



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRICAL ENGINEERING

CERTIFICATE III IN ELECTRICAL ENGINEERING

EEC301- ELECTRICAL CALCULATIONS 1

FINAL EXAMINATION – QUARTER 3, 2019

DURATION – 2 HOURS AND 10 MINUTES

TOTAL MARKS – 100

Day / Date / Time / Room: As per timetable

INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each answer on a fresh page and use both sides of the sheet.
3. Write your candidate-number at the top of each attached sheet
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string
5. For all sheets of paper on which rough/draft work has been done, cross it though and you **MUST ATTACH** to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. **ANSWER ALL QUESTIONS.**
8. Show all workings where necessary.
9. Do not use programmable calculators, especially the ones that do the conversions of number systems.
10. Total number of pages: 8

Section A: Multiple Choice

[15 marks]

1. $9/8$ is an example of:

- A. Mixed fraction
- B. Improper fraction
- C. Proper fraction
- D. All of the above

2. $(b + c)(a + c)$ is equal to

- A. $b(a + c) + c(a + c)$
- B. $b^2 + ac + bc + ba$
- C. $c^2 + ba + ca + b^2$
- D. $a(b + c) + c(a + c)$

3. 0.00258 written in standard form is:

- A. 2.58×10^{-3}
- B. 25.8×10^{-4}
- C. 25.8×10^4
- D. 2.58×10^3

4. Which of the following is a supplementary angle to 123° ?

- A. 57°
- B. 43°
- C. 93°
- D. 203°

5. Transpose V from $P = V^2R$:

- A. $V = P/R$
- B. $V = 2\sqrt{(P/R)}$
- C. $V = \sqrt{(P/R)}$
- D. $V = \sqrt{PR}$

6. $3(c + d)$ is equal to

- A. $3cd$
- B. $3c + d$
- C. $3c + 3d$
- D. $3 + c + d$

7. Given $A = 2 + j2$ and $B = 5 - j3$ determine $A + B$

- A. $7 - j$
- B. $-3 + j2$
- C. $7 + j$
- D. $-1 - j$

8. Express $5/13$ as a percentage correct to three significant figures.

- A. 38.50%
- B. 38.46%
- C. 38%
- D. 38.5%

9. Express 0.3716 in standard form.

- A. 0.3716×10^{-2}
- B. 3.716×10^{-1}
- C. 31.76×10^4
- D. 3.176×10^{-3}

10. $6^3 \times 6^5$ in the simplest form using indices is

- A. 6^{-2}
- B. 6^{15}
- C. 6^8
- D. 6^1

11. The volume of a sphere is equal to:

- A. $4\pi r^2$
- B. πr^2
- C. $\frac{4}{3}\pi r^3$
- D. 2π

12. The diameter of a circle is 14mm. Hence the area is:

- A. 15.3 mm²
- B. 153.93 mm²
- C. 193.56 mm²
- D. 150 mm²

13. What is 24.45 converted into degrees, minutes and seconds is

- A. 24°27'0"
- B. 24°17'0"
- C. 23°27'0"
- D. 23°17'0"

14. Find the volume of the sphere whose diameter is 4cm. (use $\pi = \frac{22}{7}$)

- A. 30 cm
- B. 31.25 cm
- C. 33.52 cm
- D. 35.32 cm

15. Expand $5x(2x+3)$

- A. $10x^2 + 15x$
- B. $7x + 8x$
- C. $15x^2 + 15x$
- D. $10x + 15x$

Section B: Use of Calculators

[10 marks]

1. Express $33/78$ as a decimal fraction correct to **4 significant figures**.
2. Work out : $3.02 + 23.891$
3. Calculate and write the answer in mixed number: $\frac{67}{51} + \frac{62}{71}$
4. The volume of a cube is 27m^3 . Calculate its length.
5. Subtract $32^\circ 31' 51''$ from $41^\circ 19' 01''$.

6. Evaluate $5x^3 - 4x^2 + 3x - 8$ when $x = 6$.
7. Change $6 + j8$ to polar form.
8. Express 0.000346 in standard form
9. Solve for x when $\cos x = 0$.
10. Find the area of a circle whose circumference is 18cm.

