FNU FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRICAL ENGINEERING-STAGE 2

EEE327- MATHEMATICS FOR TRADE 2

FINAL EXAMINATION – PENSTER 4, 2015

DAY/DATE: as per timetable. TIME: 2 HOURS 10 MINUTES
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 does the conversions of number systems.*
10. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

SECTION A — MULTIPLE CHOICE — [20 MARKS]

Circle the *letter* of the *best choice* in the ***Answer Sheet*** provided.

1. The correct transposition of the equation: $N = \frac{120f}{P}$ is:
   - A. $P = 120f - N$
   - B. $f = \frac{120N}{P}$
   - C. $f = \frac{120P}{N}$
   - D. $P = \frac{120f}{N}$

2. Solve for x: $0.7x + 2(x - 3) = 0.2x + 3$
   - A. 2.5
   - B. 3.5
   - C. 3.6
   - D. 4.5

3. $x^2 - 9$ is equivalent to:
   - A. $(x - 3)(x + 3)$
   - B. $-3 - x^2$
   - C. $(x - 3)^2$
   - D. $(x - 3)(x - 3)$

4. Determine the total capacitance of the following capacitors in series: 220µF, 330µF, 1000µF, 50µF (correct to 3 significant figures) is equal to:
   - A. 1600 µF
   - B. 35 µF
   - C. 26.6 µF
   - D. 0.035 µF

5. In decimal number, the hexadecimal 7B is:
   - A. 1111011
   - B. 173
   - C. 123
   - D. 7B

6. Find the angle C if angle A read 45° 45' 0"and angle B reads 65° 45' 18":
   - A. 66° 27' 10"
   - B. 111° 30' 18"
   - C. 111.505°
   - D. 68° 29' 42"

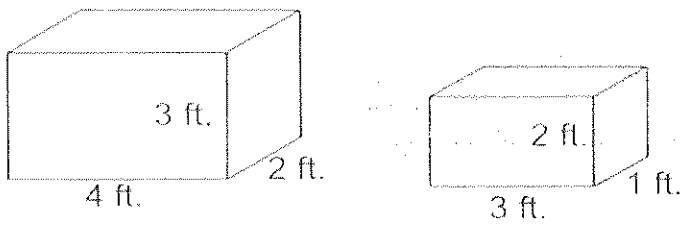
7. Which of the following is a Pythagorean Triad?
   A. 6, 12, 13
   B. 12, 14, 15
   C. 8, 15, 16
   D. 6, 8, 10

8. State the general name for the angle 275°.
   A. Obtuse angle
   B. Right angle
   C. Acute angle
   D. Reflex angle

9. A circular plate has the diameter of 100mm. Find its area in square centimeters.
   A. 78.54 cm^2
   B. 31.42 cm^2
   C. 15.71 cm^2
   D. 37.4 cm^2

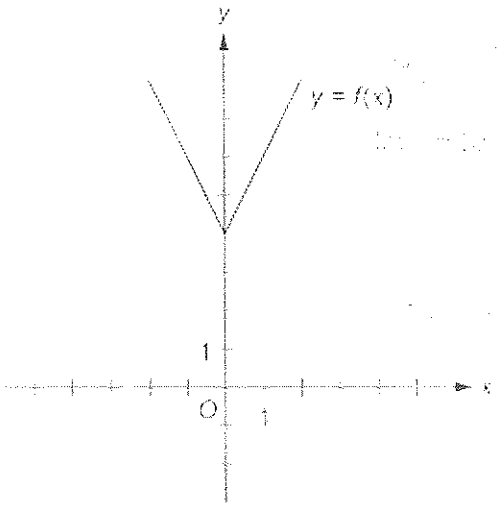
10. In the general sinusoidal equation $y = ASin(\omega t \pm \alpha)$; the leading phase shift is represented as:
   A. $+\alpha$
   B. $-\alpha$
   C. $-$
   D. $+$

11. Cisterns are large tanks used to store water. The larger of the cisterns at the right is completely filled with water. If enough water is taken from the larger cistern to completely fill the smaller empty cistern, how many cubic feet of water will remain in the larger cistern?



