

**SASTRA Deemed to be University**  
**First Year – B.Tech Computer Science and Business Systems**  
**First Continuous Internal Assessment – March 2023**  
**ENG138 Business Communication & Value Science – II**

**Duration: 90 mts**                                   **Marks: 50**

**I. Answer all the questions.**                                   **(5x4=20 Marks)**

- 1) Explain any four types of branding.
- 2) Correct the paragraph by adding appropriate punctuation and capitalization.

winston is one of the most laid-back people i know he is tall and slim with black hair and he always wears a t-shirt and black jeans his jeans have holes in them and his baseball boots are scruffy too he usually sits at the back of the class and he often seems to be asleep however when the exam results are given out he always gets an A i don't think hes as lazy as he appears to be
- 3) Describe the dos and don'ts of the secret of good writing.
- 4) Write an advertising tagline and create a logo for any two electronic devices of your choice. The two devices should have separate taglines and logos.
- 5) Describe the benefits of microblogs.

**II. Answer all the questions:**                                   **(2x15=30 Marks)**

**6) Write a five-paragraph essay that answers the prompt**

Sometimes when we meet someone, we have no idea how important that person will become to us later in our lives. Describe the time you first met someone who later became very important to you.

**7) Write a story based on the given pointers in about 300 words.**

**Also, give a title to your story.**

**'The man pleads for mercy.'**

**SASTRA Deemed to be University**

**First Year – B.Tech Computer Science and Business Systems  
Second Continuous Internal Assessment – May 2023  
ENG138 Business Communication & Value Science – II**

**Duration: 90 Minutes                          Marks: 50**

**I. Answer all the questions.                          (5x4=20 Marks)**

- 1) Write a paragraph about the career you are considering. Explain why you are choosing that career path, and how you plan to accomplish your goals.
- 2) Explain the five personality traits of Lindgren.
- 3) Write down the differences between empathy and sympathy with examples.
- 4) State the importance of feedback in a PowerPoint presentation.
- 5) Discuss any four narrative techniques with examples.

**II. Answer all the questions:                          (2x15=30 Marks)**

- 6) Describe Meredith Belbin's team roles with their strengths and allowable weakness.
- 7) i) Read the following passage and answer the questions given below:                          (10 Marks)

A demonetization that delegitimizes a certain currency, or even certain denominations of it, would extinguish wealth held in that form. What we have seen, however, is a less extreme case. In this one, holders of Rs.500 or Rs.1000 notes can exchange them or pay these into their bank accounts. This does not extinguish wealth as much as it will bring the hoards into the taxman's radar when their owners draw upon them to make payments. For, as these will be bank transactions there would be a record of them. So, existing black money cannot be used to generate more of the same. To this extent,

the scheme cannot be faulted. Of course, it cannot be assumed that what is in a bank will necessarily be declared to the income tax authorities, but it will certainly come under scrutiny in a way that it was not when stashed under the mattress.

What are some reasons why we may welcome such a move?

First, the concealment of income to avoid tax is a crime. So, in a constitutional democracy such as ours, those who avoid taxes deserve to be punished. Second, to evade the law, those with unaccounted wealth proceed to corrupt others, most importantly representatives of the state. This criminalizes the system further. If democracy is a way of actualizing the public will, such criminalization of the machinery of government works against the ideal. So, the practice of tax evasion needs to be rooted. To that extent, this move of the government may be welcomed.

But how significant is it likely to be in the punishment it meets out to tax evaders and in its ability to control the generation of unaccounted wealth in the future? The quantitative significance of this move depends upon the extent to which unaccounted, or 'black', wealth is held in the form of high-value currency notes of the specified denomination. If unaccounted money by Indians is held in the form of foreign bank accounts, the present scheme can do nothing about it. This speculation would suggest that if unaccounted money is not held as Rs.500 or Rs.1000 notes, the move is pretty much useless. There is, however, the separate issue of counterfeit currency. If there is a significant volume of counterfeit currency circulating in the form of Rs.500 or Rs.1000 notes, the demonetization will also extinguish unaccounted money from this source. If the counterfeit currency is used to destabilize the Indian Union, as has been claimed, deflating this route enhances its security. This would count as another reason to welcome the move.

Now to the question of whether demonetization will eliminate the black economy of the future. It should be obvious that it cannot

by itself. For this, we would need a policy that checks the generation of black incomes at the source. It would be a good surmise that much of the unaccounted money is generated in the purchase and sale of gold and property. The markets for gold and property are highly concentrated, with relatively few sellers exerting considerable control over supply. Monopoly power combined with the cultural significance of both home and gold ornaments in India empowers these sellers to insist that they are paid in cash, leaving many ordinary people in this country to have to abet criminal activity. However, the very fact of property firms, lesser builders, and jewellers are highly visible and small in number makes it that much easier for the long arm of the law to control them. For this to take place though, action by the tax authorities alone will not suffice. It would require the Central government to step in and legislate that all transactions in gold and property go through banks. There could be hue and cry following this of course, but you can't govern crime by being sensitive to the grief of criminals.

**1. Which of the following is one of the main objectives of demonetization of Rs. 500 and Rs.1000 notes?**

- a) To stop the circulation of money in the economy.
- b) To identify the population living below the poverty line.
- c) To bring the hoarders of money into the taxman's radar.
- d) To increase the inflation in the economy.

**2. The author of the passage is referring to the phrase 'stashed under the mattress':**

- a) Plastic money
- b) Black money
- c) White money
- d) Liquid money

**3. Which of the following is incorrect regarding demonetization in India?**

- a) It will help in identifying the tax invaders holding the black money.
- b) Unaccounted wealth will be scrutinized.
- c) Black money will be redistributed in the economy in various forms.
- d) Income tax authorities will not be authorized to look into the bank account details of the hoarder of black money.

**4. According to the author of the passage, the demonetization move is only helpful when:**

- a) Black money is kept in bank accounts outside India.
- b) Black money is kept in the form of gold.
- c) Black money is kept in the form of high-value currency notes of the specified denomination.
- d) Black money is kept in the demat accounts.

**5. Other than the issue of black money, which of the following issue is being addressed by the demonetization step?**

- a) Increase in the population in India.
- b) Increase in the circulation of counterfeit currency in India.
- c) Increase in unemployment in India.
- d) Increase in the demand and supply of currency in India.

ii) Write a film review of the movie you have watched recently.

**(5 Marks)**

**SASTRA Deemed to be University**  
**First Year – B.Tech Computer Science and Business Systems**  
**Second Continuous Internal Assessment – June 2023**  
**ENG138 Business Communication & Value Science – III**

**Duration: 90 Minutes**

**Marks: 50**

**I. Answer all the questions. (5x4=20 Marks)**

**1) Use appropriate punctuation marks in the following sentences.**

- a) Some people work best in the mornings while others do better in the evenings
- b) The following are the primary colours red, blue, and yellow
- c) Do you recall my name my address my job my passion
- d) I knew what would happen if we went there but we had to go anyway

**2) Write an advertising tagline and create a logo for any two fictitious brands.**

**3) Describe Lindgren's five personality traits.**

**4) Explain the effective reading strategies to enhance students' cognitive abilities.**

**5) Fill in the blank spaces with the correct vocabulary.**

- a) Grandfather was a \_\_\_ and hearty man. (hail, hale).
- b) He travelled over hill and \_\_\_ to see her. (veil, vale).
- c) An unmoving object is said to be \_\_\_. (stationary, stationery).
- d) Don't be impolite! Don't be such a \_\_\_. (boar, boor, bore).

