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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY UNA
HIMACHAL PRADESH
An institute of National Importance under MoE
Saloh, Una - 177 209

Website: www.iiitu.ac.in

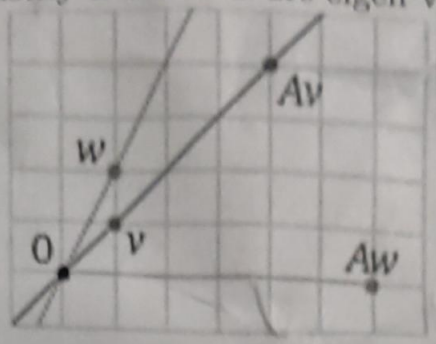
AY 2023-24
School of Computing
Curriculum: IIITUGCSE22
Cycle Test - I
October 16, 2023

Degree	B.Tech.
Branch	CSE
Semester	I
Subject code/name	MAC111/Engineering Mathematics
Time	60 minutes
Maximum Marks	20

Answer all the questions.

Q.No.	Questions	Marks
1(a)	Compute the rank of the matrix $B = \begin{bmatrix} 1 & 3 & -4 \\ -1 & -3 & 4 \\ 2 & 6 & -8 \end{bmatrix}$.	1
1(b)	Using Gauss-Jordan method, determine the inverse of the matrix $D = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$.	2
1(c)	Determine the values of b for which the matrix equation $AX = b$ has solution, where $A = \begin{bmatrix} 1 & 4 & 5 \\ -3 & -11 & -14 \\ 2 & 8 & 10 \end{bmatrix}$ and $b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$, $\{b_i, 1 \le i \le 3 \in \mathbb{R}\}$.	2
2(a)	Define the terms consistent and inconsistent system of linear equations.	1
2(b)	Examine the system of equations given below for consistency: $x - 2y + 4z = 2$ $2x - 3y + 5z = 3$ $3x - 4y + 6z = 7$	2
2(c)	Obtain the basis and dimension of the solution space W of the following homogeneous system: $x - 2y + 4z = 0$ $2x - 3y + 5z = 0$ $3x - 4y + 6z = 0$	2

3 4 8
11 2

3(a)	Consider Figure 1 and justify if v and w are eigen vectors of A?  Figure 1: Vectors v, w, Av, Aw in a two dimensional plane.	1
3(b)	Compute the eigen values of the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.	2
3(c)	Find the eigen vectors of A corresponding to eigen values computed in question 3(b). Is the matrix A diagonalisable?	2
4(a)	Consider the matrix $B = \begin{bmatrix} 2 & 2 \\ -4 & 8 \end{bmatrix}$, and vectors $X = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$, $Y = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$. Without using characteristic equation, check if X and Y are eigen vectors of B? If so, what is/are the eigen value(s)?	1
4(b)	Reduce the matrix $D = \begin{bmatrix} 1 & 2 & 0 & -1 \\ 3 & 4 & 1 & 2 \\ -2 & 3 & 2 & 5 \end{bmatrix}$ to normal form.	2
4(c)	Using Cayley-Hamilton theorem, compute A^8, A^{10} if $A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$.	2

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AY 2023-24

School of Basic Sciences

CURRICULUM: IIITUGCSE22

Cycle Test – I

17, Oct.'23

Degree	B. Tech.	**Branch**	CSE
Semester	I		
Subject Code & Name	BIC104: Introduction to Biotechnology		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. No.	Question	Marks
1.a	What is the magnification power of the light microscope employed for visualizing the plant cell with the following parameters: an eyepiece of 10 X and an objective lens of 40 X?	(1)
1.b	Bioengineering of cells is done with the addition/removal of some of the selected cellular components. Interpret the result outcome of the engineered cells: (i) Addition of mitochondria, ribosomes (ii) removal of peroxisomes, lysosomes.	(1+1=2)
1.c	(i) Calculate the percentage of guanine concentration if the total percentage of adenine and thymine concentration present in a given organism is 40%. (ii) Determine the amino acid sequence of the polypeptide encoded by the mRNA sequence as follows: 5'-AUGGUGGCCUAUCAUUAGCUU-3'	(1+1=2)
2.a	Determine the polarity and complementary DNA sequence pattern to the given DNA sequence as follows: 5'-AGCCCCGACTCTATTC-3'.	(1)
2.b	Design the set-up of a medium size biotechnology Industry with a proper layout.	(2)
2.c	Illustrate how DNA is proved experimentally the genetic material of life?	(2)
3.a	Calculate the haploid chromosome number of papaya plants when the total number of chromosomes are 18.	(1)
3.b	(i) Find the mRNA sequence if the coding strand of DNA is as follows: 5'-AATTCAAATTAGG-3'. (ii) Determine the pattern of mRNA sequence if the template strand of DNA is as follows: 5'-ATGCGATGCTGACAG-3'	(1+1=2)
3.c	Demonstrate the role of three types of RNA interplay in controlling the process of translation.	(2)
4.a	How is the screening of recombinant DNA done from the non-recombinant DNA?	(1)
4.b	Illustrate the process of cDNA library construction with utility in genetic engineering.	(2)
4.c	Demonstrate the working principle of PCR with a suitable diagram.	(2)