Section C: Arithmetic Fundamentals and Algebra (Show all working) [25 marks]

1. Convert the following fractions from improper fraction to mixed number. [2 Marks]
 - a) $\frac{9}{6}$
 - b) $\frac{4}{3}$
 - c) $\frac{36}{7}$
 - d) $\frac{44}{12}$

2. Convert the following fractions from mixed number to improper fraction. [2 Marks]
 - a) $5\frac{1}{3}$
 - b) $3\frac{4}{7}$
 - c) $2\frac{2}{4}$
 - d) $1\frac{5}{6}$

3. Solve the following and simplify the answer the answer in simpler fractions. [4 Marks]
 - a) $\frac{2}{5} + \frac{6}{7}$
 - b) $\frac{4}{9} - \frac{5}{4}$
 - c) $\frac{1}{8} \times \frac{6}{2}$
 - d) $\frac{7}{3} \div \frac{4}{3}$

4. Write these in simpler forms using indices. [2 Marks]
- a) $4 \times 4 \times 4 \times 4$
 b) $a \times a \times a \times b \times b \times b \times b \times b$
5. Simplify the following. [3 Marks]
- a) $2a^3 \times 5a^2$
 b) $8b^5 \times 5b^{-4}$
 c) $8c^4 \div 9c^{-4}$
6. Peter brought a cake to the class on his birthday. He divided the cake into 24 pieces. He gave one piece to each student and gave 2 pieces to his class teacher and 3 pieces to the head teacher. Calculate the fraction of the cake left if there were 12 students. [2 marks]
7. A tree of unknown height cast a shadow 26m long at the same time and place that a 36m yardstick cast a 13m shadow. How high is the tree? [2 marks]
8. In a stationery shop, cost of 3 pencil exceeds the price of 2 pens by \$2. Also, total price of 7 pencil cutters and 3 pens is \$43. Calculate how much each pencil and pen cost. [3 marks]
9. In a Hardware store, any customer who wishes to buy a special 3 piece Lounge Suite at cash price of \$1, 200.00 has to pay a deposit of $\frac{1}{8}$ of the cash price. How much does a customer have to pay as a deposit for these 3 pieces Lounge Suite? [2 marks]
10. Make the subject of the formula as indicated in brackets [3 marks]
- a) $V = \frac{1}{3} \pi R^2 H$ (R)
 b) $y = mx + c$ (m)
 c) $2x + 3y = xy + z$ (y)

Section D: Measurements and Graphs**[25 marks]**

1. By plotting the vertex and y intercept of the parabolas, sketch the graph of $y = (x - 1)^2 + 2$ [5 marks]
2. Find the gradient, co-ordinates of x-intercept, y-intercept and sketch the graph for the following equations:
 - a. $y = -3x + 2$ [5 marks]
 - b. (1,1) and (-1, 3) – [Find gradient, x-intercept, y-intercept, write the equation and sketch] [5 marks]
3. When the maximum value of an alternating voltage is 240V, determine: [5 marks]
 - a. Average value?
 - b. Peak value?
 - c. R.M.S. value?
 - d. Peak – to – peak value?
 - e. Draw AC waveform
4. A main shaft is running at 300rev/min and a machine is to be installed driven directly from the shaft, to run at 180rev/min. The pulley on the machine is 230 mm diameter. What diameter of pulley will be required on the shaft to drive the machine? [3 marks]
5. Find the volume of the cone with radius 10cm and height 24cm. [2 marks]

Section E: Trigonometry, Geometry and Vectors**[25 marks]**

1. Add $100^{\circ}50'59''$ and $55^{\circ}9'1''$ [2 marks]
2. Convert $105^{\circ} 44' 22''$ to degrees and decimals of a degree: [2 marks]
3. The angle of a sector in a given circle is 40 degrees and the area of the sector is equal to 20 cm^2 . Calculate the arc length of the sector. [2 marks]
4. Convert the following angles in radians to degrees.
 - a. $\frac{3\pi}{2}$ [1 marks]
 - b. $\frac{\pi}{4}$ [1 marks]

5. Sketch the following graphs: [4 marks]
- $y = -\cos x$
 - $y = \sin (x + 30^\circ)$
6. Two vectors are defined as, $A = 6 + j2$ and $B = 3 + j4$ respectively. Determine the sum and difference of the two vectors in both rectangular ($a + jb$) form and graphically as an Argand Diagram. [7 marks]
7. Given $A = 3 + j4$ and $B = 5 - j2$ determine:
- $A + B$ [1 marks]
 - $B - A$ [1 marks]
 - $A \times B$ [1 marks]
 - $\frac{A}{B}$ [1 marks]
8. Convert $5 + j10$ to polar form. [2 marks]

The End