**II. Answer all the questions: (2x15=30 Marks)**

**6) Create a branding campaign for a teenagers' group who want to crowdsource funds to set up an old-age home. You need to create a presentation for your idea.**

**7) Write a five-paragraph essay that answers the prompt.**

In our increasingly global society, many people feel that all students should be required to learn a foreign language before graduating from high school. Do you agree? Why or why not? Explain your position using specific reasons and examples.



**School of Computing**  
**First CIA Exam – March 2023**

Course Code: CSE209 Course Name: Data Structures & Algorithms

Duration: 90 minutes

Max Marks: 50

**PART A**

**Answer all the questions**

**(10 x 2 = 20)**

1. Find the bound for the following algorithm:

**Algorithm func1( $n$ )**

1.  $i = 1, sum = 0$
2.  $x = 3, y = 5$
3.  $while i \leq n$
4.      $if sum \% 2 = 0$
5.          $sum = sum + y$
6.      $else$
7.          $sum = sum + x$
8.      $end if$
9.      $i = i * 2$
10.  $end while$
11.  $return sum$

2. Trace the following recursive algorithm for  $m = 35$  and  $n = 120$ .

**Algorithm Rec\_func( $m, n$ )**

1.  $if n \geq m$
2.      $return Rec\_func(n, m)$
3.  $else if n = 0$
4.      $return m$
5.  $else$
6.      $return Rec\_func(n, m \% n)$
7.  $end if$

3. Rearrange the following functions in the increasing order of their order of growth:  $100n^5, 35 \log_2 n, n \log_2 n, n^2 \log_2 n, 4n, 2^n, 300n^2, n!, 4^n$

4. Identify the basic operation in the following algorithm and determine how many times it is repeated for  $n = 64$ . Also find the return value.

**Algorithm find\_sum( $n$ )**

1.  $i = n, sum = 0$
2.  $while i \geq 1$
3.      $sum = sum + i$
4.      $i = i / 2$
5.  $end while$
6.  $return sum$

5. Consider the following matrix of order  $4 \times 6$ . It is stored as 2-D array A in row major order starting from location 2000 and assume that each element is stored using 2 bytes. Find the address of the element  $A(3,5)=35$  will be stored using the formula.

$$\begin{pmatrix} 1 & 40 & 9 & 2 & 4 & 29 \\ 8 & 27 & 16 & 8 & 21 & 1 \\ 3 & 30 & 2 & 3 & 35 & 60 \\ 22 & 5 & 7 & 20 & 24 & 17 \end{pmatrix}$$

6. Write the recursive algorithm for finding the sum of  $n$  elements of a given array.  
 7. Consider the following operations on an empty stack of size 3. What will be the contents of stack after each operation?

- |             |              |
|-------------|--------------|
| i. Push X   | vi. Pop      |
| ii. Push V  | vii. Push E  |
| iii. Push M | viii. Push K |
| iv. Push R  | ix. Pop      |
| v. Pop      | x. Pop       |

8. Assume  $a = 5, b = 7, c = 10, d = 18, e = 6$ . Evaluate the following postfix expression using stack:  $abc * de / + *$ . Draw the stack content after each operation.  
 9. Write the algorithm for pushing all the elements of a file into a stack.  
 10. The queue of size 5 is shown below. Draw the contents of the queue after performing Enqueue(72), Dequeue, Enqueue(37), Dequeue operations along with front and rear values.

	1	2	3	4	5	
Q	35	11	45	32		

front=1, rear=4

### PART B

Answer all the questions

(2 x 15 = 30)

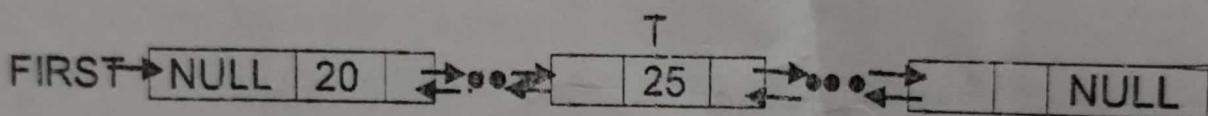
11. Write the non-recursive algorithm using stack for finding the minimum number of movements required to move  $N$  discs of increasing diameter from source needle A to destination needle B using intermediate needle C with the following two constraints:  
 (i) Only one disc can be moved at a time and placed in any one of the needles.  
 (ii) A larger diameter disc should not be placed on top of a lower diameter disc at any point of time during the movement.  
 12. Convert the following infix expression into postfix expression using stack:  $(d * (k + t) / f - u / (r + x)) - h$ . Write the contents of stack for each iteration.

**PART A**

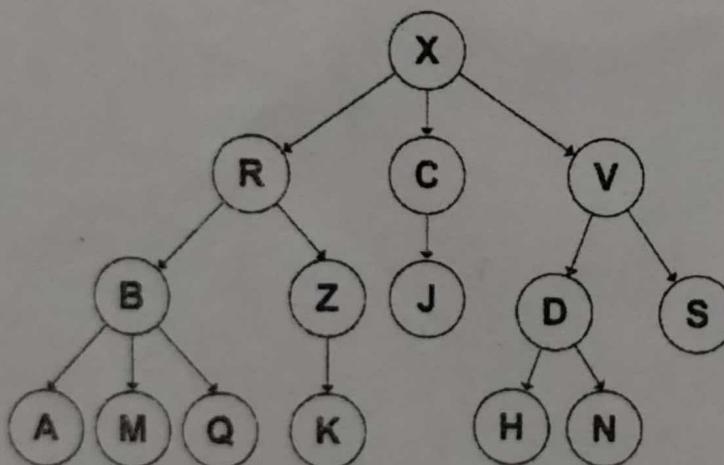
**Answer all the questions**

(10 x 2 = 20)

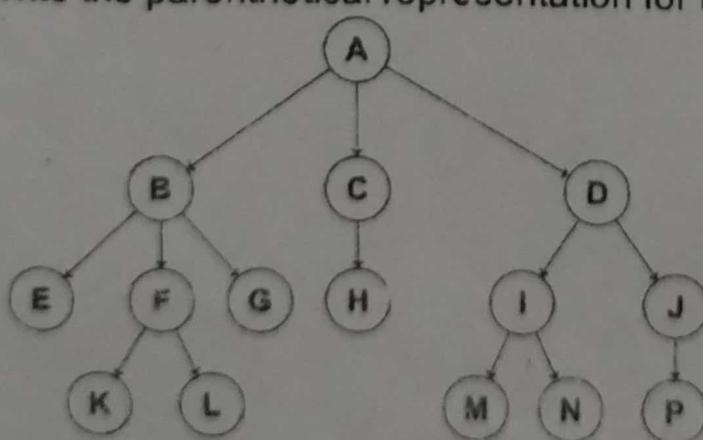
1. Write an algorithm to insert an element into beginning of a singly linked list.
2. Write the algorithm to attach a new polynomial term at the end of the polynomial which is stored as a singly linked list.
3. Let T be the address of the node to be deleted from a non-empty doubly linked list as shown below. Write the pseudocode to delete the node T.