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AY 2023-24
School of Electronics
Cycle Test – I
17, Oct.'23
Curriculum – IIITUGECE22

Degree	B. Tech.	**Branch**	CSE
Semester	I		
Subject Code & Name	EEC103: Basic Electrical and Electronics Engineering		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1. a	Define the following: i. Node ii. Mesh	(1)
1. b	Find an equivalent π- network for the T-network shown in Figure 1:	(2)
1. c	Find voltages at node 1 and node 2 in the circuit shown in Figure 2.	(2)

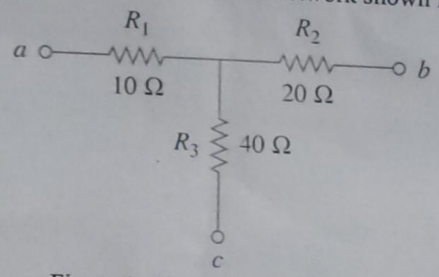


Figure 1: Circuit for Question 1b

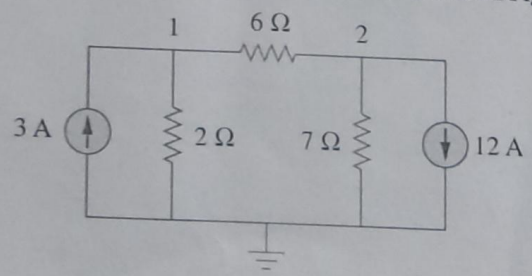
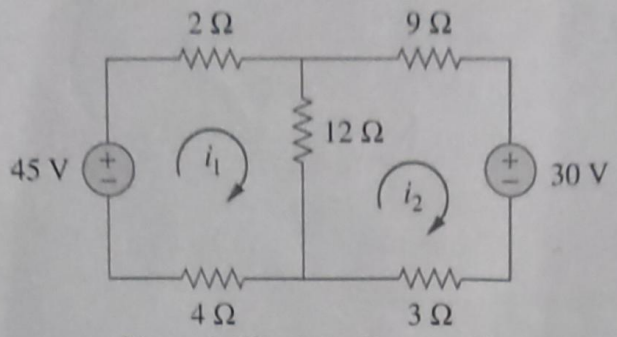
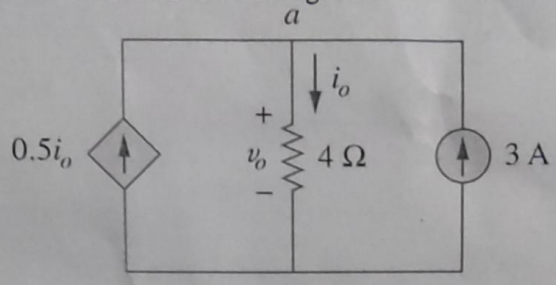
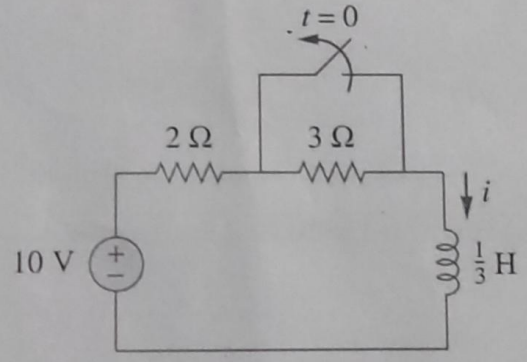
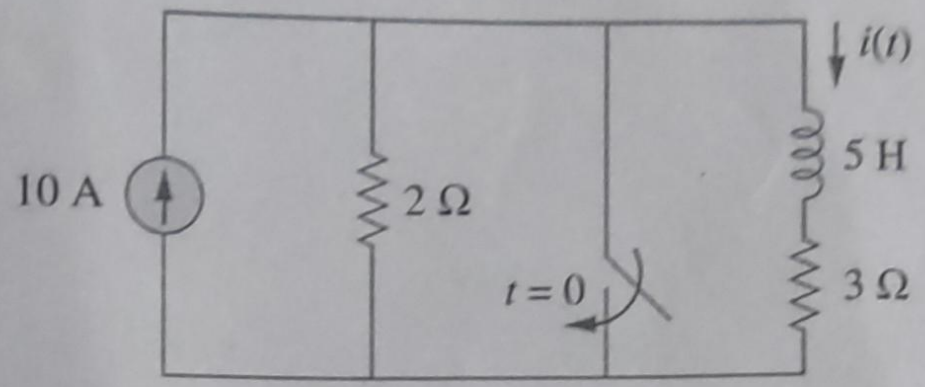
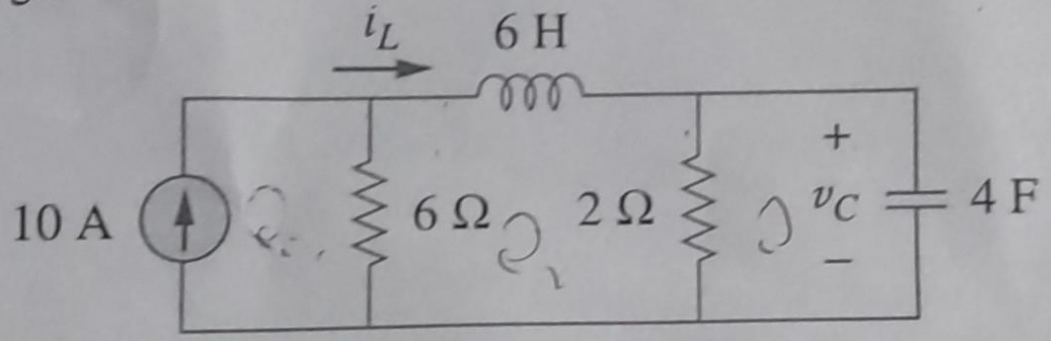