   A. 3
   B. 4
   C. 12
   D. 18

12. The figure below shows the graph of the function *f*, defined by $f(x) = |2x| + 4$ for all numbers *x*. For which of the following functions *g*, defined for all numbers *x*, does the graph of **g** intersect the graph of *f* ?



A. $g(x) = x - 2$
B. $g(x) = 2x - 2$
C. $g(x) = 3x - 2$
D. $g(x) = x + 3$

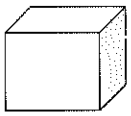
13. Subtract *14 – 6j* from *28 + 3j*.
A. *42 + 9j*
B. *14 + 9j*
C. *14 – 3j*
D. *-14 – 9j*

14. Which of the following points lie on the line = $3x + 2$?

A. (1, 3), (-1, -1)
B. (1, 5), (-1, -1)
C. (-1, 1), (0, 2)
D. (-1, -1), (-2, 4)

15. Which of the following is incorrect?
A. 1 revolution = 60 degree
B. 1 degree = 60 minute
C. 1 minute = 60 seconds
D. 1 degree = 3600 seconds

16. What is the total surface area of the cube shown below if the length of one side of the cube is 15mm?



A. $225mm^2$
B. $35mm^2$
C. $3375mm^2$
D. $1350mm^2$

17. Two angles are complementary. One angle measures **(4x + 1) degrees**. The other measures **(5x - 16) degrees**. Which of the following would be an equation you could use to solve this problem?
A. $90 = (4x + 1) - (5x - 16)$
B. $180 = (4x + 1) + (5x - 16)$
C. $90 = 9x - 15$
D. $180 = 9x - 15$

18. The longest chord is known as _____ :
A. Chord
B. Diameter
C. Radius
D. Segment

19. Name the quantity that has magnitude and direction:
A. Gravity
B. Mass
C. Scalar
D. Vector

20. 1 radian is equivalent to:
A. 2π
B. $360° / 2\pi$
C. $180°$
D. $180° / 2\pi$

SECTION B [20 MARKS]

Instruction:

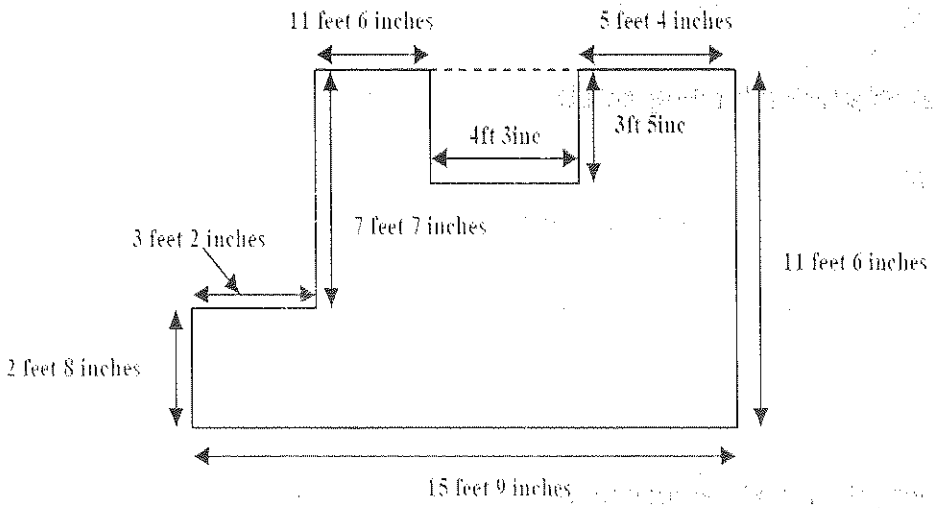
Show all necessary working where applicable.

1. Transpose to make A the subject of formula

$$q = A\sqrt{\frac{2gh}{\left[\frac{A}{A_1}\right]^2 - 1}}$$

(6 marks)

2. What is the perimeter of the courtyard shown below? (answer to the nearest feet and inches)



(6 marks)

3. In an electrical alternating currentcircuit the impedance Z is given by:

$$Z = \sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}$$

Transpose the formula to make C the subject and hence evaluate C when Z = 130, R = 120, ω = 314 and L = 0.32?

(4 marks)

4. A ladder 60m long reaches to the top of a building when its foot stands 23m from the building. How high is the building?

