

2022 KVC P 1079

Indian Institute of Information Technology, Kota
B.Tech. (Computer Science and Engineering), II Semester
Mid Term Examination, Even Semester (2022-23)

Data Structures and Algorithms (CST102)

Marks: 30 (Weightage – 40%)

Time: 90 minutes

Date: 9/05/2023

Question 1

(3 Marks)

State true or false, if true write constant values (c and n_0) to justify the answer.

f(n)	is $f(n) = O(n^2)$?
log n	
2^n	
n!	

Question 2

(3 Marks)

Analyze the running time complexity for the following code.

```
int i = 1;
for(; i <= n log n; i++)
{
    for(i++; i <= n; i++)
    {
        printf("1")
    }
}
```

Question 3

(4 Marks)

Which of the sorting method will be best if the number of swappings done is the only measure of the efficiency? Justify your answer with an appropriate example.

Question 4

(1.5+2+1.5 = 5 Marks)

Discuss Quicksort with center as pivot with suitable example, algorithm, and explanation for the algorithm.

Question 5

(2+3 = 5 Marks)

Analyze the average number of comparisons performed by the merge sort algorithm, in merging two sorted lists of length n. Justify your answer with an appropriate example.

(5 Marks)

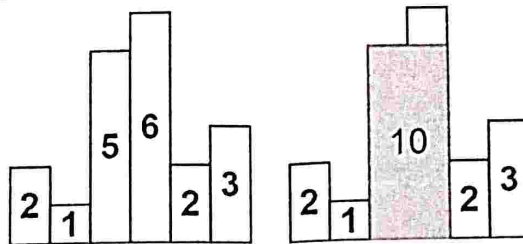
Question 6

Given an array of integers representing the histogram's bar height where the width of each bar is 1, Write an algorithm to return the area of the largest rectangle in the histogram.

Input: heights = [2,1,5,6,2,3]

Output: 10

Explanation: The above is a histogram where the width of each bar is 1.
The largest rectangle is shown in the red area, which has an area = 10 units.



Question 7

(5 Marks)

Given an unsorted array *Arr* of size *N* of positive integers. One number 'A' from set {1, 2, ...N} is missing and one number 'B' occurs twice in the array. Write an algorithm to find these two numbers.

Example Input: $N = 2$, $Arr[] = [2, 2]$ Output: Missing number is 1 and Repeating Number is 2

Example Input: $N = 4$, $Arr[] = [2, 2, 3, 1]$

Output: Missing number is 4 and Repeating Number is 2.

-----Best Wishes

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B.Tech. (CSE+ECE), Semester – II
Mid Term Examination, Even Semester 2022-23

Fundamentals of Electrical Engineering (ECT104)

Marks: 30 (Weightage – 30%)

Time: 90 minutes

Date: 6th May 2023

Instructions:

- (a) There are a total of six questions. All questions are compulsory.
- (b) Assume suitable data (if any).
- (c) Calculators are allowed.

1. A power transformer, rated at 2300 : 230 V, 60 Hz, 46 kVA, is to be modeled as a non-ideal transformer. When the high-voltage winding is the primary, the open circuit test results in readings of 2300 V, 0.35 A, and 400 W; and the short circuit test results in 40 V, 20 A, and 350 W. Find the model parameters R_m , X_m , R_s , and X_s . (6 marks)
2. Find $v_2(t)$ for the circuit shown in Fig. (1). Given $v_1(t) = 5\cos(6t+30^\circ)$. (5 marks)

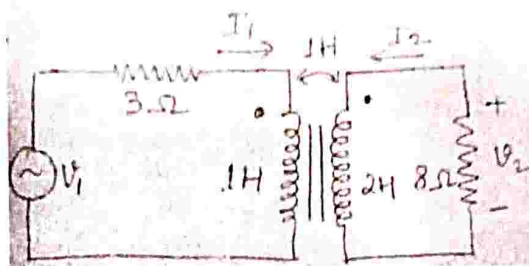


Fig (1)

3. For the ideal transformer circuit in Fig. (2), $N = 0.1$ and $Z_g = 10 \text{ K}\Omega$. Find (a) Z_L for maximum power, (b) V_g/I_1 , and (c) V_2/V_g . (5 marks)

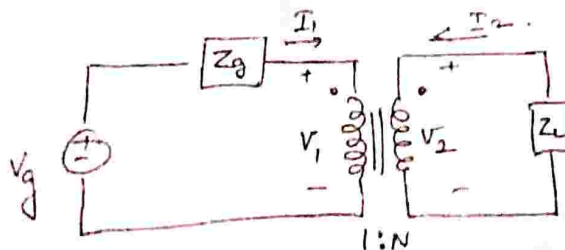


Fig. (2)

4. The coil of a moving coil voltmeter is 40 mm long and 30 mm wide and has 100 turns on it. The control spring exerts a torque of $240 \times 10^{-6} \text{ N-m}$ when the deflection is 160 divisions on full scale. If the flux density of the magnetic field in the air gap is 1.0 Wb/m^2 , estimate the resistance that must be put in series with the coil to give one volt per division. The resistance of the voltmeter coil may be neglected. (5 marks)
5. The four arms of a Wheatstone bridge are as follows: $AB = 100 \Omega$, $BC = 10 \Omega$, $CD = 4 \Omega$ and $DA = 50 \Omega$. The galvanometer has a resistance of 20Ω and is connected across BD. A source of 10 V d.c. is connected across AC. Find the current through the galvanometer.

$$40 \Omega$$

What should be the resistance in the arm DA for no current through the galvanometer?