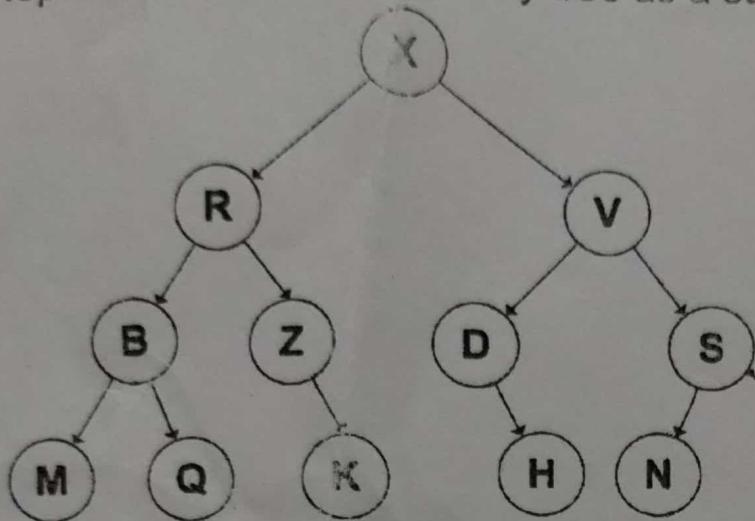
4. Identify the siblings of Q in the following general tree.



5. Write the parenthetical representation for the following general tree:



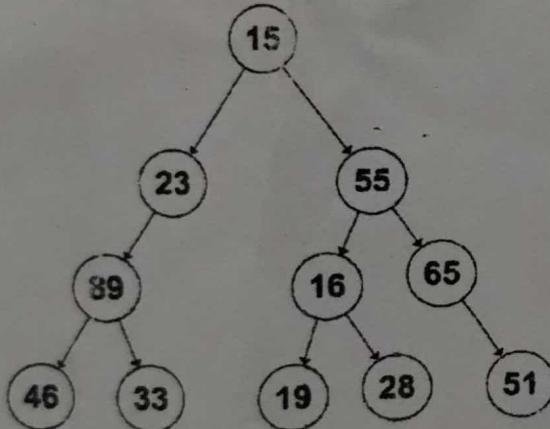
6. Represent the following binary tree as a sequential array.



7. Define height of a binary tree.

8. What is the maximum number of nodes in a binary tree of height h?

9. Find the inorder traversal of the following binary tree



10. Write the algorithm to find the maximum element in a binary search tree.

### PART B

Answer any THREE questions

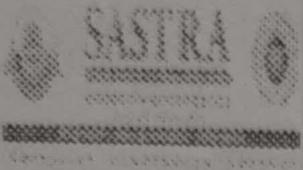
(3 x 10 = 30)

11. Write the algorithm for adding two polynomials represented using singly linked list that store non-zero terms.

12. Write the algorithms to perform insertion, deletion, and search operations in an ordered singly linked list with first pointer.

13. Write the algorithms to perform insertion at beginning, insertion at end, insertion at specific location into a circular doubly linked list:

14. Construct a binary search tree for the following input sequence:  
45, 11, 34, 87, 56, 72, 89, 51, 68, 35, 22, 19, 69, 9



School of Computing  
Third CIA Exam – June 2023

Course Code: CSE209 Course Name: Data Structures & Algorithms  
Duration: 90 minutes Max Marks: 50

**PART A**

**Answer all the questions**

(10 x 2 = 20)

- Find the complexity of the following algorithm:

*Algorithm GE(A, n)*

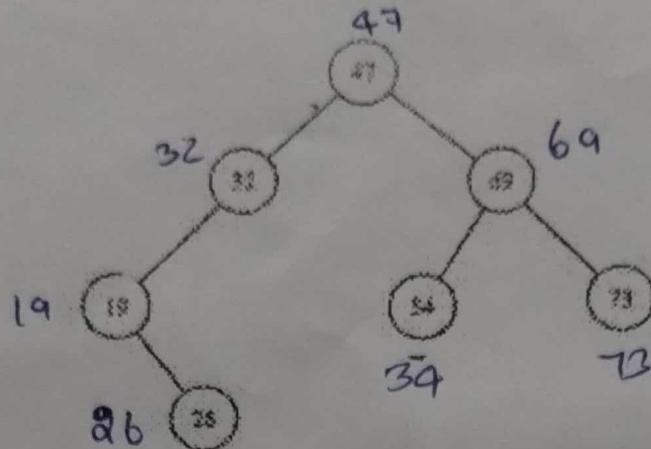
```
1. for k = 1 to n - 1
2.   for i = k + 1 to n
3.     if A[k, k] ≠ 0
4.       r = A[i, k]/A[k, k]
5.       for j = k to n + 1
6.         A[i, j] = A[i, j] - r * A[k, j]
7.       end for
8.     end if
9.   end for
10. end for
11. return
```

- Trace the algorithm and find the return value when x=2 and y=5:

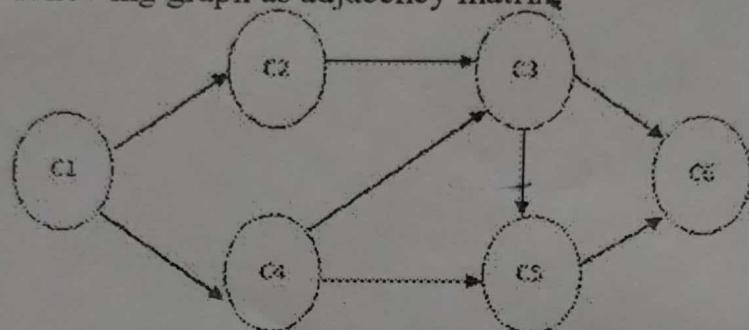
*Algorithm Compute(x, y)*

```
1. if x == 0
2.   return 0
3. if y == 1
4.   return x
5. term = func2(x, [y/2])
6. if y%2 == 0
7.   return term * term
8. else
9.   return term * term * x
```

- Define  $\Omega$ -Notation.
- Evaluate the following postfix expression when a=7, b=18, c=3, d=10 using stack: abc/+d\*. Write the contents of stack at each step of evaluation.
- Represent the following polynomial using singly linked list:  
$$P = x^{10} - 3x^8 + 17x^4 + 6x^3 - 7x + 20$$
- Write an algorithm to search for the position of a given element  $x$  in a singly linked list
- Draw the general tree whose parenthetical representation is:  
(1 (2 (3 (4 5) 6) 7 (8 (9) 10) 11 (12 13 14 (15 16) 17)))
- Search for 26 in the following splay tree and draw the resultant tree after splaying.



