

University of Dhaka  
Affiliated Engineering Colleges  
Department of Computer Science and Engineering  
2<sup>nd</sup> Year 1<sup>st</sup> Semester B.Sc. in CSE Final Examination, 2022  
Course Code: CSE-2103      Course Name: Digital Electronics & Pulse Technique  
Total Marks: 70      Time: 3 Hours

Answer any 5 (Five) of the following Questions

1. a) Define leakage current and Knee voltage. Implement universal gate by diode. 2+3  
b) Show that Transistor acts as a switch. 4  
c) Implement Exclusive NOR gate by transistor. 5
2. a) Describe Bipolar logic family; Explain NOR gate using TTL 3+3  
b) Define Digital IC; Describe the Implementation of NAND gate using RTL 2+3  
c) Describe the implementation of NAND gate using DTL 3
3. a) What is counter modulus? Design a 4 bit synchronous counter circuit with counting sequence. 5  
b) Differentiate between latches and flip flop. Describe Clocked SR flip-flop. 2+3  
c) Implement Right shift register circuit with working procedure. 4
4. a) Prove that, Transistor works as a switch 4  
b) Draw the internal circuit diagram of 555 timer circuit and describe the functionality of each pin. 5  
c) Mention the difference between Clipping and Clamping circuit with example. 5
5. a) What is PLA? Implement the circuit with PLA having the following functions: 5  
 $F1(A, B, C) = \sum(3, 5, 6, 7)$   
 $F2(A, B, C) = \sum(0, 2, 4, 7)$   
b) Describe the pulse transformer circuit and its equivalent circuit. 5  
c) Explain pulse transmission with input and output waveforms in different media. 4
6. a) Draw the block diagram of a D/A converter and explain its operation 5  
b) Describe negative clipping circuit. 4  
c) Write down the usages of a clipping circuit 3  
d) Define LED & LCD 2
7. a) Explain the memory Read and Write operation. 4  
b) Explain pulse generator block diagram. 5  
c) Implement mono-stable multivibrator circuit. 5

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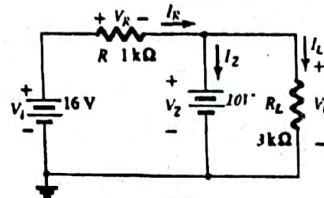
**EEE 2104 : Electronic Devices and Circuits**

Time: 3 Hours

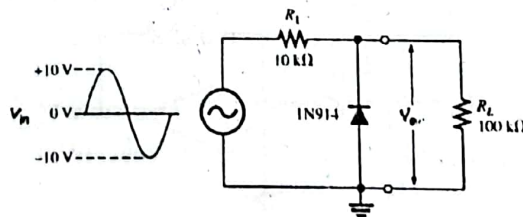
Total Marks: 70

Answer any 5 (Five) set of the following Questions

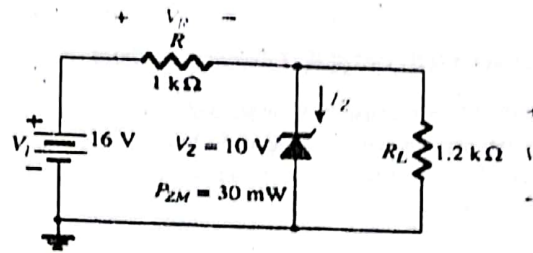
1. a) What is semiconductor? Why do we use semiconductors? 1+2  
 b) Differentiate between extrinsic and intrinsic semiconductor. 3  
 c) Explain the volt-ampere (V-I) characteristics of PN junction. 5  
 d) What is doping? Why it is done? 1+2
  
2. a) Explain working principle of a full wave bridge rectifier with a neat sketch. 4  
 b) What is LED? Explain the working principle of LED. 1+3  
 c) Write down advantage and disadvantage of full wave rectifier. 03  
 d) An a.c supply of 230 V is applied to a half wave rectifier circuit through a transformer of turn ratio 10: 1 Find (i) the output d.c voltage and (ii) the peak inverse voltage. Assume the diode to be ideal. 3
  
3. a) What is Zener diode? Explain how does zener diode regulate voltage? 1+4  
 b) For the Zener diode regulator, Determine: (i)  $V_L$  (ii)  $V_R$  (iii)  $I_Z$  (iv)  $P_Z$  5



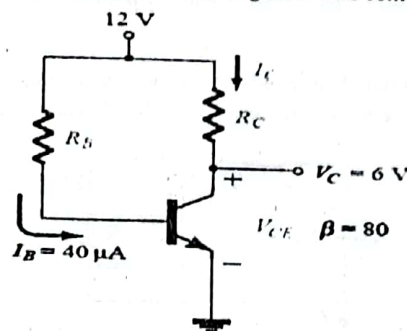
- c) Discuss working principle of JFET with necessary diagram. 4
  
4. a) How does transistor work as a switch? 3  
 b) Why does the transistor need biasing? 3  
 c) What is stability factor? For a transistor, Prove that  $\beta = \frac{\alpha}{1-\alpha}$ . 1+3  
 d) What is clipper circuit? Determine the output waveform for network of the following figure [Assume the diode to be Silicon]. 1+3



