



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS
CERTIFICATE IN MECHANICAL ENGINEERING (CME – Y1 S 1)

AMA 1150: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions
 Answer question **ONE (COMPULSORY)** and any other **TWO** questions
 Maximum marks for each part of a question are as shown
 This paper consists of **FOUR** printed pages
Question One (Compulsory)

a) Evaluate the following:

$$\frac{\frac{2}{3} \div \frac{7}{3}}{\frac{2}{3} + \frac{5}{6}} \div \frac{1}{2}$$

(i)

$$\frac{\frac{1}{4} + \frac{1}{5} \div \frac{1}{2} \text{ of } \frac{1}{3}}{\frac{1}{2} \text{ of } \left(\frac{4}{5} - \frac{3}{4} + \frac{1}{2} \right)}$$

(ii)

(4 marks)

$$A = \frac{C}{\sqrt{(c-b)(c+b)}}$$

b) If _____, make b the subject of the formula and hence evaluate A² if C = 2b

(4 marks)

c) Express each of the following as a single fraction in its simplest form.

(i) 11. $\frac{5\dot{2}3}{\dot{2}3}$

$$\frac{\frac{14}{16} - r}{\frac{7}{8} - \left(\frac{r}{r+2} \right)}$$

(ii)

$$\frac{x-2}{x+2} - \frac{x+2}{x-2}$$

(iii)

(7 marks)

$$\frac{a+3c}{b+3d} = \frac{7a-5c}{7b-5d}$$

d) If a, b, c and b are in continued proportion, prove that

(5 marks)

Question Two

a) (i) Derive the quadratic equation formular.

(6 marks)

(ii) A proper fraction is such that the denominator exceeds the numerator by 3. If both the numerator and the denominator are reduced by 2, the fraction is decreased by 1/8. Find the fraction.

(5 marks)

b) Factorize completely each of the following expressions:

$$w^4 - t^4 + t^2 + w^2$$

(i)

$$\frac{1}{x^2} - \frac{4}{x} + 4$$

(ii)

(4 marks)

c) Solve the following simultaneous equation

(5 marks)

$$3x + y = 10$$

$$\frac{1}{x} + \frac{1}{y} = \frac{3}{4}$$

Question Three

$$\frac{a\sqrt{a} + 1}{\sqrt{a} - 1}$$

a) (i) Rationalize the denominator of

$$\frac{1}{(1 + \sqrt{3})^2} + \frac{1}{(1 - \sqrt{3})^2}$$

(ii) Without using tables, evaluate

(5 marks)

$$s = \sqrt{3} + 4 \quad t = \sqrt{3} - 4$$

b) If _____ and _____, find the values of:

(i) $2st$

(ii) $s^2 - t^2$

$$s^2 + 2s \quad s = \sqrt{5} \quad \sqrt{s} = 2.24$$

(iii) Evaluate _____ if _____ and _____

(6 marks)

c) Simplify:

$$\frac{16^{x+1} + 20(4^{2x})}{2^{x-3} \times 8^{x+2}}$$

(i)

$$\frac{\left(a^3 b^{\frac{1}{2}} c^{-\frac{1}{2}}\right) (ab)^{\frac{1}{3}}}{\sqrt{a^3} \sqrt{b}}$$

(ii)

(4 marks)

d) Solve:

$$2^{2x} - 3(2^x) + 2 = 0$$

(i)

$$2^{2x+1} + 4(2^x) - 3 = 0$$

(ii)

Question Four

$$\frac{\log 343 - \log 125}{\log \left(\frac{49}{25}\right)}$$

a) (i) Evaluate without using tables

- (ii) Given that $\log_7 3 = 0.5646$ and $\log_7 15 = 1.3917$, evaluate without using tables or calculator, $\log_7 0.125$ (7 marks)

b) Solve the following equations:

$$2 \log y = \log 2 + \log x$$

$$2^y = 4^x$$

(i)

$$(\log_{10} x)^2 = 3 - \log_{10} x^2$$

(ii)

(8 marks)

$$a^{-n} = \frac{1}{a^n}$$

c) (i) Prove that

$$\log_2 y = 2 - \log_2 x$$

(ii) Given that express y in terms of x.

(5 marks)

Question Five

a) In the figure below, O is the centre of the circle radius 10cm. Angle AOB = 80°. Find:

Figure 1

(i) The perimeter of the major arc

$$\pi = \frac{22}{7}$$

(ii) The area of the shaded segment (Take $\pi = \frac{22}{7}$) (10 marks)

b) The ends of the roof of a workshop are segments of a circle of radius 10m. The roof is 20m long. The angle at the centre of the circle is 120°

Figure 2

Calculate:

- (i) The area of one end of the roof
- (ii) The area of the curved surface of the roof
- (iii) Find the cost of covering the two ends and curved surface with galvanized iron sheets costing sh 400 per square metre. **(10 marks)**