9. Represent the following graph as adjacency matrix.



10. Perform first three iterations of selection sort on the following input sequence:  
15, 12, 25, 17, 20, 9, 11, 8, 10, 4

### PART B

Answer any TWO questions

(2 x 10 = 20)

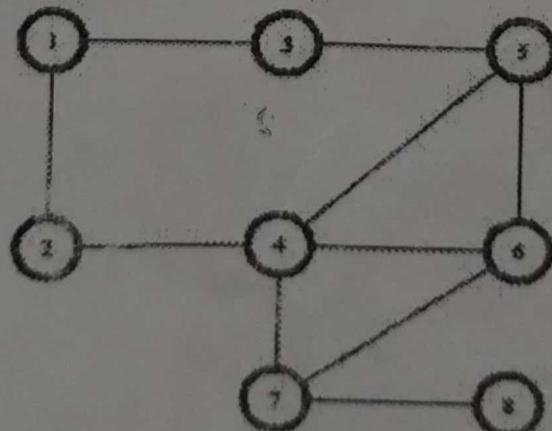
11. Write the algorithm for converting infix expression into postfix using stack.
12. Write the algorithms to perform insertion, deletion, and search operations in an ordered doubly linked list.
13. Construct an AVL tree for the following input sequence: 25, 32, 64, 11, 78, 50, 9, 3, 61, 75, 47, 39

### PART + C

Answer all the questions

(1 x 10 = 10)

14. (i) Represent the following graph as adjacency list and perform breadth first traversal.  
(6 Marks)



- (ii) Sort for the following input sequence using heap sort: 5, 41, 34, 7, 56, 12, 81, 56, 60  
(4 Marks)



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THANJAVUR KUMBAKONAM CHENNAI



School of Electrical & Electronics  
Engineering

First CIA Test – March 2023

Course Code: EIE 110

Course Name: Principles of Electronics

Duration: 90 minutes

Max Marks: 50

### PART-A

$10 \times 2 = 20$  Marks

**Answer all the questions**

- Find the Current flowing through the diode shown in Fig.1. Assume the diode is ideal.

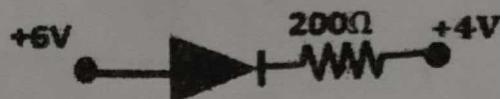


Fig.1

- A half wave rectifier uses a transformer of turns ratio 4:1. If the primary voltage is 240V rms, find (i) DC output voltage, (ii) PIV
- Differentiate avalanche breakdown and zener breakdown
- Sketch the output voltage( $V_o$ ) waveform across the  $R_L$  as shown in Fig.2. Assume the voltage drop across the diode is 0.7 V.

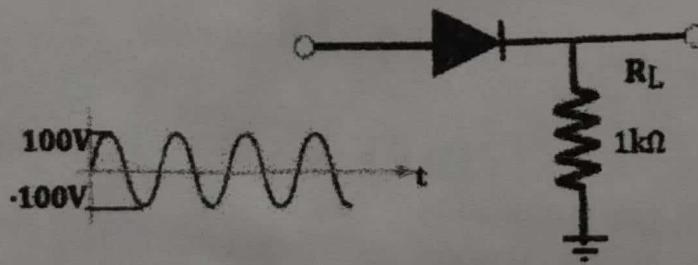


Fig.2

- Choose the states of three ideal diodes shown in the following circuit.
  - D1 ON,D2 ON and D3 ON
  - D1 ON,D2 OFF and D3 ON
  - D1 ON,D2 ON and D3 OFF
  - D1 OFF,D2 ON and D3 ON

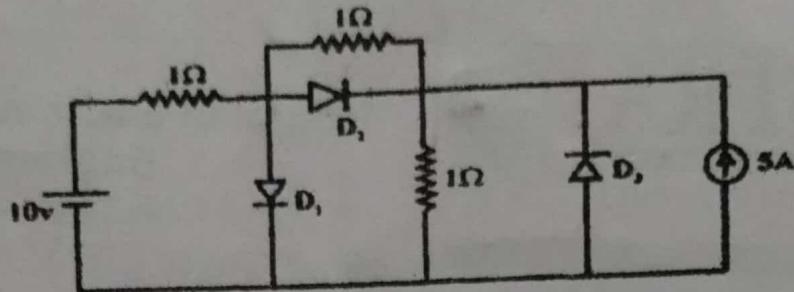


Fig.3

6. Assume that the diode in fig.4 has  $V_{on} = 0.7V$ , The magnitude of the current  $I_2$  (in mA) is equal to \_\_\_\_\_

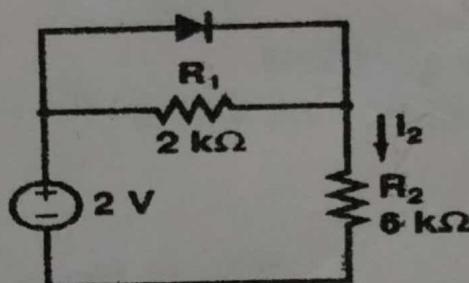


Fig.4

7. Write the significance of calculating PIV in the midpoint full wave rectifier design.
8. A full wave rectifier uses two diodes, and the internal resistance of each diode may be assumed constant at  $20\Omega$ . The transformer rms secondary voltage from the center tap to each end secondary is 50V, and the load resistance is  $980\Omega$ . Find the mean load current.
9. How does a zener diode act as a voltage regulator?
10. Compare drift current and diffusion current

### PART- B

**$3 \times 10 = 30$  Marks**

**Answer all the questions**

11. A full wave center tapped rectifier circuit is connected to a 230 V, 1Φ, 50 Hz AC supply through a 5:1 transformer. A resistive load of  $100\Omega$  is connected to the rectifier circuit. Determine (i) dc output voltage (ii) peak inverse voltage (iii) ripple factor and (iv) Rectification efficiency
12. The four diodes used in a bridge rectifier circuit have forward resistance which may be considered constant at  $1\Omega$  and infinite reverse resistance. The alternating supply voltage is 240V rms and load resistance is  $480\Omega$ . Determine (i) mean load current (ii) power decipation in each diode
13. Explain the operation of a zenor diode and compare it with PN junction diode.



# SASTRA

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THANJAVUR KUMBAKONAM CHENNAI



## School of Electrical & Electronics Engineering

**Second CIA Test – May 2023**

Course Code: EIE 110

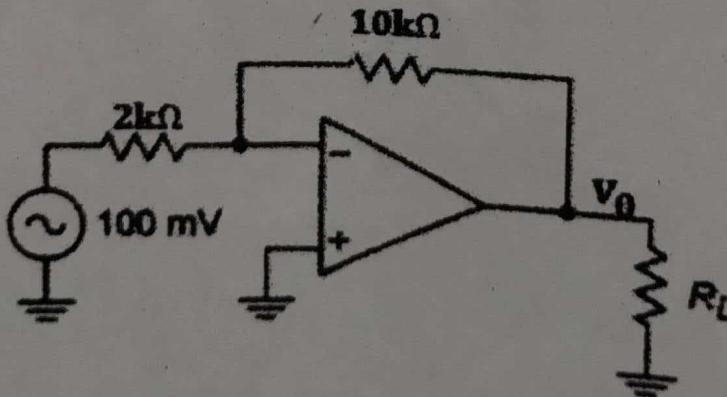
Course Name: Principles of Electronics

Duration: 90 minutes Max Marks: 50

### PART-A

**10 x 2 = 20 Marks****Answer all the questions**

1. Design a fixed bias circuit using a silicon transistor having  $\beta$  value of 100,  $V_{CC} = 10$  V and DC bias condition are to be  $V_{CE} = 5$  V and  $I_C = 5\text{mA}$ . Calculate  $R_B$ ,  $R_C$  and  $I_B$ .
2. For a transistor  $\beta=45$  and voltage drop across  $1\text{k}\Omega$  which is connected in the collector circuit is 1V. Find the base current for common emitter configuration.
3. Enumerate the significance of emitter feedback in the design of voltage amplifiers.
4. What is meant by faithful amplification
5. Compare CS, CD and CG configurations.
6. Draw the CMOS device structure and write its applications
7. Draw the emitter follower circuit and comment about its current gain
8. Differentiate D-MOSFET and E-MOSFET
9. Find  $V_0$  for the inverting amplifier shown in Fig.1



