Eta Kappa Nu
ELECTRICAL ENGINEERING HONOR SOCIETY

Initiation Test

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 2023 - 2024 officers with their respective position:

____ President	a. Ian Jackson
____ Vice President	b. Samuel Moody
____ Treasurer	c. Jackson Price
____ Secretary	d. Rhia Bipin Roy

7. Write the decimal number 8513 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 75 Ω drawing a current of $20\sin(30t+45^{\circ})$ A?
    a. 0 kW
    b. 15 kW
    c. 21.21 kW
    d. 30 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:

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

Choose among the following multiple-choice options

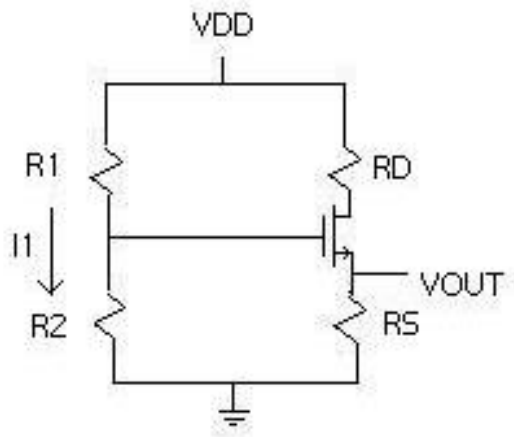
   a. $F = ABC + A\bar{B}C$
   b. $F = ABC + \bar{A}\bar{B}C$
   c. $F = AB\bar{C} + A\bar{B}C$
   d. $F = AB\bar{C} + \bar{A}\bar{B}C$

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

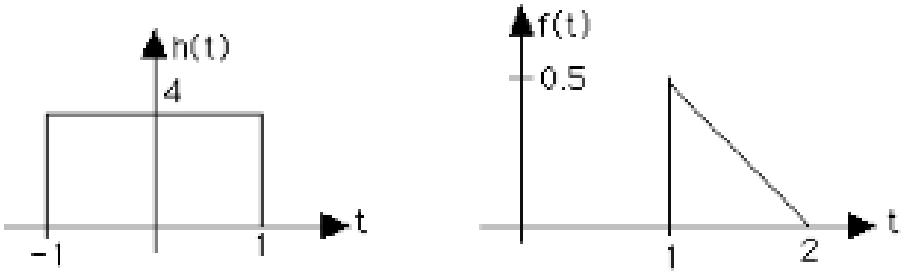
$$H(s) = \frac{20}{s^2 + 2s + 4}$$

If the system receives a step input, what is the steady state output, $y_{ss}(t)$?
   a. 0
   b. 1
   c. 5
   d. ∞

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 $V_{GS} \approx I_D \cdot R_S$. The current across the bias resistors (I_1) is equal to $0.05I_D$, and $R1 \,||\, R2 = 96\ \Omega$. Find R_1, R_2, R_D, and R_S.

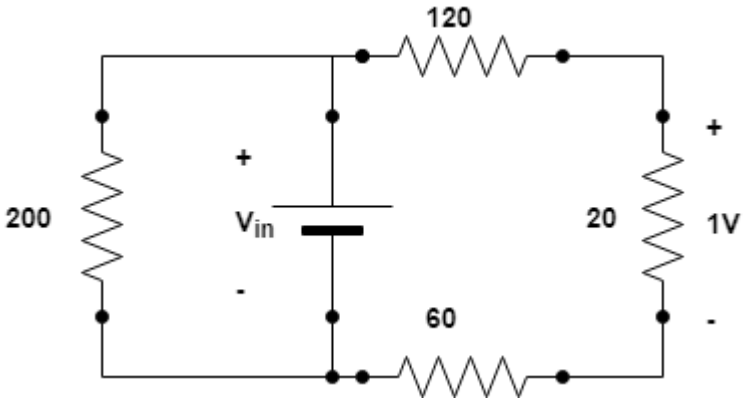


13. For h(t) and f(t) sketched below, the convolution $y(t) = h(t) * f(t)$ has $y(1) =$?



a. 1
b. 4
c. 2
d. 0.5
e. 0.25
f. 0
g. None of the above

14. For the circuit below, find V_{in}



15. The elements in Figure 1 and Figure 2 are linear and the sources are DC. As seen by the terminals a and b, the circuit in Figure 1 can be equivalently represented by the circuit in Figure 2 with V_s $[V]$ and R $[\Omega]$ values as follows:

