



TECHNICAL UNIVERSITY OF MOMBASA
FACULTY OF APPLIED AND HEALTH SCIENCES
DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

Diploma in Building and Civil Engineering (DBCE Y2 S1)/Diploma In Electrical and Electronics Engineering (DEEE)/Diploma in Electrical Power Engineering (DEPE)/Diploma in Telecommunications Engineering (DTE)/Diploma in Quantity Survey / Architecture (DQS/DARC)

AMA 2150 ENGINEERING MATHEMATICS I

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: September 2018

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass, scientific calculator, student ID and no mobile phones.

This paper consists of five questions. Attempt question one compulsory and any other two questions

Do not write on the question paper.

Question ONE

(a) Solve the equation $\frac{y+2}{4} + \frac{3}{y-1} - 5$ by completing the square (5mks)

(b) Solve the following

i. $2^x=5$ (2mks)

ii. $3^{x+1}=2^{2x-3}$ (3mks)

(c) Simplify

i. $E=(5x^2y^{-3/2}z^{1/4})^2 \times (4x^4y^2z)^{-1/2}$ (3mks)

(d) Use the binomial expansion to find an approximation for the value of $\sqrt{10}$ (3mks)

(e) i. express $(4, -3)$ in polar coordinates (4mks)

ii if $(2+j3)(3-j4)=x+jy$, find x and y (3mks)

(f) (i) A rod length $7\sqrt{2}$ cm is inclined to the horizontal at an angle of $\frac{\pi}{4}$ radians. A shadow is cast immediately below it from a lamp directly overhead. What is the length of the shadow? What is the new length of the shadow if the rods inclination is changed to $\frac{\pi}{3}$ to the vertical? (4mks)

(ii) Prove that $\frac{\sin^2\theta}{1+\cos\theta} = 1-\cos\theta$ (3mks)

Question TWO

(a) From a window 10.0m above horizontal ground, the angle of elevation of the top of a vertical tower is 42° and the angle of depression of the bottom of the tower is 13° . Calculate the distance from the window to the tower, the height of the tower and the elevation of the top of the tower from ground level at a point perpendicularly below the window (6mks)

(ii) Given that $\sin 2A = 2\sin A \cos A$, $\cos 2A = \cos^2 A - \sin^2 A$ and that $\cos^2 A + \sin^2 A = 1$,

Prove that $\cos 2A = \frac{1 - \tan^2 A}{1 + \tan^2 A}$ (5mks)

(b) (i) If $\sin A = 3/5$ and $\cos B = 15/17$ where A is obtuse and B is acute with aid of diagram, find the exact value of $\sin(A+B)$ (5mks)

(ii) Eliminate θ from the equation $x = a \sin \theta$, $y = b \tan \theta$ (4mks)

Question THREE

(a) (i) express $\log_{10} \frac{a^2 b^3}{100\sqrt{c}}$ in terms of $\log_{10} a$, $\log_{10} b$, $\log_{10} c$ and simplify (3mks)

(ii) Evaluate by changing to base 10 $\log_2 7$ (3mks)

(iii) Simplify without using the calculator $\frac{\log 125}{\log 25}$ (show the working) (2mks)

(b) (i) simplify $\frac{(1+x)^{1/2} - \frac{1}{2}x(1+x)^{-1/2}}{1+x}$ (3mks)

(ii) The roots of the equation $3x^2+4x-5=0$

are α, β : find the values of $1/\alpha + 1/\beta$ and $\alpha^2 + \beta^2$ (4mks)

(iii) Factorize $2x^3+3x^2-32x+15$ (5mks)

Question FOUR

(a) (i) Obtain the first four terms of the expansion of $(1+\frac{1}{2}x)^{10}$ in ascending powers of x.

Hence find the value of $(1.005)^{10}$ correct to four decimal places. (6mks)

(ii) A mixed work force team containing 5 men and 6 women is to be chosen from 7 men and 9 women. In how many ways can this be done? (4mks)

(b) (i) On a geometrical progression, the sum of the second and third terms is 6, and the sum of the third and fourth term is -12. Find the first term and the common ratio. (5mks)

(ii) Find the coefficient of x^{10} in expansion of $(2x-3)^{14}$ (5mks)

Question FIVE

(a) (i) given that by demovres theorem

$\text{Cos } n\theta + j \sin n\theta = (\cos\theta + j \sin\theta)^n$, prove that $\tan 3\theta = \frac{3\tan\theta - \tan^3\theta}{1 - 3\tan^2\theta}$ (6mks)

(ii) With aid of a diagram

Express the complex number $-4-j3$ in polar form and simplify (4mks)

(b) (i) express in polar form $\frac{10(\cos 126^\circ + j \sin 126^\circ)}{2(\cos 72^\circ + j \sin 72^\circ)}$ (4mks)

(ii) Rationalize

$\frac{2-j3}{1+j2}$ (3mks)

(iii) Simplify $3+j^2+5-j^2+10+j^3+15-4$

(3mks)