10. Implement the following equations using op-amps.

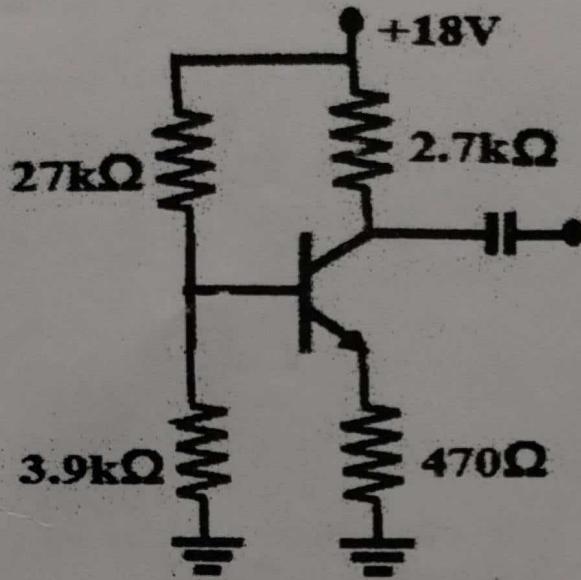
$$V_0 = -5V_1 + 2V_2 - 10V_3.$$

PART-B

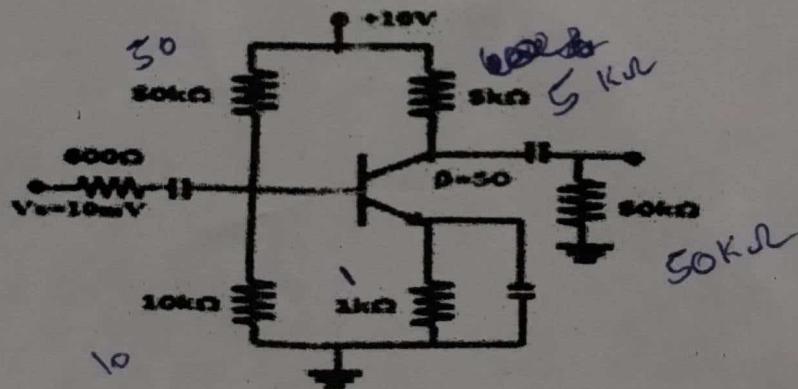
$3 \times 10 = 30$  Marks

Answer any three questions

11. Find  $V_B$ ,  $V_E$ ,  $V_C$  and  $V_{CE}$  for the circuit shown in Fig. 1.  $\beta=100$ ,  $V_{BE}=0.7V$



12. For the amplifier as shown in Fig. 2, Draw the DC load line and mark the operating points



13. Explain the operation of JFET with its VI characteristics. Compare its operation with BJT.
14. Explain the operation of E-MOSFET with its VI characteristics



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THINK MEET THINK TRANSPARENCY | THINK NAVYAKA™

THANJAVUR KUMBAKONAM CHENNAI



**School of Electrical & Electronics  
Engineering**

**Third CIA Test – June 2023**

**Course Code: EIE 110**

**Course Name: Principles of Electronics**

**Duration: 90 minutes Max Marks: 50**

### **PART- A**

**Answer all the questions**

**5x 2 = 10 Marks**

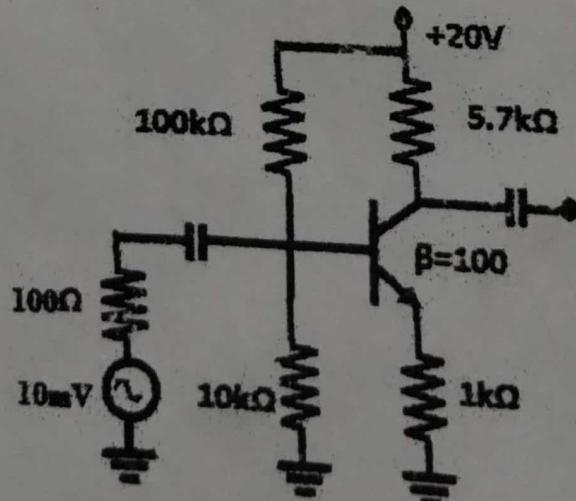
1. State the associative property of Boolean algebra.
2. Implement the equation  $F = XY + X'Y'$  using Logic gates.
3. How does a Zener diode act as a voltage regulator?
4. In a CE transistor circuit  $V_{CC} = 10V$  and the quiescent Current is  $2mA$ . Determine the operating point when the collector load is  $5k\Omega$ .
5. Implement the following equations using op-amps  $V_o = -2V_1 + V_2 - 2V_3$ .

### **PART- B**

**Answer any three questions**

**3 x 10 = 30 Marks**

6. Determine  $I_c(Q)$  and  $V_{CE}(Q)$ . Draw the DC load line and mark the operating points.



**Fig,1**

- |    |   |
|----|---|
| 7. | Explain the operation of E-MOSFET with its VI characteristics   |
| 8. | A full wave center tapped rectifier circuit is connected to a 230 V, 1Φ, 50 Hz AC supply through a 2:1 transformer. A resistive load of $100\Omega$ is connected to the rectifier circuit. Determine (i) dc output voltage, (ii) peak inverse voltage, (iii) ripple factor, and (iv) Rectification efficiency |
| 9. | Explain Half and full adder using logic gates.  |