(4 marks)

SECTION C [20 MARKS]

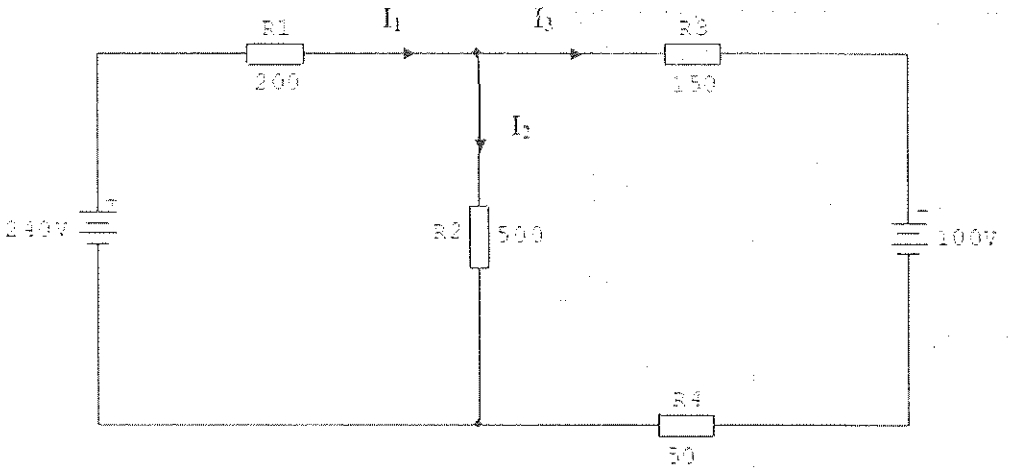
Instruction:

Show all necessary working where applicable.

1. A drinking glass is in the shape of a cylinder that is 60mm in diameter and 15cm tall. How many cubic centimetres of water will it hold?

(5 marks)

2. Calculate the values of I_1, I_2 and I_3 for the electrical circuit shown below:



(10 marks)

3. A pendulum 2m in length swings so that the horizontal distance between the outermost positions of the end is 0.64m. Calculate the vertical height between the lowest and highest positions of the free end, correct to the nearest centimeter.

(5 marks)

SECTION D: [20 MARKS]

Instruction:
Show all necessary working where applicable.

1. Sketch the graphs of:
   a) $2y = -2x^2 + 8$ (2 marks)
   b) $y = 2x^2 + 4x + 2$ (2 marks)

2. Acceleration of $Z_1 = 0 + j1.5\ m/s^2$ and $Z_2 = -2.129 + j1.491\ m/s^2$
   a) $Z_1 + Z_2$ (2 marks)
   b) $Z_1 - Z_2$ (2 marks)

3. A Tank was full at odometer reading 37,250 and is refilled with 12 gallons at an odometer reading of 37,500.
   Cost per gallon of regular fuel is $1.00
   Cost per gallon of premium fuel is $1.20
   a. How many miles were travelled on one tank of fuel? (1 mark)
   b. What was the MPG? (2 marks)
   c. If the cost of fuel was $14.40. What type of fuel was purchased? (2 marks)
   d. How many miles could this car be driven on 15 gallons of fuel? (2 marks)

4. The resistance, ***R*** of a copper winding is measured at various temperatures, ***t*** (°C) and the results are as shown below:

R(Ω)	50	52	54.5	56.5	58.5	60.8	63
t(°C)	0	10	20	30	40	50	60

   a). Draw the graph of resistance, ***R*** of a copper winding, plotting ***R*** vertically on the ***standard graph paper provided.*** The graph has an equation in the form of $R = at + b$. (3 marks)
   b). From the graph find the values of a and b, and write down the equation representing the graph. (2 marks)

SECTION E: **[20 MARKS]**

Instruction:

Show all necessary working where applicable.

1. Convert the following binary numbers to decimal numbers:
   a). 11011_2 (3 marks)
   b). 1011_2 (3 marks)

2. Convert the following decimal numbers to binary numbers:
   a) 47_{10} (3 marks)
   b) 29_{10} (3 marks)

3. Use substitution method to solve the following equation:

   $2y + x = 3$ (1)

   $4y - 3x = 1$ (2) (4 marks)

4. Solve $2x^2 + 5x + 4 = 0$ by using quadratic formula: (4 marks)

THE END