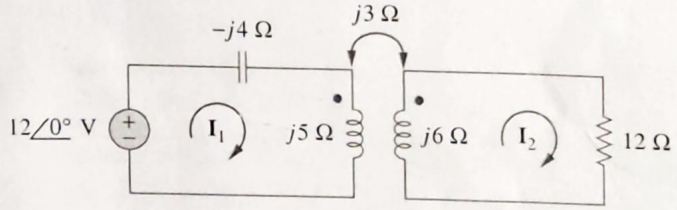
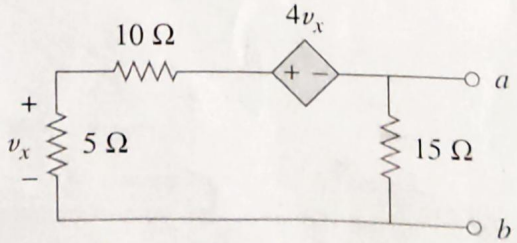
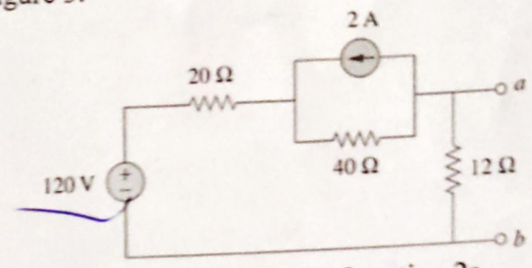
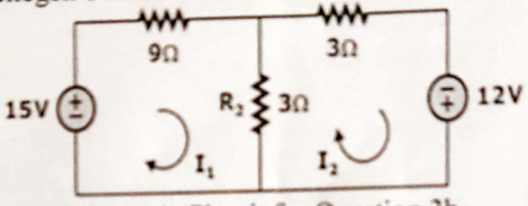
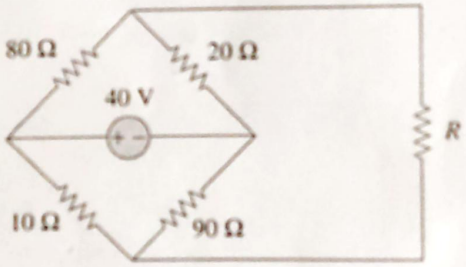
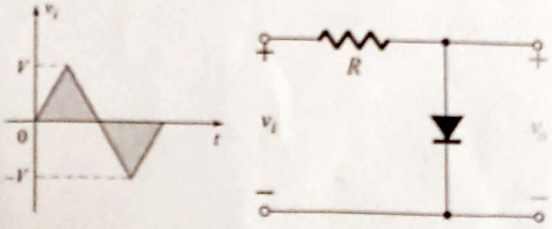
INDIAN INSTITUTE OF INFORMATION TECHNOLOGY UNA
HIMACHAL PRADESH
An Institute of National Importance under MoE
Saloh, Una – 177 209
Website: www.iiitu.ac.in

AY 2023-24
School of Electronics
Cycle Test – II
21, Nov.'23
Curriculum – IIITUGECE22

23108.

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	Find the amplitude, phase, period, and frequency of the sinusoid represented by: $V(t) = 12\cos(50t + 10^\circ)$ V	(1)
1. b	Determine the phase angle between the two sinusoids given by $V_1 = 45\sin(\omega t + 30^\circ)$ V and $V_2 = 50\cos(\omega t - 30^\circ)$ V. Which one of them is leading?	(2)
1. c	Find current I_1 and I_2 in the circuit shown in Figure 1.  Figure 1: Circuit for Question 1c	(2)
2. a	What is reciprocity theorem? Explain with the help of one example.	(1)
2. b	Find the Thevenin's equivalent across terminal a-b for the circuit shown in Figure 2.  Figure 2: Circuit for Question 2b	(2)