## PART-C

**Answer all the questions**

**1X10=10 Mark**

10. Find the output voltage( $V_o$ ) for the adder circuit shown in Fig.2

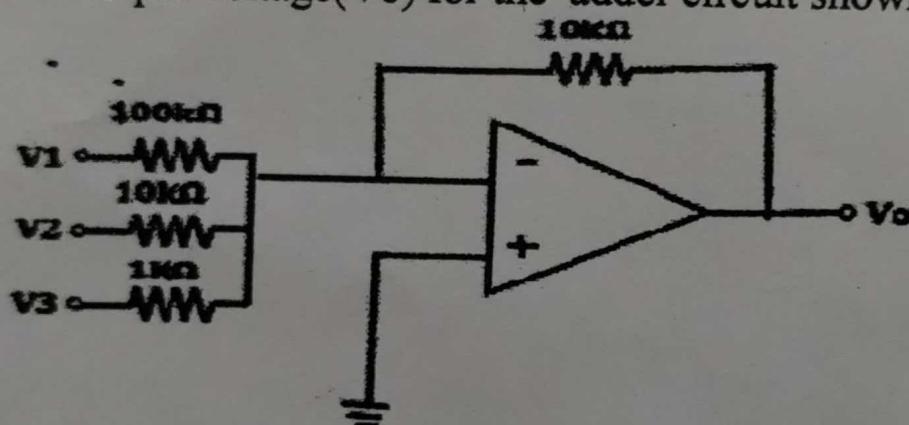


Fig.2

- b. Find  $I_C(Q)$  and  $V_{CE}(Q)$  for the circuit shown in Fig.3

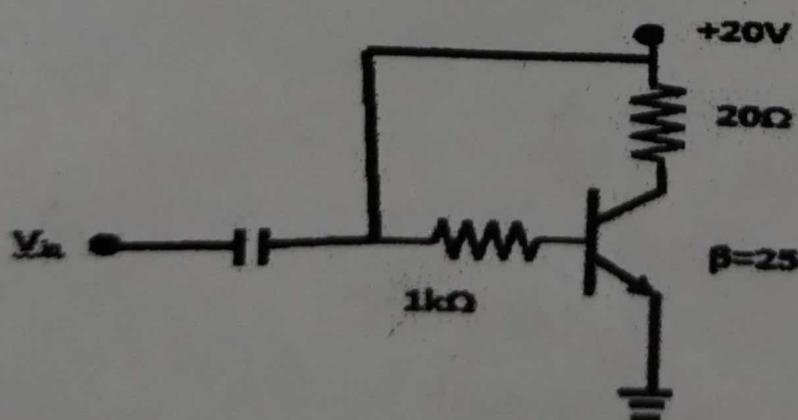


Fig.3



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TRANSPARENCY HONESTY

THANJAVUR KUMBAKONAM CHENNAI



**SASHE**

**First CIA Exam – March 2023**

Course Code: **MAT244**

Course Name: **STATISTICAL MODELLING**

Duration: 90 minutes

Max Marks: 50

### PART - A

#### Answer all the questions

(5 x 2 = 10)

1. Distinguish between linear and non-linear correlation
2. From the following information, calculate line of regression of y on x:

	x	y
Mean	40	60
Standard Deviation	10	15
Correlation co-efficient		0.7

3. Distinguish between additive model and multiplicative model in the analysis of time series.
4. What are the components of a time series? Give an example of each component.
5. Find the autocorrelation function of the process  $X_t = X_{t-1} - 0.25X_{t-2} + a_t$  and obtain  $\rho_1$  and  $\rho_2$ .

### PART B

#### Answer all the questions

(4 x 10 = 40)

6. Calculate the coefficient of correlation between the age of cars and annual maintenance cost and comment.

Age of Cars in Year :	2	4	6	7	8	10	12
Maintenance cost ('000):	16	15	18	19	17	21	20

7. Fit a second-degree parabola to the data below, and forecast the sales for 2023 and 2024.

Year :	2018	2019	2020	2021	2022
Sales ('000) :	16	18	19	20	24

8. Compute the multi-linear regression line of  $X_1$  on  $X_2$  and  $X_3$  from the following data and estimate the value of  $X_1$  when  $X_2=6$  and  $X_3=10$

X1:	4	6	7	9	13	15
X2:	15	12	8	6	4	3
X3:	30	24	20	14	10	4

0.074

9. (i) The three autocorrelation coefficients are  $r_1 = 0.756$ ;  $r_2 = 0.314$ ;  $r_3 = 0.141$ , calculate the pacfs. (6)

- (ii) For the model  $(1 - 0.7 B)(1 - B)X_t = (1 - 0.8 B)a_t$ ; find p, d, q and express it as ARIMA (p, d, q). (4)

0.232  
0.2501

0.20572



**SASTRA**  
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**SASHE**

Second CIA Exam – May 2023

Course Code: **MAT244**

Course Name: **STATISTICAL MODELLING**

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Duration: 90 minutes

Max Marks: 50

### PART - A

**Answer all the questions**

**(5 x 2 = 10)**

- What are the uses of ANOVA?
- Say true or false: (i) ANOVA cannot be used when there are sample of unequal sizes (ii) Analysis of variance is a statistical method of comparing the means of several populations.
- What is the Difference Between a Parametric and Non-Parametric Test?
- What are the Advantages of a Non-Parametric Test?
- Write the four properties of good estimator.

### PART B

**Answer any FOUR questions**

**(4 x 10 = 40)**

- Three varieties of coal were tested and the ash contents form the varieties are given below:

Variety	Ash contents				
	I	II	III	IV	V
A	9	7	6	5	8
B	7	4	5	4	5
C	6	5	6	7	6

Do the varieties differ significantly in their ash content?

- A certain company had four salesmen *A*, *B*, *C*, and *D* each of whom was sent for a month to three types of areas country side *K*, outskirts of a city *O*, and shopping centre of a city *S*. The sales in hundreds of rupees per month are as follows:

Salesmen	Distributors			
	A	B	C	D
K	30	70	30	30
O	80	50	40	70
S	100	60	80	80

Perform an ANOVA test and interpret your results.

8. The survey shows that differences in heart rate of men and women whilst waiting for an interview: Use a Mann-Whitney U test to test if heart rate differs between men and women at the 95% level for the following data:

Men	80	74	73	72	78	75	70	74	69
Women	84	81	80	70	72	69	65	74	80

9. A professor believes that students in his class are not getting enough sleep to perform to the best of their ability on tests. To test this theory, he asks 10 students in his class to keep sleep diaries over a four-week period. He tells the students to ensure they sleep for 8 hours per night. At the beginning and end of the four weeks, all the students take a standard IQ test. Scores on the test at the beginning and end of the four-week period are below. Is there any evidence to support the researcher's theory that longer periods of sleep improve performance?

Test-1	92	97	76	87	80	79	99	111	103	93
Test-2	102	100	74	85	83	89	100	112	99	97

10. (i) Prove that for the binomial population with density function  $P(X = x) = nc_x p^x q^{n-x}$ ;  $x = 1, 2, \dots, n$ ,  $q = 1-p$ ; the maximum likelihood estimator for  $p$  is  $X/n$ .

(ii) If  $X_1, X_2, \dots, X_n$  is a random sample of size  $n$  taken from a population whose pdf is  $f(x, \theta) = e^{-(x-\theta)}$ ;  $\theta \leq x < \infty$ ;  $-\infty < \theta < \infty$  then show that the sample mean is an unbiased estimator of  $(1 + \theta)$ .



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HANJAVUR KUMBAKONAM CHENNAI

SASHE

Third CIA Exam – June 2023

Course Code: **MAT244**

Course Name: **STATISTICAL MODELLING**

Duration: 90 minutes Max Marks: 50

### PART - A

#### Answer all the questions

(5 x 2 = 10)

1. Define one-tailed and two-tailed tests.
2. State the condition for Neyman-Pearson's lemma to test the best critical region.
3. Write the syntax of if else in R
4. Write the syntax for loading and printing a .csv file in R?
5. Write the syntax of correlation and plotting of any two vectors.

### PART B

#### Answer all the questions

(2 x 15 = 30)

6. (i) Based on the following data, calculate multiple correlation coefficients of  $R_{1.23}$ ,  $R_{3.12}$ , and  $R_{2.13}$ .

$$\bar{x}_1 = 6.8$$

$$\bar{x}_2 = 7.0$$

$$\bar{x}_3 = 74$$

$$s_1 = 1.0$$

$$s_2 = 0.8$$

$$s_3 = 9$$

$$r_{12} = 0.6$$

$$r_{13} = 0.7$$

$$r_{23} = 0.65$$

6. (ii) The mean diameter of a random sample of 200 ball bearings made by a certain machine during one week is 0.824 inches and standard deviation is 0.042 inches. Find (a) 95% (b) 99% confidence interval for the mean diameter of all the ball bearings.