(4 marks)

6. A sheet of bakelite 4.5 mm thick is tested at 50 Hz between electrodes 0.12 m in diameter. The Schering bridge (shown in Fig. (3)) employs a standard air capacitor C_2 of 106 pF capacitance, a non-reactive resistance R_4 of $1000/\pi \Omega$ in parallel with a variable capacitor $C_4 = 0.5 \mu\text{F}$, and a non-reactive resistance R_3 .

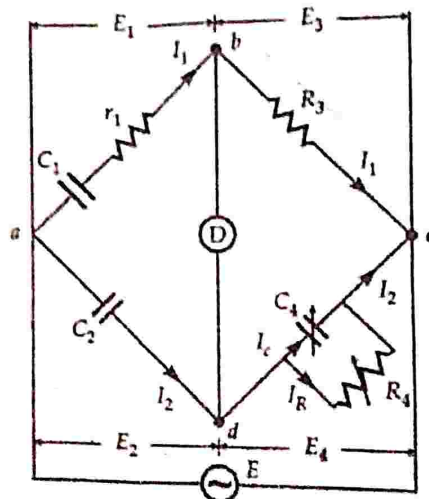


Fig. (3)

Balance is obtained with $C_4 = 0.5 \mu\text{F}$ and $R_3 = 260 \Omega$. Calculate the capacitance C_1 , dissipation factor and relative permittivity of sheet. (Assume $\epsilon_0 = 8.84 \times 10^{-12} \text{ F/m} =$ permittivity of free space)

(5 marks)

$$129.77 \text{ pF}$$

XXXXXXXXXXXXXXXXXXXXX
All the best

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, KOTA

B.Tech. (CSE and ECE) I year, Semester- II

Mid Term Examination, Even Semester 2022-23

Technical Writing and Presentation Skills (TWPS) (HST 102)

Time: 1.5 hrs.

MM: 30 (Weightage -30%)

Date: 4th May, 2023

Instructions: *All questions are compulsory.*

Follow the order of questions and do all questions of same section together.

SECTION A: Answer the following question in about 120 words each

(3*4=12)

1. What is Technical Writing? Point out 5 ways in which it is different from academic writing. Also explain briefly the 7C's of Effective Technical communication?
2. What is 'Cross- Cultural Communication? What is the need to understand cross cultural communication and how can a global mindset be developed?
3. Identify the different dimensions of culture and explain them. Also draw a labeled cultural Iceberg.
4. What is Negotiation? What are the different approaches of Negotiations? Explain with a help of a quadrant diagram.

5. Explain the following terms in not more than 30 words each.

(1*8=8)

- | | | | |
|-------------------------|---------------------------|---------------------|-----------------------|
| a) Stereotype | b) Melting Pot | c) Cultural Synergy | d) plagiarism |
| e) Bcc and Cc in emails | f) use of visuals in ppts | g) voice inflection | h) transition markers |

SECTION B: Writing Skills

(3)

- 6. As the Sales Manager of a company, draft an email reply which has to be sent to three customers who have complaint about your product. Invent necessary details to convey your point.**

SECTION C: Vocabulary

7. Give the meaning of the following word pairs.

(3)

- | | | |
|-------------------|----------------|-----------------------|
| a) affect/ effect | b) adept/adopt | c) augment/supplement |
|-------------------|----------------|-----------------------|

8. Fill in the blanks as per subject-verb agreement:

(2)

- a) The number of jobs Increasing in the technology sector.
- b) Each of the runners going at top speed.

9. Give the meaning of the following words

(2)

- a) Boisterous
- b) Enervate
- c) Clandestine
- d) vociferous

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B.Tech. (CSE+ECE), Semester – II
Mid Term Examination, Even Semester 2022-23

Electronic Devices and Circuits (ECT102)

Marks: 30 (Weightage – 30%)

Time: 90 minutes

Date: May 8, 2023

Note: Attempt all questions in sequence. Attempt all parts of a question at one place. Show all the steps.

Q1. The intrinsic resistivity of Ge is $47 \Omega\text{-cm}$ at 300 K. The mobility of Holes for Ge is $1900 \text{ cm}^2/\text{V-sec}$ and mobility of Electrons for Ge is $3900 \text{ cm}^2/\text{V-sec}$. [4M]

a) Find the intrinsic carrier concentration.

b) Drift velocity of holes and electrons for applied Electric field of 100 V/cm .