Figure 2: Circuit for Question 1c

2. a	What are dependent sources? Discuss their types.	(1)
2. b	Find i_1 and i_2 in the circuit shown in Figure 3.  Figure 3: Circuit for Question 2b	(2)
2. c	Find i_o and v_o in the circuit shown in Figure 4.  Figure 4: Circuit for Question 2c	(2)
3. a	Write down the current and voltage relations for a capacitor.	(1)
3. b	What is the voltage across a 4.5 μF capacitor if the charge on one plate is 0.12 mC? How much energy is stored?	(2)
3. c	Find $i(t)$ through the inductor for $t > 0$ in the circuit shown in Figure 5.  Figure 5: Circuit for Question 3c	(2)

4. a	What is a second order circuit?	(1)
4. b	Find the initial and final value of current flowing through the inductor in the circuit shown in Figure 6.  Figure 6: Circuit for Question 4b	(2)
4. c	Find v_C, i_L, and the energy stored in the capacitor in the circuit shown in Figure 7.  Figure 7: Circuit for Question 4c	(2)

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Cycle Test – I
16, Oct.'23

Degree	B. Tech.	Branch	CSE
Semester	First		
Subject Code & Name	CYC102: Engineering Chemistry		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Sl. No.	Questions	Marks
1.a	Describe the utility of calgon and phosphate conditioning to overcome the boiler feed water problem.	(1)
1.b	A water sample from the Beas River was collected for analytical study. 25 ml of standard hard water containing 0.1 g of pure $CaCO_3$ per litre consumed 20 ml of EDTA. 10 ml of the given river water sample consumed 15 ml of EDTA solution. 10 ml of the above sample after boiling consumed 10 ml of EDTA. Calculate the temporary hardness of the river water sample.	(2)
1.c	Identify and draw the structure of monomers used in the fabrication of the following polymers: (i) Plexiglass (ii) Nylon 6 (iii) Neoprene (iv) Dacron	(2)
2.a	Three samples A, B and C were analyzed for their salt content: (i) Sample A was found to contain 168 mg of Magnesium carbonate per litre. (ii) Sample B was found to contain 820 mg of Calcium chloride per 500 millilitre. (iii) Sample C was found to contain 20 g of Potassium Chloride per litre. Determine the hardness in all the above three samples in ppm.	(1)
2.b	Explain the mechanism of water softening by Zeolite Process along with the concept of regeneration of exhausted zeolites.	(2)
2.c	Calculate the quantities of lime (80% pure) and soda (90% pure) required for softening of 1 litre of water using 10 ppm of Sodium aluminate as a coagulant. The result of the water analysis is as follows: Analysis of raw water: $Ca^{2+} = 20$ ppm, $Mg^{2+} = 5$ ppm, $CO_2 = 10$ ppm, $HCO_3^- = 20$ ppm, and $H^+ = 5$ ppm. Analysis of treated water: $OH^- = 10$ ppm and $CO_3^{2-} = 20$ ppm.	(2)
3.a	What is the principle of reverse osmosis? What is the main advantage of reverse osmosis over ion-exchange process?	(1)

3.b What type of hardness is associated with the dissolution of $CaSO_4$ salts in water? Determine the amount of $CaSO_4$ (in grams) dissolved per litre of solution which gives 200 ppm of water hardness? (2)

3.c Explain the principle and working of Hot-Lime Soda process with the help of a well labelled diagram. (2)

4.a Differentiate between thermoplastic and thermosetting polymers. Give two examples for each type. (1)

4.b Two litres of water obtained from a bore well gave the following analysis for salts: $MgSO_4$ = 30 mg, $CaSO_4$ = 15 mg, $MgCl_2$ = 40 mg, $Ca(HCO_3)_2$ = 20 mg, $Mg(HCO_3)_2$ = 10 mg, and NaCl = 15 mg. Find out the carbonate and non-carbonate hardness of water in ppm units. (2)

4.c Explain the detailed mechanism of free radical polymerization to form polyethylene. (2)

*** GOOD LUCK ***