### OR

7. (i) Perform Kendall Concordance test at 5% level to test the qualities of mangoes.

	Ranking of qualities of Mangoes							
A	8	4	2	3	5	1	6	7
B	7	3	1	4	5	2	6	8
C	8	2	5	6	7	1	4	3
D	8	3	4	2	5	1	6	7

7. (ii) Using Neyman Pearson lemma, obtain the best critical region for testing Null hypothesis  $H_0: \theta = \theta_0$  Vs Alternative hypothesis  $H_1: \theta = \theta_1 (\leq \theta_0)$  given that  $f(x, \theta) = \theta e^{-\theta x}$

8. The following table gives the number of units of production per day turned out by four different types of machines :

Employee	Types of Machines			
	$M_1$	$M_2$	$M_3$	$M_4$
$E_1$	40	36	45	30
$E_2$	38	42	50	41
$E_3$	36	30	48	35
$E_4$	46	47	52	44

Using analysis of variance (a) test the hypothesis that the mean production is the same for the four machines and (b) test the hypothesis that the employees do not differ with respect to mean productivity.

**OR**

9. Analyze the summary of linear regression given below and give suitable interpretations:

Call:

```
lm(formula = ROLL ~ UNEM + HGRAD + INC, data = datavar)
```

Residuals:

Min	1Q	Median	3Q	Max
-1148.840	-489.712	-1.876	387.400	1425.753

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	-9.153e+03	1.053e+03	-8.691	5.02e-09 ***
UNEM	4.501e+02	1.182e+02	3.809	0.000807 ***
HGRAD	4.065e-01	7.602e-02	5.347	1.52e-05 ***
INC	4.275e+00	4.947e-01	8.642	5.59e-09 ***

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 670.4 on 25 degrees of freedom

Multiple R-squared: 0.9621, Adjusted R-squared: 0.9576

F-statistic: 211.5 on 3 and 25 DF, p-value: < 2.2e-16

## PART - C

**Answer all the questions**

**(1 x 10 = 10)**

10. (i) Create a data frame with  $a = c(1, 2, 3)$ ,  $b = c(4, 5, 6)$ ,  $c = c(7, 8, 9)$  and find the value of the following (a) How to select the  $c(4, 5, 6)$ ? (b) How to select the 1 (c) How to select the 5? (d) What is  $df[ , 3]$ ? (e) What is  $df[1, ]$ ? (f) What is  $df[2, 2]$ ?

(ii) Write the R-code to create a simple data frame of five COVID-19 patient details. Your data frame should contain the columns "ID", "AGE", "MOBILE NO", "GENDER" and "TREATMENT STATUS".

**Answer all the questions.**

✓ Write down the formulas for Cramers rule - Solving system of equations

✗ Find the rank of a matrix  $A = \begin{pmatrix} 1 & -1 & 1 & -1 \\ 1 & -3 & 4 & -6 \\ 4 & 3 & -2 & -3 \\ 7 & -4 & 7 & -16 \end{pmatrix}$

For what values of  $k$  is the following an inner product on  $R^2(R)$ .

3  $\langle u, v \rangle = x_1y_1 - 3x_1y_2 - 3x_3y_1 + kx_2y_2$  where  
 $u = (x_1, x_2), v = (y_1, y_2)$

✗ Prove that if two vectors are linearly dependent, one of them is a scalar multiple of other.

✗ Examine the set  $B = \{(1, 2, 1), (3, 1, 5), (3, -4, 7)\}$  is LI or LD

**Answer the following questions. PART B  $4 \times 10 = 40$  marks**

6 Investigate for what values of  $\lambda$  and  $\mu$  the simultaneous  
 $x + y + z = 6, x + 2y + 3z = 0, x + 2y + \lambda z = \mu$  have  
i) No solution (ii) a unique solution (iii) infinitely many solutions

Find the values of  $\lambda$  for which the equations

$$(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0,$$

$$(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0$$

$$2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0$$

Are consistent, and find the ratios of  $x: y: z$  when  $\lambda$  has the smallest and greatest of these values?

(a) Solve the system of equation by LU - Decomposition

$$x + y - z = 2, 2x + 3y + 5z = -3, 3x + 2y - 3z = 6$$

8 (b) Convert the set  $S = \{(1, 0, 2, 0), (1, 2, 3, 1)\}$  is an orthonormal set. Use standard inner product in  $R^4(R)$ . (6+4)

9 Prove that  $V = \{A_{2 \times 2}(R) / \text{Trace}(A) = 0\}$  is a vector space over R-Set of real numbers, also Find Basis and dimension.



**Answer all the questions.**

**PART A**

**5 x 2 = 10 Marks**

1 Verify the following is linear transformation  $T: R^3 \rightarrow R^3$ ,  
 $T(x, y, z) = (z, y + z, x + y + z)$ .

2 Let  $A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \\ 1 & 2 & 0 \end{pmatrix}$  and I be the  $3 \times 3$  identity matrix. If  
 $6A^{-1} = aA^2 + bA + cI$  for  $a, b, c$  in  $R$ . Then  $(a, b, c)$  is equals to?

3 For every  $4 \times 4$  real symmetric invertible matrix A, there exist a positive integer  $p$  such that which of the following is / are true  
Justify your answers (a)  $pI + A$  is positive definite (b)  $A^p$  is negative definite (c)  $A^{-p}$  is positive definite

4 If  $A = \begin{pmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{pmatrix}$  then find the eigen values of  $A^{99} - 2I$ .

5 Let A and B be  $n \times n$  matrices. Then show that AB and BA have same eigen values.

**Answer any four questions. PART B**

**4 x 10 = 40marks**

6 State and prove Rank nullity theorem

7 Find the QR-Decomposition of  $A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \\ 1 & 2 & 0 \end{pmatrix}$

8 Diagonalise the matrix  $A = \begin{pmatrix} 3 & 1 & 1 \\ 1 & 3 & -1 \\ 1 & -1 & 3 \end{pmatrix}$

9 Verify T is linear and also find Range,rank,null space and nullity of T.  $T(a, b) = (a + b, a - b, b)$  where  $T: R^2 \rightarrow R^3$ .

10 Verify that  $A = \begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$  satisfies its characteristic equation and hence find  $A^4$ .



