



UGANDA BUSINESS AND TECHNICAL EXAMINATIONS BOARD

PAPER CODE TCTM 101	PROGRAMME NATIONAL CERTIFICATE COURSES (NCAM, NCES, NCET, NCMF, NCWF, NCRA, NCPL, NCBC, NCWT, NCCE) YEAR I	DATE MONDAY, 13 TH DECEMBER 2021
SERIES NOV/DEC 2020	PAPER NAME APPLIED TECHNICIAN MATHEMATICS I	TIME ALLOWED 3 HOURS
YOU SHOULD HAVE THE FOLLOWING FOR THIS EXAMINATION Answer Booklet Non-Programmable Electronic Calculator Mathematical set Graph Paper		

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **eight** questions.
2. Answer only **five** questions.
3. All questions carry equal marks.
4. All answers to each question should begin on a fresh page.
5. **Do not** write anywhere on this question paper.
6. All rough work should be done in the official answer booklet provided.
7. Read other instructions on the official answer booklet.

Question One

- (a) **Fig.1** shows a tank of diameter $AB = 140\text{cm}$ and height $BC = 250\text{cm}$ on a concrete base with a brick wall surrounding it, filled with water to capacity.

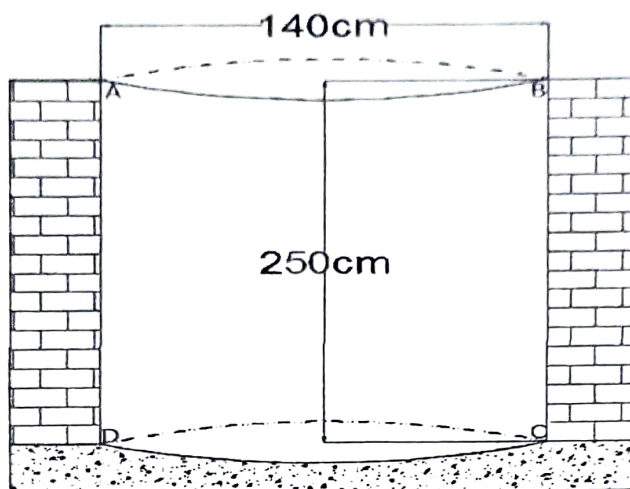


Fig.1

Taking $\pi = \frac{22}{7}$, find the;

- (i) Volume of the tank. (03 marks)
 - (ii) Surface area of the curved part of the tank. (04 marks)
 - (iii) Number of 20 litre jerricans that can fill the tank. (03 marks)
 - (iv) Time taken in seconds to empty the tank through an outlet at C if it releases water at a rate of $96.25\text{cm}^3/\text{min}$. (04 marks)
- (b) A football has a diameter of 50cm . Find the;
- (i) Surface area. (04 marks)
 - (ii) Volume. (Take $\pi = 3.14$) (02 marks)

Question Two

- (a) A surveyor 1.4m tall and 100m away from a building measures the angle of elevation of the top of a building to be 40° on a levelled ground. With the aid of a suitable sketch, find the height of the building. (08 marks)
- (b) Two trainees, Alice who is 1.2m tall and Musa stand at a distance of 2.3m apart in the workshop to watch a spinning bolt. The angles of depression of the bolt from Alice and Musa are 45° and 60° respectively. Calculate the;
- (i) Distance of Alice from the bolt. (07 marks)
 - (ii) Height of Musa. (05 marks)

Question Three

(a) Find the LCM of 12, 6 and 8. (04 marks)

(b) Ben plans to buy the following items;

- 160 feet of round bars.
- 480 inches of angle bars.
- 24000mm of hollow sections.
- 600 feet of pipe Y.

When he reached the hardware shop, he found the cost as below;

- Round bars at UGX 6000 per metre.
- Angle bars at UGX 1200 per foot.
- Hollow section at UGX 1500 per metre.
- Pipe Y at UGX 100 per centimetre.

