# Eta Kappa Nu

## ELECTRICAL ENGINEERING HONOR SOCIETY

**Initiation Test 2018**
Due by November 16, 2018
Submission options:
(a) Scan answer sheet and email: David.Graham@mail.wvu.edu
(b) Bring to Dr. Graham's office: AER 355 (leave under door if nobody there)

## Turn in just the answer sheet (last page of the test)

1. West Virginia University's chapter of Eta Kappa Nu is the _____ chapter.

2. Eta Kappa Nu was founded by _____ in the year of _____.

3. Eta Kappa Nu's symbol is the:

    a. The Wheatstone Bridge

    b. The Capacitance Bridge

    c. The Bent

    d. The P-N Junction.

4. Dr. _____ is the Eta Kappa Nu faculty advisor.

5. Eta Kappa Nu is a(n) _____ Honor Society for Electrical and Computer Engineers.

    a. West Virginia University

    b. National

    c. International

    d. Universal

6. Match the 2015 - 2016 officers with their respective position:

| | |
|---|---|
| ____ President | a. Matt Keaton |
| ____ Vice President | b. Morgan Menke |
| ____ Bridge Correspondent | c. John Bowling |
| ____ Corresponding Secretary | d. Jacob Dameron |
| ____ Recording Secretary | e. Clay Vincent |
| ____ Treasurer | f. John McCauley |

7. Write the decimal number 6831 in

    a. Base 2

    b. Base 8

    c. Base 16

8. What is the average power dissipated by an electric heater with a resistance of 50 Ω drawing a current of 30sin(30t) A?

    a. 0 kW

    b. 10 kW

    c. 14.14 kW

    d. 22.5 kW

9. Write one line of code to implement each of the following in MATLAB (no loops or semicolons allowed):

    a. Sum all odd integers from 1 to 100 **without** using the sum function.

    b. Create the following matrix

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 |
| 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 |
| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 |
| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

    c. Sum of all numbers from 1 to 100 that aren't divisible by 5

10. Express the following function as a sum of products:

$$F = (\bar{A} + B)(\bar{B} + \bar{C})(A + C)$$

Pick from among the following multiple-choice answers

a. $F = ABC + A\overline{B}C$

b. $F = ABC + \overline{AB}C$

c. $F = AB\overline{C} + A\overline{B}C$

d. $F = AB\overline{C} + \overline{AB}C$

11. A second order, continuous-time system is defined by the following transfer function:

$$H(s) = \frac{20}{s^2+2s+4}$$

If the system receives a step input, what is the steady state output, $y_{ss}(t)$?

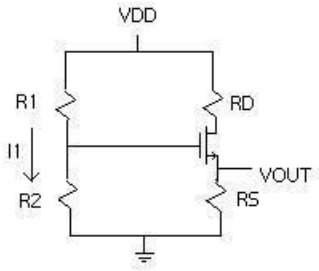
a) 0

b) 1

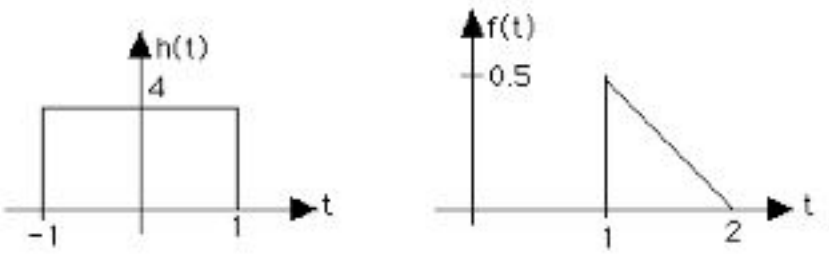
c) 5

d) $\infty$

12. For the circuit below, $V_{DD} = 10V$ and $V_{OUT} = 2V$. Assume the transistor is in saturation, $V_{TN} = 1.2V$, $V_{DSQ} = 5V$, and $V_{GS} \approx I_D * R_S$. The current across the bias resistors ($I_1$) is equal to $0.05 * I_D$, and $R_1 \parallel R_2 = 96$. Find $R_1$, $R_2$, $R_D$, and $R_S$.



13. For h(t) and f(t) sketched below, the convolution y(t) = h(t)*f(t) has y(1) = :




d. 1

e. 2

f. 3

g. 4

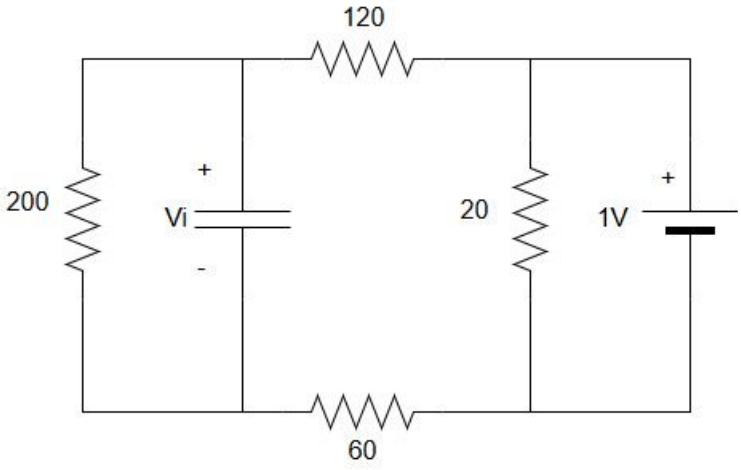
h. 0.5

i. 0

j. 0.25

k. None of the above

14. For the circuit below, find $V_i$.




15. The elements in **Figure 1** and **Figure 2** are linear and the sources are DC. As seen by terminals **a** and **b,** the circuit in **Figure 1** can be equivalently represented by the circuit in **Figure 2** with VS(V) and R(Ω) values as follows:

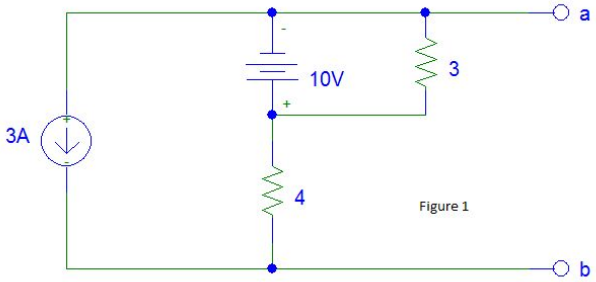


Figure 1

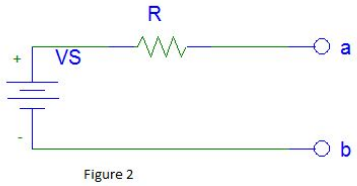


Figure 2

a. VS = -22, R = 4

b. VS = -22, R = 7

c. VS = -21, R = 7

d. VS = -21, R = 4

16. Select the answer which equates to the following function in sum of products form:

$$F = C + \overline{(A + B)} \left( \overline{(\overline{A} + \overline{C})} + (A + B) \right)$$

a) $F = \overline{AB}C$
b) $F = \overline{A} + \overline{B}$
c) $F = C$
d) $F = \overline{A} + \overline{B} + C$

17. What is a full duplex connection?

a. Data can only be transmitted and received in one direction at a time

b. Data can be transmitted and received in both directions simultaneously

c. Data can only flow in one direction and can not flow back the other way

d. Data is transmitted and received over a wireless connection

18. Magnetic flux density, B, and magnetic field strength, H, may experience changes at the interface of materials whose magnetic properties differ from one another. Consider the following:

    i. magnitude of **B**

    ii. normal component of **B**

    iii. tangential component of **B**

    iv. magnitude of **H**

    v. normal component of **H**

    vi. tangential component of **H**

What combination represents the properties of an electromagnetic wave that are continuous (i.e, do not change) across such an interface?

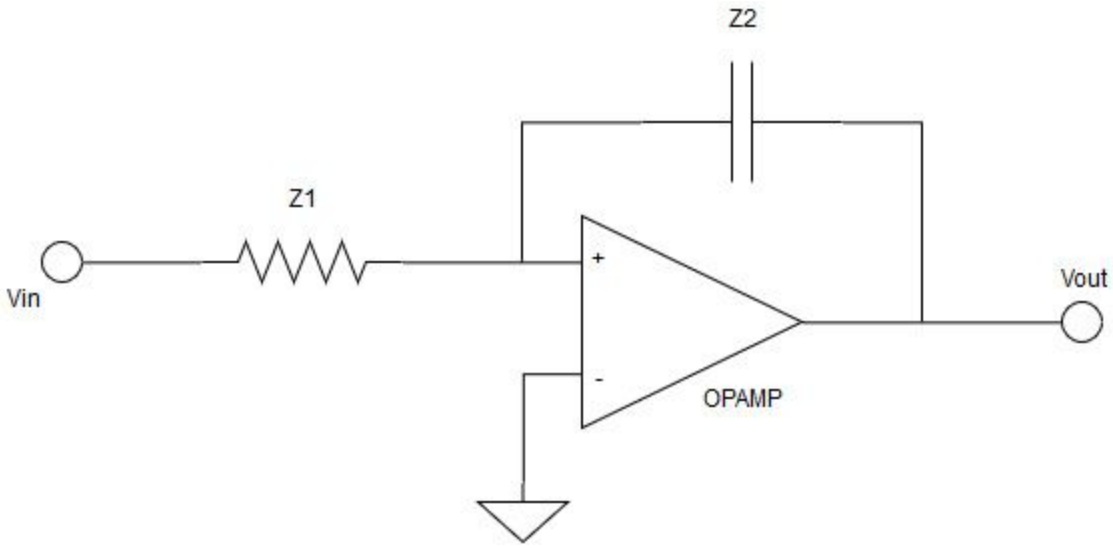
a) i and ii

b) ii and vi

c) iii and v

d) iv and vi

19. For the circuit shown, assume Z1 = 20kΩ and Z2 = -j80kΩ. Vout is most nearly:




a) $4\angle -90°$ Vin

b) $4\angle 90°$ Vin

c) (1-j4) Vin

d) (1+j4) Vin

20. The Frequency response of a system directly tells us what?

a. How the system phase shifts the input to the system.

b. What the spectral and power efficiency of the system is.

c. The sampling rate of input.

d. All of these

## Answer Sheet:

Name:_____

1. _____

2. _____ _____

3. _____

4. _____

5. _____

6. _____

(sort the letters a through f in the proper order)

7.

   a.) _____

   b.) _____

   c.) _____

8. _____

9.

   a.) _____

   b.) _____

   c.) _____

10. _____

11. _____

12. R1= _____

R2=_____

RD=_____

RS=_____

13. X(f)=_____

Draw your sketch to the right →

14. Vi=_____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____