**Answer all the questions.**

**PART A       $5 \times 2 = 10$  Marks**

- |   |   |
|---|---|
| 1 | What is the difference between the Gauss elimination and Rank method for solving system of equations?                     |
| 2 | Find the singular values of $\begin{pmatrix} 4 & 11 & 14 \\ 8 & 7 & -2 \end{pmatrix}$                                     |
| 3 | Let A and B be $n \times n$ matrices are positive definite Then what can you say about $A-B$ ?                            |
| 4 | Find the basis and dimension for $V(R) = \left\{ \begin{pmatrix} a & b \\ 2b & c \end{pmatrix}; a, b, c \in R \right\}$ . |
| 5 | Define projection with Example  |

**Answer any two questions. PART B       $15 \times 2 = 30$  marks**

- |   |   |
|---|---|
| 6 | Find the singular value decomposition of $\begin{pmatrix} 4 & 11 & 14 \\ 8 & 7 & -2 \end{pmatrix}$ (OR)   |
| 7 | A Landsat image with three spectral components was made of Homestead Air Force Base in Florida (after the base was hit by Hurricane Andrew in 1992). The covariance matrix of the data is shown below. Find the first principal component of the data, and compute the percentage of the total variance that is contained in this component |

$$S = \begin{pmatrix} 164.12 & 32.73 & 81.04 \\ 32.73 & 539.44 & 249.13 \\ 81.04 & 249.13 & 189.11 \end{pmatrix}$$

- |   |  |
|---|--|
| 8 | Obtain the orthonormal basis for V= the space of all polynomials of degree atmost 2, the inner product is defined by $\langle f, g \rangle = \int_0^1 f(x)g(x)dx$ . (OR) |
|---|--|

- |   |   |
|---|---|
| 9 | Verify T is linear and also find Range,rank,null space and nullity of T. $T(a, b) = (a, a, b)$ where $T: R^2 \rightarrow R^3$ . |
|---|---|

**Part C Answer the following       $1 \times 10 = 10$  marks**

- |    |   |
|----|---|
| 10 | Solve the system of equations by rank method<br>$x + y + z = 3, x + 2y + 3z = 4, x + 4y + 9z = 6$ |
|----|---|



Course Code: SH

Course Name: Fundamentals of Economics

Duration: 90 minutes Max Marks: 50

**PART A**

**10 x 2 = 20 Marks**

What happens to the demand?

1. (1) When an individual's money income rises (while everything else remains constant),

(2) A change in the individual's tastes for a commodity

Identify the concepts:

2. (1) The individual's demand curve for steaks will shift up, if the individual's money income rises.

(2) Some commodities (such as bread and potatoes) whose demand curve usually shifts down when the individual's income rises.

$P_x$	$QD_x$	$QS_x$
6	2000	8000
5	3000	6000
4	4000	4000
3	5000	2000
2	6000	0

Determine equilibrium price and the equilibrium quantity for commodity X.

4. (a) What does the elasticity of demand measure in general? (b) What do the price elasticity of demand, the income elasticity of demand, and the cross elasticity of demand measure in general?

5. Sketch the demand curve given by  $P_x = \$3$ , and find its price elasticity.

6. Illustrates the principle of diminishing marginal utility with a neat diagram.

For each consumer their maximum willingness to pay for SweetbrandCheese cakes are given in the table:

Students	Willingness to buy (Rs.)
Abi	11.65
Sam	17.99
Mary	12.99
Pippin	16.75

Which of the four consumers receives the most consumer surplus, if the market price of the Cheese cakes is Rs.12.50 each?

8. Outline Price Ceiling and Price Floor with a neat diagram.

9. What is 'Giffen Paradox'? Explain with an example.

10. Explain Deadweight loss with an example.

**PART B      3 x 10 = 30 Marks**

A vegetable fiber is traded in a competitive world market, and the world price is \$9 per pound. Unlimited quantities are available for import into the United States at this price. The U.S. domestic supply and demand for various price levels are shown as follows:

Price(Rs.)	Demand(Millions)	Supply(Millions)
3	34	2
6	28	4
9	22	6
12	16	8
15	10	10
18	4	12

11. a. What is the equation for demand? What is the equation for supply?  
 b. At a price of \$9, what is the price elasticity of demand? What is it at a price of \$12?  
 c. What is the price elasticity of supply at \$9? At \$12?

12. Suppose the market for cameras has a supply curve of  $P = 30 + Q$ , and a demand curve of  $P = 240 - 2Q$ . Assume that the market is perfectly competitive. a) What will the equilibrium price and quantity of cameras be? b) Calculate the producer and consumer surplus associated with the equilibrium found in part (a). Illustrate on a graph.

13. From the  $TU_x$  schedule

$Q_x$	0	1	2	3	4	5	6	7	8	9
$TU_x$	0	7	13	18	22	25	27	28	28	27

- (a) Derive the  $MU_x$  schedule (2 marks)  
 (b) Plot the  $MU_x$  and indicate the saturation point. (2marks)  
 (c) Explain the theory behind the concept. (6 marks)



**PART A**

**10 x 2 = 20 Marks**

1. What is a production function? How does a long-run production function differ from a short-run production function?
2. Define isoquant and isoquants can be convex, linear, or L-shaped. What does each of these shapes tell you about the nature of the production function?
3. The marginal product of labor in the production of laptops is 50 per hour.
3. The marginal rate of technical substitution of hours of labor for hours of machine capital is  $1/4$ . What is the marginal product of capital?
4. Discuss the features of monopolistic competition.
5. Why does a tax create a deadweight loss? What determines the size of this loss?
6. A monopolist is producing at a point at which marginal cost exceeds marginal revenue. How should it adjust its output to increase profit?
7. How is monopoly different from perfect competition?
8. Briefly explain the reason for the shape of a marginal revenue curve for a perfectly competitive firm.
9. What shapes would you generally expect each of the following cost curves to have: fixed costs, variable costs, marginal costs, average total costs, and average variable costs?
10. What is the relationship between product differentiation and monopolistic competition?

**PART B       $3 \times 10 = 30$  Marks**

11. Explain how the profit-maximizing rule of setting  $P = MC$  leads a perfectly competitive market to be allocatively efficient with an illustration. Explain how price and output is determined in perfect competition.
12. A monopoly faces an inverse market demand of  $P = 100 - 0.375Q$ , and its total cost of production is given by  $C = 1200 + 0.125Q^2$ . Solve for the monopolist's profit-maximizing price, quantity, and profit.
13. Explain Income and substitution effect with an example.



**SASTRA**

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School of Computing  
Third CIA Test – Jun 2023

Course Code: MGT131

Course Name: Fundamentals of Economics

Duration: 90 minutes

Max Marks: 50

**PART A**

**10 x 2 = 20 Marks**

1. Write the significance of NFIA.
2. Compare Factor Income and Transfer Income.

Particulars	In Crores
NNP at FC	2000
Depreciation	200
Subsidies	70
Factor Income from Abroad	110
Indirect taxes	180
Factor Income to Abroad	50

Calculate GDP at MP.

4. What does Aggregate Demand mean? List its components.
5. Identify the relationship between MPC and MPS.

Identify the type of motive of money in the following cases and explain it.

6.
  - 1) An individual maintains a savings account with a specific emergency fund to cover unexpected medical expenses or job loss.
  - 2) An investor purchases shares of a company's stock based on their anticipation of a future increase in its value.
7. Differentiate induced investment and autonomous investment.
8. Outline the equilibrium of IS-LM model and explain its shape.
9. What is Multiplier and discuss how it is calculated
10. Discuss Monetary and Fiscal Policy.

**PART B**       $3 \times 10 = 30$  Marks

11. Discuss the components of National Income and explain how a nation's output is calculated using these components.
12. Explain various phases of Business Cycle and discuss the impact on some macroeconomic indicators.
13. Elaborate on different types of unemployment and its impact.