INDIAN INSTITUTE OF INFORMATION TECHNOLOGY UNA [HP]

An Institute of National Importance under MoE

Saloh, Una (HP) – 177 209

Website: www.iiitu.ac.in

AY 2022-23

School of Electronics

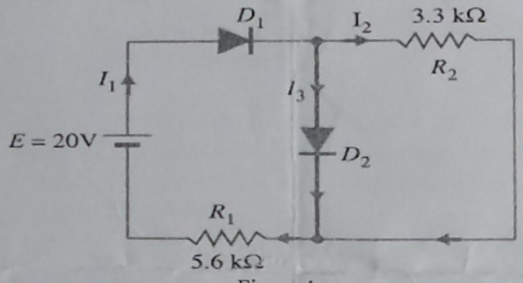
CURRICULUM: IIITUGECE22

Cycle Test – I

26, Oct.'22

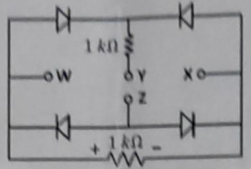
Time: 9:00AM-10:00AM

Degree	B. Tech.	**Branch**	ECE
Semester	III		
Subject Code & Name	ECC301: Electronic Devices and Circuits		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Discuss the difference between Zener and Avalanche breakdown mechanism.	(1)
1.b	Determine the majority and minority carrier concentration for N-type semiconductor by using the electrical charge neutrality condition.	(2)
1.c	Draw the energy band diagram of PN junction diode in forward and reverse bias. Also derive the expression for barrier potential of PN junction diode.	(2)
2.a	Discuss the concept of temperature coefficient of resistivity for conductors and semiconductors. Justify it.	(1)
2.b	Determine the currents I_1, I_2 and I_3 for the network shown in Figure 1 for silicon diodes.  Figure 1	(2)
2.c	Define the drift current, diffusion current, mobility and drift velocity of semiconductor. Explain the significance of Einstein relation.	(2)
3.a	Obtain the internal electric field for non-uniform P-type semiconductor?	(1)

$v_d = \mu E$

$I = \frac{V}{R}$

3.b	A voltage 1000sin(ωt) volts is applied across YZ terminals of Figure 2. Assuming ideal diodes, calculate the voltages measured across WX terminals.  Figure 2	(2)
3.c	Design a voltage regulator that will maintain an output voltage of 20 V across a 1-kΩ load with an input that will vary between 30 V and 50 V. Determine the value of R_S and the maximum current I_{ZM}.	(2)
4.a	Draw the V-I characteristics of PN junction diode for Si and Ge. Also mention the current equation for forward and reverse biased diode.	(1)
4.b	Si sample is doped with 10^{17} Arsenic (As) atoms/cm^3. What is the equilibrium minority and majority concentration at 300 K? Where E_F lies relative to E_I for this semiconductor?	(2)
4.c	Explain the significance of the continuity equation and derive the expression of carrier concentration for electron and hole with respect to time.	(2)

**** GOOD LUCK *****

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
UNA [HP]
An Institute of National Importance under MoE
Saloh, Una (HP) – 177 209
Website: www.iiitu.ac.in

School of Electronics
CURRICULUM: IIITUGECE22
Cycle Test - I
October 26, 2022

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

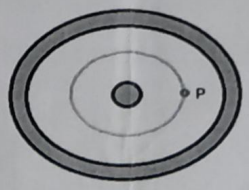
Sl. No.	Question	Marks
1.a	What does the base of the number system represent? Mention the base of Binary, Octal, Decimal and Hexadecimal number systems.	1
1.b	Convert the following numbers into decimal number system: i) $(10011)_2$ = _____ ii) $(5A)_{16}$ = _____	2
1.c	Perform the binary addition of $(01011001)_2$ and $(10110)_2$, and show the result in Hexadecimal number system.	2
2.a	Explain r's and (r-1)'s complement.	1
2.b	Consider two numbers A = $(25)_{10}$ and B = $(9)_{10}$, perform binary subtraction using 2's complement method for the following: i) A – B, and, ii) B –A	2
2.c	A source station in IIIT Una is transmitting the data in BCD format to a remote receiving station using Hamming error detection and correction coding method. Source needs to transmit the data "302" to the receiver, evaluate the code that needs to be transmitted using even parity.	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 NAND gates only. i) $A\overline{B} + \overline{A}B$ ii) $A + \overline{B}C$	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) $F_1(x, y, z) = xyz + \overline{x}y + xy\overline{z}$ ii) $F_2(a, b) = ab + a\overline{b} + \overline{a}b$	2

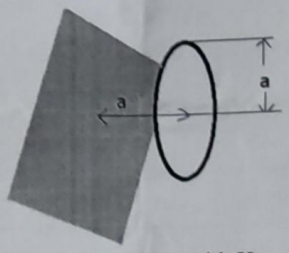
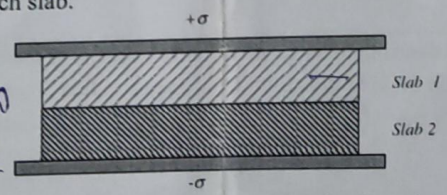
4.a	Explain about canonical form and standard form representations with suitable examples.	1
4.b	Express the functions F_3 and F_4 in the form of a truth table by forming the minterms. i) $F_3(x,y,z) = xy + \bar{x}y + yz$ ii) $F_4(a,b,c) = ab + a\bar{b}c + \bar{a}c$	2
4.c	Minimize the following expression using K-maps and implement the minimized expressions using 2 input basic gates only. i) $F_5(x,y,z) = \sum m\,(0,2,3,4,6)$ ii) $F_6(x,y,z) = \sum m\,(1,3,4,5,6,7)$	2

