



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF MATHEMATICAL AND COMPUTING SCIENCES

TRADE DIPLOMA IN ELECTRICAL ENGINEERING

EEE401- MATHEMATICS FOR TECHNICIAN

FINAL EXAMINATION – SEMESTER 1, 2015

TIME ALLOWED = 2 HOURS

**INSTRUCTIONS TO STUDENTS**

1. You are allowed 10 minutes Extra Reading Time during which you are NOT to write.
2. Write your candidate-number at the top of each attached sheet
3. Begin each answer on a fresh page and use both sides of the sheet. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string. For all sheets of paper on which rough/draft work has been done, cross it though and you **MUST ATTACH** to your answer scripts.
5. **ANSWER ALL QUESTIONS AND SHOW ALL WORKINGS WHERE NECESSARY**
6. The question paper is 8 pages long including this cover page and is divided into 4 Sections. The mark allocation is given below:

Section A	40 marks
Section B	20 marks
Section C	20 marks
Section D	20 marks
7. Do not use programmable calculators.
8. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!**

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## Section A Multiple Choice

- The sum of  $3a$ ,  $-2a$ ,  $-6a$ ,  $5a$  and  $4a$  is
  - $8a$
  - $4a$
  - $15a$
  - $8a^5$
- From  $4x - 3y + 2z$ , subtract  $x + 2y - 3z$ .
  - $3x - 5y + 5z$
  - $3x - y - z$
  - $5x - y - z$
  - $3x - 5y - z$
- Subtract  $\frac{3}{2}a - \frac{b}{3} + c$  from  $\frac{b}{2} - 4a - 3c$ .
  - $\frac{11}{2}a - \frac{5}{6}b + 4c$
  - $-\frac{3}{2}a - \frac{5}{6}b + 4c$
  - $\frac{1}{6}b - \frac{3}{2}a - 2c$
  - $\frac{5}{6}b - \frac{11}{2}a - 4c$
- Multiply  $2a - 5b + c$  by  $3a + b$ .
  - $6a - 13ab - 5b^2 + 3ac + bc$
  - $6a^2 + 18ab + 5b^2 + 3ab + bc$
  - $6a^2 - 13ab + 5b^2 + 3ac + bc$
  - $6a^2 - 13ab - 5b^2 + 3ac + bc$
- Simplify the expression  $4a^2b \div 2a$ .
  - $8a^3b$
  - $2ab$
  - $2a^2b$
  - $4ab$

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6. Factorize  $ay + by + a + b$ .
- A.  $(a + b)(y + 1)$
  - B.  $(a + b)(y + b)$
  - C.  $(a + y)(b + 1)$
  - D.  $(a + 1)(b + y)$
7. A bonus is paid to 4 men in the ratio 9 : 11 : 13 : 15. If the total bonus is \$240, then how much does each man receive in order?
- A. 20 : 30 : 40 : 50
  - B. 45 : 55 : 75 : 85
  - C. 45 : 55 : 65 : 75
  - D. 45 : 65 : 75 : 85
8. Express 22 seconds as a percentage of a minute.
- A. 40.3%
  - B. 11.6%
  - C. 22%
  - D. 36.7%
9. An alloy consists of 65% by weight of zinc, the remainder being copper. Find the weight of copper in 300g of alloy.
- A. 100 g
  - B. 200 g
  - C. 195 g
  - D. 105 g
10. Which of the following sequences shows these fractions  $\frac{5}{8}$ ,  $\frac{11}{8}$ ,  $\frac{3}{5}$ ,  $\frac{7}{12}$  in descending order?
- A.  $\frac{11}{8}, \frac{7}{12}, \frac{5}{8}, \frac{3}{5}$
  - B.  $\frac{11}{8}, \frac{5}{8}, \frac{3}{5}, \frac{7}{12}$
  - C.  $\frac{11}{8}, \frac{3}{5}, \frac{5}{8}, \frac{7}{12}$
  - D.  $\frac{11}{8}, \frac{7}{12}, \frac{3}{5}, \frac{5}{8}$