Calculate Ben's expected expenditure. (16 marks)

Question Four

(a) (i) Simplify; $\frac{P^{\frac{1}{2}}Q^{\frac{2}{3}}R^{\frac{2}{3}}}{P^{\frac{1}{4}}Q^{\frac{1}{2}}R^{\frac{1}{6}}}$. (03 marks)

(ii) Hence evaluate the expression in 4(a)(i) when $P = 16$, $Q = 9$ and $R = 4$ taking positive roots only. (02 marks)

(iii) Work out the expression $\frac{(mn^2)^3}{(m^{\frac{1}{2}}n^{\frac{7}{4}})^4}$, when $m = 49$, and $n = 81$ taking positive roots only. (05 marks)

(b) Write $\log 30$ in terms of $\log 2$, $\log 3$ and $\log 5$. (03 marks)

(c) Solve the equation $\log(x^2 - 3) - \log x = \log 2$. (07 marks)

Question Five

(a) Matrices P , Q and R are such that;

$$P = \begin{pmatrix} x+2 & 5 \\ 4 & y \end{pmatrix}, Q = \begin{pmatrix} -8 & \frac{n}{2} \\ m & -7 \end{pmatrix} \text{ and } R = \begin{pmatrix} 1 & 8 \\ -6 & -3 \end{pmatrix}. \text{ Find the;}$$

(i) Values of x , y , n and m if $P + Q = R$ (06 marks)

(ii) Det Q . (02 marks)

(b) In a certain technical institute, students who offer National Certificate in Building Construction are required to bring cement and concrete nails to use during training. At the beginning of the term, John bought two bags of cement and two boxes of concrete nails. Vesta bought one bag of cement and two boxes of concrete nails while Josephine bought 3 bags of cement and two boxes of concrete nails. On the

market, the price of a bag of cement and a box of concrete nails is UGX 37,000 and UGX 6,000 respectively.

- (i) Write down a 3×2 matrix for the materials bought by the three students. (02 marks)
- (ii) Write down a 2×1 cost matrix for the materials. (02 marks)
- (iii) Which student spent more money than the others? (08 marks)

Question Six

- (a) Express the following as a single power.

- (i) $\frac{1}{\sqrt[4]{a^5}}$ (04 marks)

- (ii) $\frac{(\sqrt{x})^4 x^{\frac{3}{4}}}{x^{\frac{1}{4}}}$ (06 marks)

- (b) (i) Write $\log \left(\frac{8 \times \sqrt[4]{5}}{81} \right)$ in terms of $\log 2$, $\log 3$ and $\log 5$. (03 marks)

- (ii) Evaluate $\frac{\log 25 - \log 125 + \frac{1}{2} \log 625}{3 \log 5}$. (07 marks)

Question Seven

- (a) Given the matrices $A = \begin{pmatrix} -3 & k \\ 4 & 6 \end{pmatrix}$, $B = \begin{pmatrix} 5 & 2 \\ l & 3 \end{pmatrix}$ and $C = \begin{pmatrix} m & 4 \\ 7 & n \end{pmatrix}$. Find the values of k, l, m and n such that $A + B = C$. (08 marks)

- (b) The matrices P and Q are such that $P = \begin{pmatrix} 2 & 4 \\ 1 & -3 \\ 3 & 5 \end{pmatrix}$ and $Q = \begin{pmatrix} 1 & -2 \\ 3 & 5 \end{pmatrix}$. If $PQ = R$, find the;

- (i) Order of matrix R . (01 mark)
- (ii) Matrix R . (04 marks)

- (c) Given that $L = \begin{pmatrix} 3+x & 2 \\ 4 & 1 \end{pmatrix}$, find the value of x for which the determinant of L is 7. Hence evaluate the inverse of L . (07 marks)

Question Eight

- (a) Two concentric circles have radii 12m and 10m. Find the difference between their areas. (Take $\pi = 3.14$) (06 marks)
- (b) The floor of a kitchen measuring 3.2m by 3.0m is to be finished with marble effect floor tiles each measuring 330mm by 330mm. If there are 9 tiles in a pack, calculate the number of packs required. (09 marks)
- (c) A student wants to find the mass of a given brick measuring 30cm $\times$ 15cm $\times$ 12 cm. If 2700cm³ of the brick is approximately 2000g, find the mass of the brick in kg. (05 marks)

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