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
UNA [HP]
An Institute of National Importance under MoE
Saloh, Una (HP) – 177209
Website: www.iiitu.ac.in

AY 2022-23
School of Electronics
Cycle Test – I
27, October'22

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

Sl. No.	Question	Marks
1.a	Identify scalar and vector quantities from the list given below: Electric current, relative permeability, weight, magnetic field density	(1)
1.b	Prove Vector addition is commutative and associative.	(2)
1.c	Comment on "Two vectors are mathematically equivalent but physically not" with an elaborative example.	(2)
2.a	A charge of $6x10^{-8}C$ is distributed uniformly upon surface of a sphere with radius 1 cm. It is covered by a concentric-hollow conducting sphere of radius 5 cm as shown in Figure 1. Find the electric field at a point 'P' which is 2 cm away from the centre.  Figure 1: Sphere for Question 2a.	(1)
2.b	State and prove any one application of the Gauss Law.	(2)
2.c	The electric field intensity in free space is: $E(r) = \hat{x}Xx^2 + \hat{y}Yz + \hat{z}Zx^2z$ with $X = 6\ V/m^3; Y = 3\ V/m^2; Z = 2\ V/m^4$. Compute the charge density value at $r = 3\hat{x} - 2\hat{y}\ m$.	(2)
3.a	Define the term "Method of Images".	(1)
3.b	A hoop carries a uniformly distributed net charge with a linear density of λ . The hoop is positioned parallel to a neutrally-charged infinite conducting plane such that its distance from the plane equals the radius of hoop ('a') as shown in Figure 2. The electric field on the axis of such a ring is given by:	(2)

	$$E = \frac{\lambda a x}{2\varepsilon_0 (a^2 + x^2)^{3/2}}$$ Where x is the distance from the ring along the axis. The field points along the axis of the ring, toward (for negative charge), or away from (for positive charge) the ring. A charged point particle is placed at the center of the ring. This particle has the same total charge as the ring, but it has the opposite sign. Find the magnitude and direction of the net force on this particle in terms of λ.  Figure 2: Infinite Conducting Plane with Hoop for Question 3b.	
3.c	Explain Poisson's Equation and Laplace Equation. Are both equations inter-related?	(2)
4.a	Convert the Cylindrical coordinates for (2,0.345,−3) into Spherical coordinates.	(1)
4.b	Derive the electric field near a plane of charge to show the field contribution from only a single hoop.	(2)
4.c	The space between the plates of a parallel-plate capacitor (see Figure 3) is filled with two slabs of linear dielectric material. Each slab has thickness s, so that the total distance between the plates is 2s. *Slab-1* has a dielectric constant of 2, and *slab-2* has a dielectric constant of 1.5. The free charge density on the top plate is σ and on the bottom plate is $-\sigma$. The Displacement flux (D) through *Slab-1* and *Slab-2* is given as $-\sigma\hat{k}$. Find:- (i) Electric field E in each slab. (ii) Polarization P in each slab.  Figure 3: Parallel-Plate Capacitors for Question 4c.	(2)

GOODLUCK

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY UNA [HP]

An Institute of National Importance under MoE

Saloh, Una (HP) – 177 209

Website: www.iiitu.ac.in

AY 2022-23

School of Electronics

CURRICULUM: IIITUGECE22

Cycle Test – I

27, Oct.'22

Time: 02:00PM-03:00PM

Degree	B. Tech.	**Branch**	ECE
Semester	III		
Subject Code & Name	ECC304: COMMUNICATION SYSTEMS		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Discuss the need of modulation.	1
1.b	Derive the expression for single tone Amplitude Modulation.	2
1.c	A message signal given by $m(t) = \frac{1}{2}cosw_1t - \frac{1}{2}sinw_2t$ is amplitude modulated with a carrier of frequency w_c to generate $s(t) = [1 + m(t)]cosw_ct$. What is the power efficiency achieved by this modulation scheme.	2
2.a	Draw the circuit diagram of Envelope detector. Write the conditions for charging and discharging time constants?	1
2.b	Explain the demodulation of DSB-SC scheme.	2
2.c	A carrier of $10cos2\pi * 10^6t$ is amplitude modulated by a message signal of having frequencies 1Khz and 5Khz with modulation indexes of 0.6 and 0.8 respectively. Find all the parameters and plot the spectrum.	2
3.a	Differentiate between Amplitude Modulation and Narrow band frequency modulation techniques.	1
3.b	Derive the general expression for single tone Frequency Modulation.	2
3.c	A carrier signal $20cos2\pi * 10^{10}t$ is DSB modulated by a message signal of $m(t) = cos2\pi * 10^5t + 4cos4\pi * 10^5t + 8cos6\pi * 10^5t$. Calculate the bandwidth, modulation efficiency, and total transmitted power.	2
4.a	Write the drawbacks of Amplitude modulation.	1
4.b	Draw the frequency spectrum of AM, DSB-SC and SSB-SC modulation scheme for sinusoidal message signal.	2
4.c	An FM signal is having maximum frequency deviation of 10Khz and corresponding message frequency component of 4Khz. Find the modulation index β and Bandwidth of FM signal.	2

****** GOOD LUCK *******