

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

Data Structures and Algorithms (CST102)

Marks: 40 (Weightage – 40%)

Time: 120 minutes

Date: 9/8/2023

Question 1

(5 Marks)

Analyze the time and space complexity of the following code of a recursive algorithm that calculates the factorial of a number:

```
def factorial(n):
```

```
    if n == 0:
```

```
        return 1
```

```
    else: P
```

```
        return n * factorial(n - 1)
```

$O(n)$

Question 2

(5 Marks)

Given a string containing only parentheses ('(', ')'), write an algo to determine if the parentheses are correctly matched and nested. The algo takes a string as input and returns "True" if the parentheses are correctly matched and nested, and "False" otherwise. For example:

Correct: "()", "(())", "((()))"

Incorrect: "(", ")", "(()", "())"

Question 3

(5 Marks)

Given a linked list, determine if it contains a cycle (loop). A cycle occurs when a node in the linked list points back to a previously visited node, creating a loop.

Question 4

(5 Marks)

What is the value of the postfix expression 5 2 7 3 + - *. Answer in detail. -60

Question 5

(5 Marks)

Implement pow(x, n), which calculates x raised to the power n (i.e., x^n) using recursion.

Question 6

(5 Marks)

Level of a node is the distance from the root to that node. For example, the level of root is 1 and levels of left and right children of root is 2. Analyze the maximum number of nodes on level i of a binary tree.

Question 7

(5 Marks)

The in-order and preorder traversal of a binary search tree are d b e a f c g and a b d e c f g respectively. What will be the post order traversal of the tree? Explain each step in detail.

debfgca

Question 8

(5 Marks)

Breadth First Search (BFS) is started on a binary tree beginning from the root vertex. There is a vertex t at a distance three from the root. If t is the n-th vertex in this BFS traversal, then the maximum possible value of n will be? Justify your answer.

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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTA

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

Electronic Devices and Circuits (ECT102)

Marks: 40 (Weightage – 40%)

Time: 120 minutes

Date: August 8, 2023

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

Q1. (a) Define negative and positive feedback. (b) With help of schematic diagrams, show the four topologies of the negative feedback amplifiers. (c) Mention the effect of negative feedback on following quantities – input impedance, output impedance, transfer function gain, bandwidth. (d) Define Barkhausen criterion for sinusoidal oscillators. [1+2+4+1 = 8M]

Q2. (a) Differentiate between intrinsic and extrinsic semiconductors. Mention eight different points. (b) With the help of schematic and circuit diagrams, explain the diode switching times. (c) Explain avalanche and zener breakdown phenomenon in pn-junction diode. Also draw the pn-junction characteristic curves indicating the effects of temperature $T_2 > T_1$. (d) With the help of schematic and circuit diagrams, explain the working of the n-channel EMOSFET. Also draw the output and transfer characteristics of the n-channel EMOSFET. [2+2+2+2 = 8M]

Q3. For the circuit shown in Fig. 1, suppose that $V_{BB} = 2.5$ V, $V_{CC} = V_{EE} = 5$ V, $R_B = 10$ k Ω , and $R_C = R_E = 100$ Ω . Determine the minimum value of h_{FE} required for saturation. [6M]

Q4. The common-emitter BJT amplifier given in Fig. 2 has $h_{fe} = h_{FE} = 100$, $R_1 = 90$ k Ω , $R_2 = 10$ k Ω , $R_s = 10$ k Ω , $R_C = 1$ k Ω , $R_E = 0$ Ω , and $V_{CC} = 16$ V. Find (a) Q-point value I_{CQ} , (b) Q-point value V_{CEQ} , (c) transconductance g_m , (d) ac emitter resistance r_e , (e) input resistance as seen by the source R_{in} , (f) ac voltage gain as ratio of collector voltage to base voltage $A_v = v_c/v_b$, (g) ac voltage gain as ratio of collector voltage to source voltage $A_{vs} = v_c/v_s$. [2+2+1+1+2+2+2 = 12 M]

Q5. For the common-source amplifier using n-channel EMOSFET given in Fig. 3, when $K = 0.25$ mA/V², $V_t = 2$ V, $R_D = R_S = 1$ k Ω , $R_1 = R_2 = 2$ M Ω , and $V_{DD} = 20$ V, then the MOSFET is biased in the active region at $I_{DQ} = 4$ mA and $V_{GSQ} = 6$ V. Find (a) ac voltage gain as ratio of drain voltage to gate voltage $A_v = v_d/v_g$, (b) input resistance as seen by the source R_{in} , and (c) the output resistance R_o as seen by an external load if connected to the drain of the MOSFET. Assume r_d is infinite. [2+2+2 = 6M]

