INDIAN INSTITUTE OF INFORMATION TECHNOLOGY UNA
HIMACHAL PRADESH

An Institute of National Importance under MoE

Saloh, Una – 177 209

Website: www.iiitu.ac.in

AY 2023-24

School of Electronics

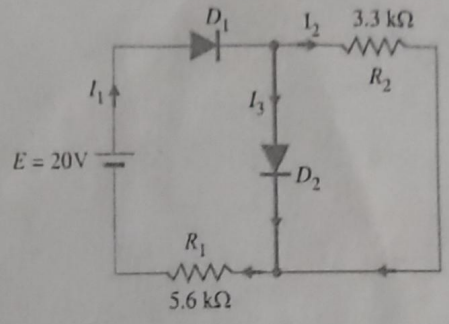
CURRICULUM: IIITUGECE22

Cycle Test – I

16 Oct.'2023 (9:00 AM – 10:00 AM)

Degree	B. Tech.	**Branch**	ECE
Semester	III		
Subject Code & Name	ECC301: ELECTRONIC DEVICES AND CIRCUITS		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sr. No.	Question	Marks
1.a	Discuss the concept of temperature coefficient of resistivity for semiconductors and conductors. Justify it.	(1)
1.b	Describe the energy band structures of an insulator, metal, and semiconductor.	(2)
1.c	Find the concentration of holes and electrons in N-type and P-type silicon at 300 K, μ_n=1300 cm^2/V-s and μ_p=500 cm^2/V-s, if the conductivity is 300 S/cm and intrinsic concentration is 1.5x10^{10}/cm^3.	(2)
2.a	Discuss the difference between Zener and Avalanche breakdown mechanisms.	(1)
2.b	A sample of silicon has a resistivity of 25x10^4 Ω-cm which is doped to the extent of 4x10^{10} donor atoms/cm^3 and 10^{10} acceptor atoms/cm^3. Find the total conduction current density if an electric field of 4 V/cm is applied across the sample for μ_n=1250 cm^2/V-s and μ_p=475 cm^2/V-s.	(2)
2.c	Determine the majority and minority carrier concentration for N-type semiconductors by using the electrical charge neutrality condition.	(2)
3.a	Define mass action law for semiconductors.	(1)
3.b	Demonstrate the concept of covalent bonding in N-type and P-type semiconductors using suitable doping examples.	(2)
3.c	Draw the V-I characteristics of the PN junction Si diode. Also mention the current equation for forward and reverse biased diode.	(2)

4.a	Given a diode current of 8 mA and n=1, find I_s if the applied voltage is 0.5 V at the temperature of 25^{0}C.	(1)
4.b	Determine the currents I_1, I_2, and I_3 for the network shown in Figure 1 for silicon diodes.  Figure 1	(2)
4.c	Define the drift current, diffusion current, mobility, and drift velocity of semiconductors. Explain the significance of Einstein's relation.	(2)

Good Luck

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CURRICULUM: IIITUGECE22
Cycle Test - I
October 16, 2023 (02:00 PM – 03:00 PM)

Degree	B. Tech.	**Branch**	ECE
Semester	III		
Subject Code & Name	ECC302: Digital Circuits and Systems		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. No.	Question	Marks
1.a	What does the base of the number system represent? Mention the base of Binary, Octal, Decimal and Hexadecimal number systems.	1
1.b	i) Convert $(10011.011)_2$ and $(5AC)_{16}$ to decimal number system. ii) Convert $(286.45)_{10}$ and $(0.875)_{10}$ to binary number system.	2
1.c	Our institute has a temperature sensor which measures daily temperature at the flag post in front of Admin block. It measures the temperature in HEXA DECIMAL format and displays the same in the DECIMAL format. After displaying it will store the temperature value in 8-bit BINARY format to a computer at the memory address location indicated by the current day in the month. Address location is represented in OCTAL format. i) If the temperature at the flag post is measured as $(20)_{16}$ on 16, Oct.'23, calculate the measured temperature to be displayed and the value stored in the memory location in the corresponding formats. ii) If the value stored at $(22)_8$ is $(00010111)_2$, find the date and temperature measured by the sensor.	2
2.a	Explain r's and (r-1)'s complement.	1
2.b	Consider two numbers A = $(23)_{10}$ and B = $(11)_{10}$, and perform the following operations using 2's complement: i) A – B ii) B – A	2
2.c	Explain the differences between BCD code and the Excess-3 code. Prove the self-complementary nature of the Excess-3 code with suitable example.	2
3.a	Classify the Logic gates into three categories, and draw the symbol of each logic gate.	1
3.b	Implement the following functions using suitable universal gates only: i) $A\overline{B}C + \overline{A}B + BC$ ii) $(A + \overline{B}).(\overline{A} + C).(B + \overline{C})$	2