2. c	Obtain the Norton's equivalent across terminals a-b for the circuit shown in Figure 3.  Figure 3: Circuit for Question 2c	(2)
3. a	What is Millman's theorem? Explain with the help of one example.	(1)
3. b	Verify the Tellegen's theorem in the circuit shown in Figure 4.  Figure 4: Circuit for Question 3b	(2)
3. c	Calculate the maximum power delivered to the load R in the circuit shown in Figure 5.  Figure 5: Circuit for Question 3c	(2)
4. a	Draw the IV characteristics of an ideal PN junction diode.	(1)
4. b	Explain the working of a full wave bridge rectifier with suitable circuit diagram and waveforms.	(2)
4. c	Plot the output waveform v_o against time for the triangular input applied to the circuit shown in Figure 6 considering the diode is ideal.  Figure 6: Circuit for Question 4b	(2)

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AY 2023-24
SCHOOL OF BASIC SCIENCES
CURRICULUM: IIITUGCSE22
Cycle Test – II
20, Nov.'23 (02:00 PM – 03:00 PM)

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

Sl. No.	Question	Marks
1.a	Define the Gross and Net Calorific Value of a fuel.	(1)
1.b	Calculate the number-average molecular weight ($\overline{M_n}$), weight-average molecular weight ($\overline{M_w}$) and Polydispersity index (**PDI**) for an equimolar mixture of Pentane (C_5H_{12}) and Nonane (C_9H_{20}).	(2)
1.c	A sample of pulverized coal contains: C = 92%; H = 3%; O = 1%; S = 2%; and ash = 2%. The following results were obtained when the above coal was tested in the bomb calorimeter: Weight of coal burnt = 1.20 g; Weight of water taken = 400 g; Water equivalent = 2150 g; Rise in temperature = 2.2°C; Fuse wire connection = 30 cal; Acid correction = 20 cal. Calculate the Gross and Net calorific value of the coal. (Assuming the latent heat of condensation of steam as 575 Kcal/Kg)	(2)
2.a	What are lubricants? Describe any four desirable properties of a lubricating oil.	(1)
2.b	Describe, with a neat diagram, the process of Extrusion Moulding. How does it differ from Thermoforming?	(2)
2.c	A sample of coal was found to contain the following composition by weight: C = 80%; H_2 = 7%; O_2 = 5%; N_2 = 4% and remaining being ash. Calculate the minimum amount of air required for complete combustion of 5 Kg of coal sample. If 25% excess air is supplied, estimate the percentage composition of the dry products of combustion.	(2)
3.a	How emulsion polymerization is utilized in the synthesis of Buna-S Rubber?	(1)
3.b	Explain the synthesis of metallurgical coke by Beehive's oven method along with a well labeled diagram.	(2)

3.c	The ultimate analysis of coal gave the following composition by weight: C = 82%; O = 3%; S = 1%; N = 2%; and ash = 2%. The net calorific value of the coal was found to be 5500 cal/g. Calculate the percentage of hydrogen in the fuel using Dulong's method.	(2)
4.a	Explain why natural rubber needs vulcanisation. How the process of vulcanisation is carried out?	(1)
4.b	A combustion tube attached with anhydrous $CaCl_2$ and KOH chambers is used to burn 5.5 g of coal. The weight of $CaCl_2$ increased by 0.82 g while that of KOH increased by 4.25 g. Determine the percentage of carbon and hydrogen in the given coal sample.	(2)
4.c	Write a short note on fractional distillation of crude petroleum. What are the various fractions obtained from crude petroleum?	(2)

***** Good Luck *****

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AY 2023-24
School of Basic Sciences
CURRICULUM: IIITUGCSE22
Cycle Test – II
21, Nov.'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	Calculate the number of peptide bonds present in a hemoglobin molecule made up of four polypeptide chains, two alpha chains of 141 amino acid residues each and two beta chains of 146 amino acid residues each.	(1)
1.b	Draw the separation pattern of three proteins of size 50 kDa, 100 kDa, 200 kDa using the size exclusion chromatography.	(2)
1.c	Calculate the specific activity, and yield (%) of a target protein for each step from the given purification data as follows:	(1+1=2)