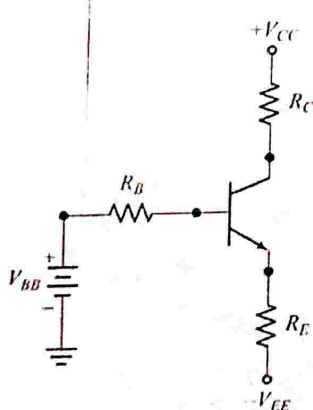


Fig. 1

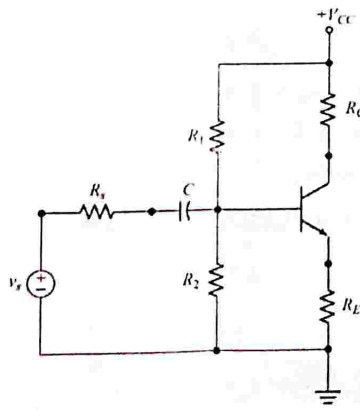


Fig. 2

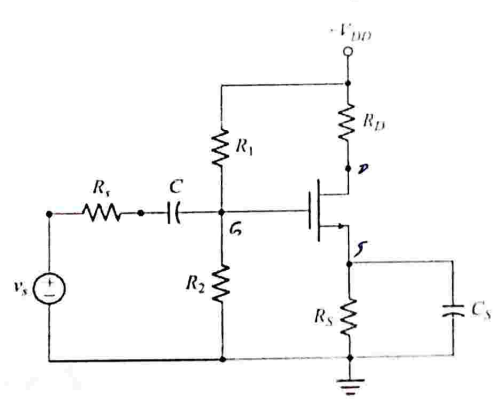


Fig. 3

*** The End ***

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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTA

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

Fundamental of Electrical Engineering (ECT104)

Marks: 30 (Weightage – 30%)

Time: 100 minutes

Date: August 07, 2023

Note: Attempt all questions of PART-A and PART B both.

PART-A

1. Explain the working of TTL NOR gate Totem pole output? Compare with other logic families. [4 + 2]

2. Explain AND gate, OR gate and NOR gate using Diodes. [3]

3. Design the following gates using CMOS logic families

- (i) NAND,
- (ii) NOR and
- (iii) EX-OR logic gates.

[2 + 2 + 2]

PART-B

4. Explain the working principle and construction of DC machines. [2+2]

5. The magnetic field produced by the stator winding of 3-phase Induction Machine is rotating in nature. Explain in detail with neat diagrams. [4]

6. What are the four conditions for connecting two synchronous generators in parallel? [3]

7. A 4-pole, wave wound DC shunt generator has an induced emf of 254 volts. When the generator is loaded, the terminal voltage is 240 volts. The armature resistance is 0.04 ohm and the field resistance is 24 ohms. Neglecting the armature reaction, calculate the load current and the current per armature conductor. [2]

8. A 3-phase, 2 pole induction motor is supplied by 400 V, 50 Hz supply. Calculate the actual rotor speed and rotor frequency when the slip is 4%. [2]

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTA

B.Tech. I Year (CSE, ECE)

End Term Examination, Even Semester 2022-23

Technical Writing & Presentation Skills (HST 102)

Marks: 40 (Weightage: 40 %)

Time: 2 Hrs.

Date: 4th Aug, 2023

Instructions: The paper consist of 7 questions and all questions are compulsory. Follow the word limit.

(1 *8= 8)

1. Define the following terms in not more than 25 words each

- | | | | |
|-----------------------------|--------------------|-------------------------|-------------------|
| a) Gesture | b) Meeting Agenda | c) circumlocution | d) Sales Pitch |
| <u>e) Lexical ambiguity</u> | f) Exit Interviews | g) interpersonal skills | h) Mock Interview |

(2*8=16)

2. Answer each questions in about 60 words. Each question is of 2 marks:

- What is the purpose of conducting meetings? Suggest 3 ways to make them effective.
- What are 5 main attributes that employers are looking for in any candidate during the interview?
- Define the term 'Brainstorming'? What is the purpose of this technique in communication?
- Explain the term 'Presentation Skills'? Suggest some ways to make your Presentations memorable?
- Write a short note on Data Visualization and Delivery?
- Point out four ways of making Technical writing more structured?
- Discuss four Do's and four Don'ts that should be kept in mind during an interview?
- What is a Slogan? Point out some characteristics of slogan writing?