3.c	Minimize the following functions F_1 and F_2 using Boolean Algebra, and implement the minimized functions using 2 input basic gates only: i) $F_1(x,y,z) = xyz + \bar{x}y + xy\bar{z}$ ii) $F_2(a,b) = ab + a\bar{b} + \bar{a}b$	2
4.a	Explain about canonical form and standard form representations with suitable examples.	1
4.b	Express the functions F_3 and F_4 in the canonical form using minterms and write the truth table. i) $F_3(x,y,z) = xy + \bar{x}y + yz$ ii) $F_4(a,b,c) = ab + a\bar{b}c + \bar{a}c$	2
4.c	Minimize the following expression using K-maps and implement the minimized expressions using NAND gates only: i) $F_5(x,y,z) = \sum m\,(0,2,3,4,6)$ ii) $F_6(p,q,r,s) = \sum m\,(0,1,2,4,8,10,15) + \sum d(5,6,7,9,13)$	2

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17, Oct.'2023 (9:00 AM – 10:00 AM)

Degree	B. Tech.	**Branch**	ECE
Semester	III		
Subject Code & Name	ECC303: ELECTROMAGNETIC FIELD THEORY		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sr. No.	Question	Marks
1.a	Graphically illustrate the positive divergence, negative divergence and zero divergence of a vector field A at point P.	(1)
1.b	Explain (in brief) the circulation of a vector.	(2)
1.c	Find out the angle between two vectors A and B where $A = 3a_x + 4a_y + a_z$ $B = 2a_y - 5a_z$	(2)
2.a	Show that the Laplacian operator (∇^2) is a scalar quantity.	(1)
2.b	Determine the curl of a vector field 'A' where A is given as $A = x^2 yz a_x + xz a_z$	(2)
2.c	Express the point $P(-2,6,3)$ in cylindrical and spherical coordinates.	(2)
3.a	Discuss the conditions for a vector field to be: i.) Solenoidal $\nabla \cdot A = 0$ ii.) Irrotational $\nabla \times A = 0$	(1)
3.b	If a point $P(x,y,z)$ in Cartesian coordinate system is expressed by point $P(r,\theta,\phi)$ in spherical coordinate system, then show that: $r = \sqrt{x^2 + y^2 + z^2}$ $\theta = \tan^{-1}\left(\frac{\sqrt{x^2 + y^2}}{z}\right)$ $\phi = \tan^{-1}\left(\frac{y}{x}\right)$	(2)

	Also, verify the following equations: $x = r\sin(\theta)\cos(\phi)$ $y = r\sin(\theta)\sin(\phi)$ $z = r\cos(\theta)$	
3.a	Determine the divergence of the following vector field 'A' $A = yza_x + 4xya_y + ya_z$ and evaluate them at a point $P(1,-2,3)$.	(2)
4.a	Points P and Q are located at (0,2,4) and (-3,1,5). Find out a vector parallel to PQ with magnitude of 10.	(1)
4.b	"The cross product of two vectors is anti-commutative." Is the given statement true or false? Justify the answer.	(2)
4.c	What is field? Distinguish between scalar and vector fields with suitable examples.	(2)

*** GOOD LUCK ***