Purification step	Total Protein (mg)	Total Activity (U)	Specific Activity	Yield %
A	2500	150000		
B	500	75000		

2.a	Contrast the process of lactic acid, and ethanol fermentations.	(1)
2.b	Demonstrate the working of Gram staining technique employed for the separation of bacteria.	(2)
2.c	Illustrate the process of protein separation of three positively charged proteins A^{+7}, A^{+5}, A^{+2} using ion exchange chromatography.	(2)
3.a	Interpret the structure of normal human cells when exposed to the isotonic, and hypertonic solutions.	(1)
3.b	Demonstrate the working principle of four types of vaccines production with suitable examples.	(1+1=2)
3.c	Calculate the isoelectric point (pI) of an amino acid lysine if the data of pK_1, pK_2, and pK_R are 2.18, 8.95, and 10.53, respectively. Interpret the significance of the obtained pI data pertaining to protein structure.	(1+1=2)

4.a Which separation technique can be employed to separate out the tryptophan, a hydrophobic amino acid, from the mixture of three polar amino acids namely serine, threonine, cysteine? (1)

4.b Determine the cleavage pattern of amino acid residues after the treatments of cyanogen bromide and chymotrypsin to the purified target protein as follows: (1+1=2)
Gly-Ala-Met-Val-Val-Ala-Try-Pro-Gly-Lys-Phe-Val-Met-Val-Arg-Val-Phe-Met-Ala-Gly-Lys-Phe-Gly-Tyr-Ser-Lys-Pro.

4.c Demonstrate the working mechanism of the lux gene present in the bioluminescent marine bacteria. How is it being exploited in biotechnological applications? (1+1=2)

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

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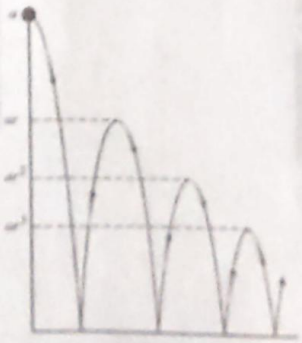
AY 2023-24
School of Computing
Curriculum: IIITUGCSE22
Cycle Test - II
November 20, 2023

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)	State if the following statement is true/false with reasoning: $Q = x_1x_2x_3$ is a positive definite quadratic form.	1
1(b)	Find the value of k so that the quadratic form given below is positive definite: $$k(x_1^2 + x_2^2 + x_3^2) + 2x_1x_2 - 2x_2x_3 + 2x_3x_1.$$	2
1(c)	Determine the nature, rank, index and signature of the quadratic form $Q = 6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4x_3x_1$.	2
2(a)	Consider the Figure 1 below. Use the knowledge of infinite series to calculate the total vertical distance traveled by the bouncing ball.  Figure 1: A ball initially at a and height of each rebound reduces by a factor 'r'.	1

2(b)	Determine if the series: $$x + \frac{2^2x^2}{2!} + \frac{3^3x^3}{3!} + \frac{4^4x^4}{4!} + \dots$$ is convergent/divergent at $x = \frac{1}{e}$.	2
2(c)	Investigate the convergence or divergence of the series $\sum_{n=1}^{\infty}\left(\frac{\sqrt[n]{n}}{n^2}\right)$.	2
3(a)	Show that, if the series $\sum_{n=1}^{\infty} u_n$ is absolutely convergent, then it is convergent.	1
3(b)	Determine if the series below is convergent or divergent: $$4 - 1 + \frac{1}{4} - \frac{1}{16} + \dots$$	2
3(c)	Examine if the series $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{(n+3\sqrt{n})^3}$ is absolutely or conditionally convergent.	2
4(a)	Is the series $\sum_{n=1}^{\infty} n!x^n$, a power series? If yes, then what is the centre?	1
4(b)	Calculate the interval and radius of convergence of the power series $\sum_{n=1}^{\infty}\frac{(x-2)^n}{n}$.	2
4(c)	Examine the convergence or divergence of the series $\frac{1}{3} + \frac{1}{10} + \frac{1}{29} + \dots$	2

******* All the best*******