3. Write a paragraph in about 120 words on the topic "Knowledge Industry in India "by using

(any 8 of) the following terms:

(5)

Information, stimulation, impetus, strategies, abundant,
Emergence, Empirically, alleviation, liberalization, stringent

4. Design and draw the contents of two slides of a Presentation (PPT) on the Topic -- 'Virtual Reality'. (4)
5. Draft Minutes of a meeting of the 3 rd Annual Sports Event Committee meeting of your college. Furnish necessary details along with agenda points that were discussed during the meeting. (4)
6. Make a slogan for a new model of a 'wrist watch' in less than 10 words? (1)
7. Read the paragraph carefully and present the data in visual form /graphical representation. (2)

The education sector in India was estimated to be worth US\$ 117 billion in FY20 and is expected to reach US\$ 225 billion by FY25. India has over 250 million school-going students, more than any other country. India had 38.5 million students enrolled in higher education in 2019-20, with 19.6 million male and 18.9 million female students.

According to UNESCO's 'State of the Education Report for India 2021', the Pupil Teacher Ratio (PTR) at senior secondary schools was 47:1, as against 26:1 of the overall school system. The number of colleges in India stood at 43,796 in FY21. As of November 25, 2022, the number of universities in India stood at 1,072. In 2022-23, there are 8,902 total AICTE approved institutes in India. Out of these 8,902 institutes, there are 3,577 undergraduate, 4,786 postgraduate and 3,957 diploma institutes.

The Indian edtech market size is expected to reach US\$ 30 billion by 2031, from US\$ 700-800 million in 2021. According to KPMG, India has also become the second largest market for E-learning after the US. The online education market in India is expected to grow by US\$ 2.28 billion during 2021-2025, growing at a CAGR of almost 20%. The market grew by 19.02% in India in 2021.

Indian Institute of Information Technology, Kota
B.Tech(CSE+ECE), Semester-II
End Term examination odd semester 2022-23
Mathematics-II (MAT102)

Maximum Marks: 40

Time: 120 minutes

Date: 3 August, 2023

1. Use the divergence theorem to evaluate the surface integral $\iint_S \mathbf{v} \cdot \mathbf{n} dA$. 1161.67
 $\mathbf{v} = 5xy\hat{i} + 3y\hat{j} + x^2\hat{k}$. D is the region bounded by $x + y = 4$, $x = 0$, $y = 0$, $z = 0$ and $z = 4$.
2. Find the directional derivative of the given scalar function at the given point in the indicated direction and find the vectors that give the direction of maximum and minimum increase.
 xyz . $(1, 4, 3)$, in the direction of the line from $(1, 2, 3)$ to $(1, -1, -3)$.
3. Evaluate the following integral using the residue theorem.
 $\oint_C \frac{1-z}{z^3(1-z)} dz$, $C : |z| = \frac{1}{2}$ $-2\pi i$
4. Show that the vector field defined by the vector function $\mathbf{v} = xyz(y\hat{i} + xz\hat{j} + xy\hat{k})$ is conservative.
5. Find the work done by the force $\mathbf{F} = -xy\hat{i} + y^2\hat{j} + z\hat{k}$ in moving a particle over the circular path $11/7$
 $x^2 + y^2 = 4$, $z = 0$ from $(2, 0, 0)$ to $(0, 2, 0)$.
6. Show that the Laplace transform of $\sin \sqrt{t} = \frac{1}{2s} \sqrt{\frac{\pi}{s}} e^{-\frac{1}{4s}}$ given $\Gamma(\frac{1}{2}) = \sqrt{\pi}$ and $\Gamma(n+1) = n\Gamma(n)$
7. State the sufficient conditions for existence of the Laplace transform.
8. Find the partial differential equation of all spheres whose centre lies on the plane $z = 0$ and whose radius is r
9. Find the Fourier transform of $f(x) = e^{-a|x|}$
10. Show that the function $f(z) = |z|^4$ satisfies the Cauchy-Riemann equations only at the origin.