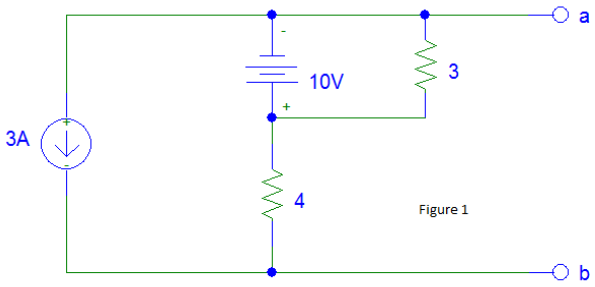


Figure 1

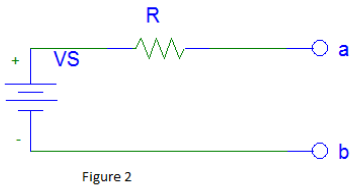
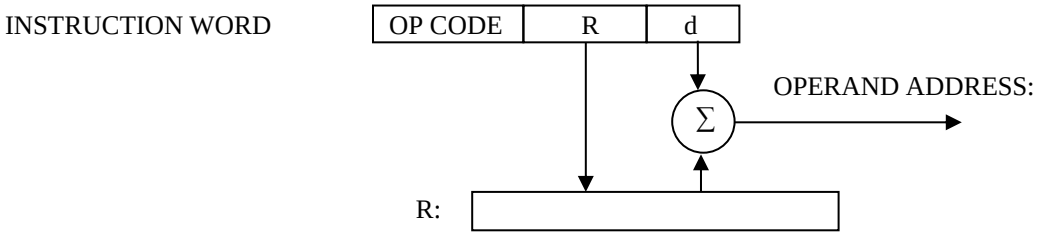


Figure 2

a. $V_s = -22\,V, R = 4\Omega$
b. $V_s = -22\,V, R = 7\Omega$
c. $V_s = -21\,V, R = 7\Omega$
d. $V_s = -21\,V, R = 4\Omega$

16. When a CPU fetches an instruction word from memory, the word contains an operation code that indicates the type of operation the CPU is to perform. A computer may use various addressing modes to specify the operand location. One such addressing mode is illustrated below, where R designates some register within the CPU and d is a constant embedded in the instruction word.



Which of the following terms best describes the addressing mode used by the instruction above?

a. Immediate addressing
b. Direct addressing
c. Indexed addressing
d. Indirect addressing

17. 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?

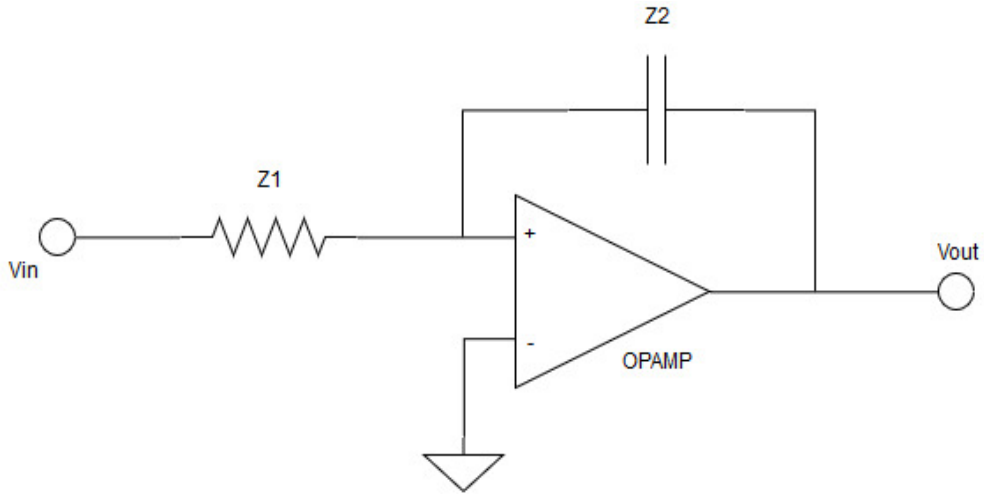
a. i and ii
b. ii and vi
c. iii and v
d. iv and vi

18. The frequency response of a system directly tells us what?

a. How the system phase shifts the input of the system
b. What the spectral and power efficiency of the system is
c. The sampling rate of the input
d. All the above

19. What is a half-duplex system?
a. Data can only be transmitted and received in one direction
b. Data can be transmitted and received in both directions simultaneously
c. Data can only flow in one direction and cannot flow back the other way
d. Data is transmitted and received over a wireless connection

20. For the circuit below, assume $Z_1 = 20k\Omega$ and $Z_2 = -j80k\Omega$. V_{out} is nearly:



a. $V_{out} = (4\angle -90^{\circ})V_{in}$
b. $V_{out} = (4\angle 90^{\circ})V_{in}$
c. $V_{out} = (1 - j4)V_{in}$
d. $V_{out} = (1 + j4)V_{in}$

Answer Sheet:

Name: _____

1. _____

2. _____ _____

3. _____

4. _____

5. _____

6. _____
(List a-d in proper order)

7.
   a. _____
   b. _____
   c. _____

8. _____

9.
   a. _____
   b. _____
   c. _____

10. _____

11. _____

12.
   a. R_1 = _____
   b. R_2 = _____
   c. R_D = _____
   d. R_S = _____

13. _____

14. V_{in} = _____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____