$

ii) use matrix method to solve the following pair of simultaneous equations;

$$x+y=5$$

$$3x-2y=0 \quad (4 \text{ mks})$$

b) The angle of depression of a boat from the top of a vertical cliff 50m high is  $10^\circ$ . find the distance of the boat from the foot of the cliff. (3mks)

c) In triangle ABC,  $AB=AC=6\text{cm}$  and  $\angle BAC=50^\circ$ . calculate BC. (3mks)

d) i) The radius of a circle centre O is 6cm. A chord AB subtends an angle  $108^\circ$  at the centre. find the length of AB. (4mks)

ii) If  $\tan x = \cos x$ , show that  $\sin x = \frac{1 \pm \sqrt{5}}{2}$  (5mks)

e) A ship leaves Mombasa ( $4^\circ\text{S}, 39^\circ\text{E}$ ) and sails due east to a point K ( $4^\circ\text{S}, 80^\circ\text{E}$ ) in the Indian ocean. calculate its speed in;

i) km/h

ii) knots (8mks)

### **Question TWO**

a) Define trigonometric ratios (2mks)

b) i) Determine the distance in km and in nautical miles between two points P ( $30^\circ\text{N}, 45^\circ\text{E}$ ) and Q ( $30^\circ\text{N}, 60^\circ\text{W}$ ) (5mks)

ii) if the local time of London ( $52^\circ\text{N}, 0^\circ$ ) is 12.00 noon, determine the local time of Nairobi ( $1^\circ\text{S}, 37^\circ\text{E}$ ) (3mks)

c) i) derive the cosine rule. (6mks)

ii) the perimeter of a triangular field is 120m. Two of the sides are 21m and 40m. Calculate the largest angle of the field. (4mks)

### Question THREE

a) Prove the following identities

i)  $\frac{\sin 2A}{1-\cos 2A} = \cot A$  (3mks)

ii)  $\frac{\cos 2A - \cos 4A}{\sin 4A} = \operatorname{cosec}^2 A - 1$  (3mks)

b) i) Given that  $\cos 2x = 49/81$ , determine the  $\sin x$  without using tables (3mks)

ii) without using tables determine  $\tan A$  given that  $\tan(A-45) = 1/3$  (3mks)

c) i) if  $\tan A = 2 \tan B = 7$ , without using tables determine  $\tan(2A-B)$  (4mks)

ii) Given  $\cot(A-B) = 8, \cot A = 1/4$ , determine without using tables  $\cot B$  (4mks)

### Question FOUR

a) The distance PQ across a river is to be determined. A point R is 200m from P and the angles QPR and PRQ are  $81^\circ$  and  $75^\circ$  respectively. Calculate the distance PQ. (4mks)

b) A ship starts from a point A on a bearing of  $053^\circ$  and travels up to Point C, if the bearing of A from C is  $290^\circ$ , find how far C is from A and the distance from B to C (5mks)

c) In triangle ABC,  $\angle A = 41^\circ, \angle B = 90^\circ$  and  $AC = 25\text{cm}$ , calculate the length AB and BC (3mks)

d) i) The position vector  $p$  of a point P is  $\begin{pmatrix} 3 \\ 6 \end{pmatrix}$  and the position vector  $q$  of a point Q is  $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ . Find the

vector PQ and the position vector of the midpoint M of PQ (4mks)

ii) Relative to the origin O, the points A and B have position vectors  $a = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$  and  $b = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$  respectively. Given

that  $i$  and  $j$  are the unit vectors in the direction of x-axis and y-axis respectively, express  $a, b$  and  $2(a-3b)$  in terms of  $i$  and  $j$ . (4mks)

### Question FIVE

a) In triangle ABC,  $AB = 6\text{cm}, AC = 7\text{cm}$  and  $\angle BAC = 50^\circ$ . Determine the area of the triangle ABC. (3mks)

b) Draw an isosceles triangle ABC with the base angles of  $40^\circ$  and  $AB = AC = 8\text{cm}$ .

ii) locate the centroid C and the circumcentre O

ii) draw the circumcircle and measure the circumradius\_\_.

(6mks)

c) Given triangle ABC with  $BC = 6\text{cm}, AB = 8\text{cm}$  and  $\angle ABC = 90^\circ$  locate the orthocenter and measure AC. (4mks)

d) i) A chord 12cm long is on a circle of radius 10cm. Find the distance of the chord from the centre of the circle. (3mks)

ii) Two chords PQ and RS of the same circle are 11cm and 13 cm long respectively. If they meet at T in the circle and TR is 3cm, find PT (4mks)

