THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

ENTRANCE EXAMINATIONS – 2019

MA003 – ENGINEERING MATHEMATICS

For candidates applying for Applied Physics, Computer Science, Electrical Engineering, Mechanical Engineering, Civil Engineering, Mining Engineering, and Mineral Processing Engineering.

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES

1. Print and sign your name below, and tick a box to indicate the type of course for which you are applying.
2. All answers must be written in this booklet.
3. Show your workings where required.
4. Do not use red ink or pencil to write this exam.
5. **Calculators are allowed in the examination room.**

Surname: _____ First Name: _____

Signature: _____ Date: _____ Venue: _____

Tick the type of course for which you are applying

[ ] Applied Physics
[ ] Computer Science
[ ] Electrical Engineering
[ ] Mechanical Engineering
[ ] Civil Engineering
[ ] Mining Engineering
[ ] Mineral Processing Engineering

Section A: Multiple Choice Questions

For Questions 1 to 21, circle the correct choice. Each question worth 2 marks.

1. Find the value of x which satisfies the pair of equations $2(x+2y)+3(3x-y)=38$ and $4(3x+2y)-3(x+5y)=-8$.
   A. 2 B. 3 C. 4 D. 5

2. Which set of numbers does 0.50 belonged to?
   A. Integers B. irrational numbers C. whole numbers D. rational numbers

3. We wish to form a 3-digit code using the sets of digits 4, 5, 6 and 7. If no digit is allowed to be used more than once, how many different codes are possible to form?
   A. 8 B. 16 C. 24 D. 32

4. An article is offered for sale at K120, which represents a profit of 20% to the dealer. On a cash sales, he allows a discount of 10%. His profit on cash sale is therefore
   A. 8 B. 10 C. 18 D. 20

5. One machine cuts 1000kg of coal in 8 minutes while another machine can cut the 1000kg of coal in 4 minutes. Find the number of minutes taken by both machines working together to cut 1000kg of coal.
   A. $2\frac{1}{3}$ mins B. $2\frac{2}{3}$ mins C. $3\frac{1}{3}$ mins D. $3\frac{2}{3}$ mins

6. A car accelerates from rest a 4m/s^2 for 5 seconds, then moves with constant speed for 10 seconds, then decelerates at 2m/s^2 back to rest. Calculate the total distance travelled by the car on this journey.
   A. 250m B. 300m C. 350m D. 400m

7. A cone has a base diameter of 6cm and a vertical height of 8cm. The volume of a cone in cubic centimetres would be
   A. 25.12 B. 75.36 C. 226.08 D. 301.44

8. If $f:x\to 3x-5$ and $g:x\to 2x+1$, then $f^{-1}g^{-1}$ would be
   A. $6x+9$ B. $\frac{1}{3}(x+9)$ C. $\frac{1}{6}(x+9)$ D. $\frac{1}{5}(x+9)$

9. If S varies inversely as T^2 and $S=2$ when $T=3$, find the value of T when $S=16$.
   A. 1.5 B. 1.05 C. 1.6 D. 1.06

10. Transpose the formula $V=\frac{2R}{R-r}$ to make R the subject of the formula.
    A. $R=\frac{Vr}{V-2}$ B. $R=\frac{V-2}{V-r}$ C. $R=\frac{2V}{V-r}$ D. $R=\frac{Vr}{2-V}$

11. Given that $\varepsilon = \{x : 1 \le x \le 10\}$, $A = \{3, 4, 5, 6\}$ and $B = \{6, 7, 8, 9\}$, list the sets $B \cup (A' \cap B)$.
A. $\{3, 4, 5, 6\}$ B. $\{7, 8, 9\}$ C. $\{6, 7, 8, 9\}$ D. $\{5, 6, 7, 8, 9\}$

12. For a regular eight-sided polygon, what is the ratio of the exterior angle to the interior angle?
A. 1 : 1 B. 1 : 3 C. 1 : 4 D. 1 : 5

13. From the top of a tower, the angle of depression of a boat is 30°. If the tower is 20 metres high, how far is the boat from the foot of the tower?
A. $10\sqrt{2}$ m B. $10\sqrt{3}$ m C. $20\sqrt{2}$ m D. $20\sqrt{3}$ m

14. Find the approximate resultant of the vectors $\mathbf{a} = 3\mathbf{i} + 5\mathbf{j}$ and $\mathbf{b} = 4\mathbf{i} + 6\mathbf{j}$.
A. 13 B. 18 C. 49 D. 170

15. The arithmetic mean of ten numbers is 36. If one of the numbers is 18, what is the mean of the other nine numbers?
A. 18 B. 27 C. 36 D. 54

16. A motorist made a journey of 192 km. He covered 48 km in 1 hour and for the remainder of the journey, his speed was 72 km/h. Calculate his average speed for the whole journey.
A. 36 km/h B. 48 km/h C. 54 km/h D. 64 km/h

17. 125 kilometres in millimetres is
A. 1.25×10^6 B. 1.25×10^7 C. 1.25×10^8 D. 1.25×10^9

18. Yerea Kambi leaves Hagen at 11:55 a.m. and arrives in Goroka, 155 miles away, at 3:01 p.m. How long in hours and minutes, did the journey take?
A. 3 hrs, 1 min B. 3 hrs, 2 mins C. 3 hrs, 4 mins D. 3 hrs, 6 mins

19. Kambiri, Williri and Yowarene shared a project fund in the ratio 2:3:5 respectively. If Kambiri receive K5,000, how much did Yowarene receive?
A. K12,000 B. K12,250 C. K12,500 D. K12,550

20. Find an expression which will give the total mass of a box containing x articles if the box has a mass of 7 kilogram and each article has a mass of 1.5 kilogram.
A. $15x + 7$ B. $1.5x + 7$ C. $7x + 15$ D. $7x + 1.5$

21. Kambiri is 3 years older than Williri while Yoarene is 1 year older than Tondono. If Tondono is 2 years younger than Kambiri, the actual age for Tondono if Kambiri's age is 29 would be
A. 26 B. 27 C. 28 D. 29

Section B: Workings Required For Full Mark

For Questions 22 to 26, show full workings. Each question worth 6 marks.

22. Solve for x for the logarithmic equation $2\log_3(x-2)=\log_3(3x)-1$.

23. Suppose inflation is running at a constant 6% p.a. For K90 at the start of this year, 2019, we could expect to purchase 15 packets of 1Kg Trukai rice. Calculate the year in which you would expect to purchase 5 packets of 1 Kg Trukai rice.

24. An aircraft flies 500 km on a bearing of 100° and then 600 km on a bearing of 160°. Find the **distance** and **bearing** of the finishing point from the starting point.

25. Integrate $\int \frac{v+1}{\sqrt{v}}\,dv$.

26. Write the values represented by A, B and C on the scale below.