FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE III AND IV IN ELECTRICAL ENGINEERING
STAGE 2

EEC327- ELECTRICAL CALCULATIONS II

FINAL EXAMINATION – QUARTER 2, 2019
DURATION – 2 HOURS AND 10 MINUTES
TOTAL MARKS – 100
TOTAL NUMBER OF PAGES: 7

Day/Date: As per timetable Time: As per timetable 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. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

SECTION A **MULTIPLE CHOICE** **[15 MARKS]**

Instruction:
Write the appropriate alphabet beside each question number in your answer booklet provided.

1. The angle of elevation of a ladder leaning against a wall is 60° and the foot of the ladder is 4.6 m away from the wall. The length of the ladder is:
   A. 2.3 m
   B. 4.6 m
   C. 7.8 m
   D. 9.2 m

2. A Shopkeeper has a sale of \$6435, \$6927, \$6855, \$7230 and \$6562 for 5 consecutive months. How much sale must he have in the sixth month so that he gets an average sale of \$6500?
   A. \$5991
   B. \$6001
   C. \$4991
   D. \$6991

3. Make w the subject of $e = w^2 + f\,t\,y^2$
   A. $w = \sqrt{(e - f\,y^2)}$
   B. $w = \sqrt{(e - f\,t\,y^2)}$
   C. $w = \sqrt{(e - t\,y^2)}$
   D. $w = \sqrt{(e - f\,t)}$

4. If the general equation for a linear graph is given by $y = mx + c$; which component determines the slope?
   A. m
   B. y
   C. x
   D. c

5. How many minutes do you find in a degree?
   A. 30
   B. 60
   C. 3600
   D. 600

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

7. What is the surface area formula of a cube if the volume of the cube is l^3?
   A. l^5
   B. l_2
   C. l_3
   D. l^2

8. $Sin^{-1}0.5 =$
   A. $1.57°$
   B. $60°$
   C. $30°$
   D. $45°$

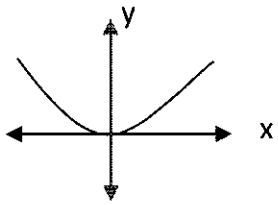
9. Which of the following is not Pythagorean Triad?
   A. 8, 15, 17
   B. 13, 14, 15
   C. 6, 8, 10
   D. 5, 12, 13

10. To convert degrees to radians is:
   A. $Mutilply\frac{\pi}{180}$
   B. $Divide\frac{\pi}{180}$
   C. $Divide\frac{180}{\pi}$
   D. $Mutilply\frac{180}{\pi}$

11. Name the quantity that has magnitude and direction:
   A. Scalar
   B. Phasor
   C. Mass
   D. Litre

12. $Z_1 = 3 + j5$ and $Z_2 = 3 + j4$; choose the appropriate answer for $Z_1 + Z_2$:
   A. $29 + j27$
   B. $-11 + j17$
   C. $6 + j9$
   D. $3 + j5$

13. Identify the given graph:



A. $y = -x^2$
B. $y = -x^2 - 1$
C. $y = x^2 + 1$
D. $y = x^2$

14. Solve: $4(2r - 3) - 2(r - 4) = 3(r - 3) - 1$
A. 3
B. -3
C. -2
D. 2

15. Convert 47_{10} to binary:

A. 110100_2
B. 101111_2
C. 101101_2
D. 111101_2

SECTION B **BASIC CALCULATION AND GEOMETRY** **[35 MARKS]**

***Instruction:* Show all necessary workings**

1. Transpose the following:
   a. $S = \frac{a}{1-r}$ [make 'r' the subject of formula] **(2 marks)**

   b. $k = \frac{1}{2}mv^2$ [make 'v' the subject of formula] **(2 marks)**

2. Given that $X = p\left[1+\frac{at}{100}\right]$; determine X when $p = 854$, $a = 6$ and $t = 20$.
   (3 marks)
3. Given that 50-meter ladder rest against a window edge that is 40 meter above the ground, find out how far is the base of ladder from the base of the building **(3 marks)**

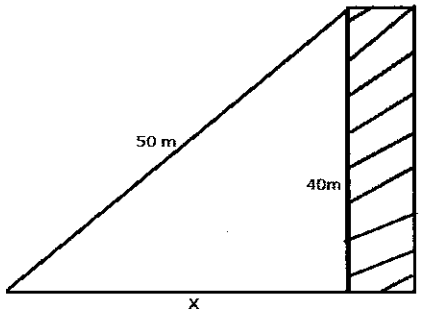


Figure 1

4. From an object at an altitude of 1550 ft, the pilot observes the angle of depression of a lake to be 25.6°. How far is the lake from a point on the ground directly beneath the plane?
   (4 marks)