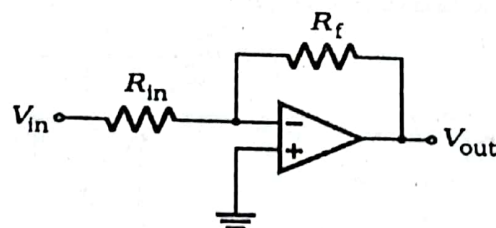
5. a) What is SCR? Explain operating principle of SCR. 05  
 b) What is TRIAC? Explain operating principle of TRIAC. 05  
 c) For the following Zener diode network, determine  $V_L$ ,  $V_R$ ,  $I_Z$ , and  $P_Z$ . 04



6. a) What is FET? Describe the operating principle of D-MOSFET. 06  
 b) Discuss the operation of summing amplifier. 03  
 c) Determine  $R_B$ ,  $R_C$ ,  $I_C$ ,  $V_B$  and  $V_{CE}$  for the following fixed-bias configuration. 05



7. a) What is the importance of power electronics? 2  
 b) What is non-inverting amplifier? Derive the output voltage equation of non-inverting amplifier. 05  
 c) What is an op-amp? What is the need of negative feedback in an op-amp? 1+2  
 d) Determine the output voltage for the circuit of Figure with a sinusoidal input of 2.5 mV. Where  $R_f = 10\text{ K}\Omega$  and  $R_{in} = 470\text{ }\Omega$ . 04



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MATH-2105: Linear Algebra

Total Marks: 70

Time: 3 Hours

Answer any 5 (Five) of the following Questions:

1. a) If A and B are idempotent matrices, then A + B will be idempotent if and only if AB = BA = 0. 5  
 b) Define rank of a matrix. Find the rank of the matrix  $\begin{pmatrix} 6 & -2 & 0 & 4 \\ -2 & -1 & 3 & 4 \\ -1 & -1 & 6 & 10 \end{pmatrix}$  5  
 c) Prove that the following system of linear equations is inconsistent: 4  

$$\begin{aligned} x_1 + 2x_2 - 3x_3 &= -1 \\ 5x_1 + 3x_2 - 4x_3 &= 2 \\ 3x_1 - x_2 + 2x_3 &= 7 \end{aligned}$$
2. a) Define matrix polynomial. Find the Eigen values and corresponding Eigen vectors of the following matrix  $A = \begin{pmatrix} 2 & 1 & 0 \\ 3 & 2 & 0 \\ 0 & 0 & 4 \end{pmatrix}$  7  
 b) If  $A = \begin{pmatrix} 2 & 3 & 4 \\ 4 & 3 & 2 \\ 2 & 4 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 1 \end{pmatrix}$ , Show that  $(A + B)^2 \neq A^2 + 2AB + B^2$  7
3. a) What is called basis and dimension of a vector space? 1+1  
 b) Does every matrix have an inverse matrix, Justify? If 1+4  

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$$
 then find the inverse of A.
- c) If U and W be two subspaces of  $\mathbb{R}^4$  generated by the set of vectors  $\{(1,2,1,1), (1,2,-1,2)\}$  and  $\{(1,2,3,0), (2,2,2,2)\}$ . Then find (i)dim(U + W) and (ii)dim(U ∩ W) 7
4. a) What is rank of the matrix? Find the rank of the matrix: 1+3  

$$\begin{pmatrix} 1 & 2 & -3 & -2 & -3 \\ 1 & 3 & -2 & 0 & -4 \\ 3 & 8 & -7 & -2 & -11 \\ 2 & 1 & -9 & 10 & -3 \end{pmatrix}$$

b) \* Define minors and cofactors. Prove that,

1+1  
+4

$$\begin{vmatrix} 1 & a & a^2 & 0 \\ 0 & 1 & a & a^2 \\ a^2 & 0 & 1 & a \\ a & a^2 & 0 & 1 \end{vmatrix} = 1 + a^4 + a^8$$

c) Prove that,  $A^2 - 5A + 7I_2 = 0$  where  $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$

4

5. a) State and prove the Cayley-Hamilton theorem.

2+4

b) What is characteristic matrix? Find the characteristic roots and associated Eigen vectors of the matrix

2+2  
+4

$$A = \begin{pmatrix} 1 & 0 & -2 \\ 0 & 0 & 0 \\ -2 & 0 & 4 \end{pmatrix}$$

~~X~~ If A and B are orthogonal matrices each of order n then the matrices AB and BA are also orthogonal.

~~X~~

6. a) For which value of  $\lambda$  will be the vector  $v = (1, \lambda, 5)$  in  $\mathbb{R}^3$  is a linear combination of the vectors

5

$v_1 = (1, -3, 2)$  and  $v_2 = (2, -1, 1)$ .

b) Show that the vectors  $(1, 1, -1)$ ,  $(1, 2, 3)$  and  $(4, 5, -3)$  in  $\mathbb{R}^3$  are linearly independent.

3

c) Let  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$  be the linear operator defined by  $T(x, y, z) = (x + 2y, y - z, x + 2z)$  Find the rank and nullity of T.

6

7. a) Let  $T: \mathbb{R}^4 \rightarrow \mathbb{R}^3$  be the linear transformation defined by

8

$$T(x, y, z, t) = (x - y + z + t, x + 2z - t, x + y + 3z - 3t)$$

Find a basis and the dimension of the (i) Range space of T (II) Null space of T.

b) Define diagonal matrix. Diagonalize the matrix  $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$  and find an invertible  $2 \times 2$  matrix such that  $P^{-1}AP$  is a diagonal matrix with the eigenvalues of A down the diagonal.

6