Q2. For the circuit shown in Fig. A, find the maximum and minimum values of Zener diode current. [4M]

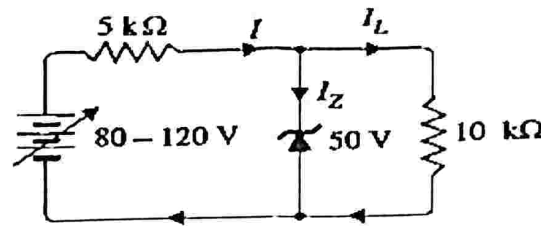


Fig. A

Q3. Design the diode based circuit using p-n junction diode and/or Zener diode and/or other necessary components to achieve the output waveform shown in Fig. B. Assume the input signal given to the circuit is $10 \sin 200\pi t$ volts. [4M]

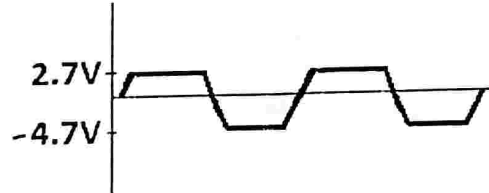


Fig. B

Q4. Draw and elaborate the input and output characteristics of CB and CE Configurations of BJT. [4M]

Q5. For the diode circuit shown in Fig. C, $V_S = 6 \text{ V}$ and the silicon diodes have a saturation current of 1 nA at 300 K. Find R_1 and R_2 for the case that $v_1 = 0.7 \text{ V}$ and $v_2 = 0.65 \text{ V}$ at 300 K. [4M]

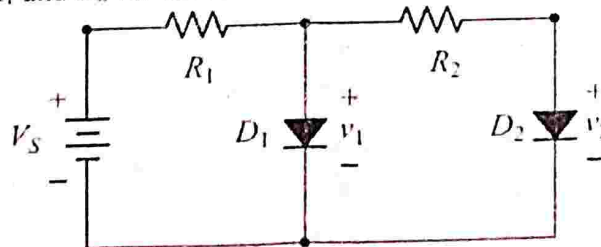
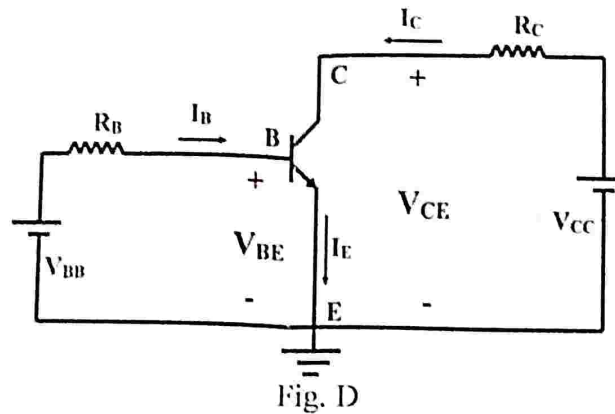


Fig. C

Q6. For the CE transistor circuit shown in Fig. D, given that $V_{BB} = 5\text{ V}$, $V_{CC} = 15\text{ V}$, $R_B = 100\text{ k}\Omega$, $R_C = 2\text{ k}\Omega$, $\beta = 100$, $V_{BE, \text{ACTIVE}} = 0.7\text{ V}$ and $I_{CBO} \approx 0\text{ mA}$. Assume active region of operation for npn transistor and determine the values of I_B , I_C , I_E , and V_{CE} . [4M]



Q7. Explain the following terms briefly with necessary schematic diagram and equation: Contact potential for a pn junction diode, Transition capacitance for a pn junction diode, Ideal diode model, Clamper circuit. [6M]

*** The End ***

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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTA

Even Semester 2022-23, Mid-term Examination

MAT 102 – Mathematics - II

May 3, 2023

Time duration: 1.5 hrs

INSTRUCTIONS:

1. This examination paper contains **FIVE** questions and comprises **TWO** printed pages including this one. All questions are to be answered.
2. The marks for each question are indicated on the right. Notation and terminology are and should be as defined in the class.
3. Answer each question beginning on a **FRESH** page. All parts of a question must be answered together in one place. If multiple answers are provided for any question, only the first attempt will be graded.
4. **NO CALCULATORS**, mobiles or any other electronic devices should be found in your possession.

Question 1.

- i) Which ingredient from vector calculus did we use while proving Cauchy's integral theorem in the lectures? [1]
- ii) Evaluate $\oint_C \sin z \, dz$, where C is given by $x^4 + y^4 = 1$. Justify. [2]
- iii) Let C be the positively oriented circle of radius r around $z_0 \in \mathbb{C}$. Using appropriate change of variables, show that [3]

$$\oint_C \frac{dz}{(z - z_0)^n} = \begin{cases} 2\pi i & \text{if } n = 1, \text{ and} \\ 0 & \text{if } n \text{ is any other integer.} \end{cases}$$

Question 2. If a particle moves with a constant speed c , show that its acceleration vector $\mathbf{a}(t)$ is perpendicular to its velocity vector $\mathbf{v}(t)$. [4]

Question 3. Find a unit normal vector and the equation of the tangent plane to the surface $y = x^2 + z^2$ at $(-1, 2, -1)$. [5]