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11. Which of the following is the mean of 45.22kg, 500grams, 347grams, 13.678kg and 98.345kg?
- A.200.849 kg
  - B.31.618 kg
  - C.200.849 g
  - D.31.618 g
12. Which of the pair  $(m, c)$  where  $m$  is gradient and  $c$  the  $y$ -intercept for the linear function  $2y = -6 + 12x$ ?
- A. $(-3, 6)$
  - B. $(-6, 12)$
  - C. $(12, -6)$
  - D. $(6, -3)$
13. Which of the following is a Pythagorean triad?
- A.7(3, 4, 6)
  - B.(7, 8, 10)
  - C.(6, 8, 10)
  - D.(2, 3, 4)
14. Adding  $25^{\circ}37'51''$  and  $41^{\circ}29'16''$ , we obtain
- A. $66^{\circ}6'7''$
  - B. $67^{\circ}7'7''$
  - C. $66^{\circ}6'6''$
  - D. $77^{\circ}7'7''$
15. The expression  $x^2 - 9$  is equivalent to
- A. $(x - 9)^2$
  - B. $(x - 3)(x + 3)$
  - C. $(x - 3)(x - 3)$
  - D.  $-3 - x^2$

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16. In a single swing, a pendulum moves through an angle of  $9^\circ$ . Determine the length of the arc traced by the pendulum bob (correct to nearest centimetre) if the length of the pendulum is 1.4m.
- A. 12.6 cm
  - B. 13 cm
  - C. 21.99 cm
  - D. 22 cm
17. Which of the following is the rectangular form of  $5\angle 60^\circ$ ?
- A. (3.4, 2.5)
  - B. (2.5, 4.33)
  - C. (2.5, 3.4)
  - D. (3.4, 4.33)
18. Evaluate  $3x^3 - 2x^2 + 4x - 8$  when  $x = 2.5$ .
- A. 31.675
  - B. 613.75
  - C. 6.14
  - D. 36.375
19. Convert  $89^\circ 12' 35''$  to degrees in decimals.
- A.  $89.297^\circ$
  - B.  $82.97^\circ$
  - C.  $98.2097^\circ$
  - D.  $89.2097^\circ$
20. Convert  $112.013^\circ$  into degrees, minutes and seconds.
- A.  $112^\circ 47' 0''$
  - B.  $112^\circ 0' 47''$
  - C.  $12^\circ 0' 47''$
  - D.  $12^\circ 47' 0''$

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## Section B

1. Given  $r = 13\text{cm}$ , find

- (a) circumference of the circle it forms.
- (b) area of the circle.
- (c) volume of the sphere it forms.

(2 + 2 + 2 marks)

2. Find the volume and total surface area of a regular metal of length 3m if each side of the hexagon is 5m.

(4 marks)

3. Determine the gradient of the straight line graph passing through the points  $(-4, -1)$  and  $(-5, 3)$ .

(2 marks)

4. Graph the linear equation

$$y = -2x - 1.$$

(3 marks)

5. The results in the table below shows how the length of a wire,  $L$  cm, depends on a load,  $W$  grams, applied to it. Show by drawing a suitable graph that the law  $L = aW + b$  is approximately true and establish from the graph the values for the constants  $a$  and  $b$ .

$L$ cm	12.2	12.85	13.47	14.1	14.75	15.35
$W$ grams	80	90	100	110	120	130

(5 marks)

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## Section C

1. Convert the following angles to radians.

(a)  $125^\circ$ .

(b)  $69^\circ 47'$ .

(1 + 1 marks)

2. Convert the following angles to degrees, minutes and seconds.

(a)  $\frac{4\pi}{9}$  rad.

(b) 0.749 rad.

(1 + 1 marks)

3. Find the sum of  $19^\circ 23' 42''$  and  $68^\circ 4' 33''$ .

(2 marks)

4. Find the resultant angle.

$$36^\circ 38' 51'' - 26^\circ 46' 11''.$$

(2 marks)

5. Sketch the trigonometric equation.

$$y = \sin(x + 60^\circ).$$

(4 marks)

6. Convert  $3\angle 120^\circ$  to rectangular co-ordinates.

(2 marks)

7. Convert  $(3, 4)$  to polar co-ordinates.

(2 marks)

8. Solve the trigonometric function

$$\cos(x + 45^\circ) = -\frac{1}{2}$$

for  $x$ , where  $0 \leq x \leq 360^\circ$ .

(4 marks)

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## Section D

1. Evaluate the limit.

$$\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}.$$

(2 marks)

2. Differentiate the following functions using appropriate techniques.

(a)  $f(x) = \frac{5 - \cos x}{5 + \sin x}$

(b)  $y = x^3 e^x$ .

(3 + 3 marks)

3. Use the technique of implicit differentiation to evaluate the derivative.

$$x^3 + y^3 = 3xy.$$

(4 marks)

4. Integrate the following function using the given  $u$ -substitution.

$$\int \sin^2 x \cos x dx; \quad u = \sin x.$$

(4 marks)

5. Integrate the function.

$$\int [2 \sin x - 2 \sec^2 x] dx.$$

(4 marks)

THE END

(All The Best)