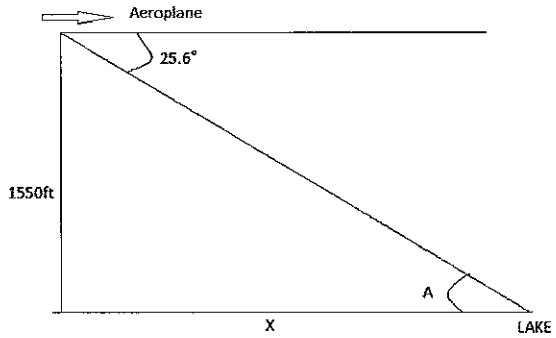


Figure 2

5. Find the supplementary angle for 150° 25' 59''. **(2 marks)**

6. Add the following angular values: **(4 marks)**
   a. 120°55'50'' and 20°10'15''
   b. 18°45'12'' and 82°5'15''

7. Convert the following angles to degrees and decimals of a degree, to 3 decimal places: **(4 marks)**
   a. 20°55'50''
   b. 12°25'30''

8. If an angle of 135° is subtended by an arc of a circle of radius 8cm, find the length of: **(4 marks)**
   a. The minor arc
   b. The major arc, correct to 3 significant figures

9. Mr. Autar wants to put down hardwood floors in his living room which is 3.0m by 2.0m. If the cost of hardwood flooring is $5.00 per square meter, find the approximate cost not including labor to put down hardwood flooring in his living room. **(4 marks)**

10. A fish aquarium shaped like a rectangular solid is 50 cm wide, 125 cm long and 150 cm tall. How much volume could the fish aquarium hold in cubic centimeters and cubic meters? **(3 marks)**

SECTION C APPLICATIONS, GRAPHS AND NUMBERING SYSTEMS [50 MARKS]

***Instruction:* Show all necessary workings**

1. Using Substitution method, solve the following simultaneous equations: **(5 marks)**

$$3x + 4y = 5$$
$$2x - 5y = -12$$

2. Factorise and solve the following quadratic equations. **(4 marks)**
   a. $4x^2 + 8x + 3 = 0$
   b. $x^2 + 2x - 8 = 0$

3. Solve $2x^2 + 8x - 4 = 0$ using Quadratic Formula and state the nature of roots. **(4 marks)**

4. Plot the graph of the followings:
   a. $y = (x - 1)^2 + 2$ **(5 marks)**
   b. $f(x) = 2x^2 + 6x + 4$ **(5 marks)**

5. Find the gradient, co-ordinates of x-intercept, y-intercept and draw the graph for the following equations:
   a. $y = 3x + 2$ **(5 marks)**
   b. $2y + 4x = 8$ **(5 marks)**

6. Referring to below circuit diagram, use a phasor diagram to find the supply voltage V_S when $V_R = 10V$ and $V_L = 12V$. **(5 marks)**

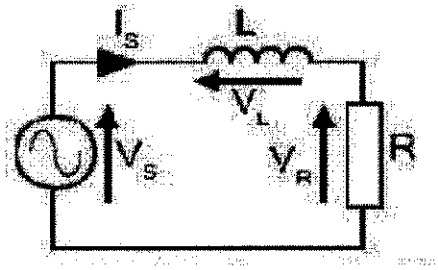


Figure 3

7. Write the generalized mathematical expression to define the two sinusoidal quantities in the below figure. **(4 marks)**

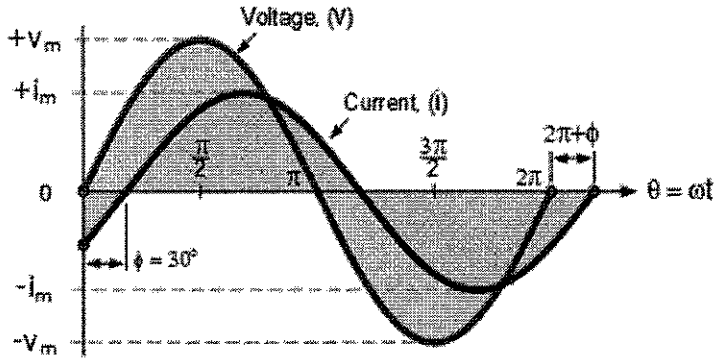


Figure 4

8. Convert the following: **(8 marks)**
   a. 11011_2 (Binary to Decimal)
   b. 1011_2 (Binary to Decimal)
   c. 29_{10} (Decimal to Binary)
   d. $A6_{16}$ (Hexadecimal to binary)

**********THE END**********

All the best