Indian Institute of Information Technology Una
An institute of National Importance under MoE.
Saloh, Una (HP)-177209.

AY 2022-23
School of Electronics
Curriculum: IIITUGECE22
Cycle Test - I
June 5, 2023

Degree	B.Tech
Branch	ECE
Semester	II
Subject code/name	MAC221/ Mathematics-II
Time	60 minutes
Maximum Marks	20

Answer all the questions.

Q. No.	Questions	Marks
1(a)	Mention the order and degree of the following differential equation: $$y = x\frac{dy}{dx} + a\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{1/2}$$	1
1(b)	Apply the method of variation of parameter to solve the following ordinary differential equation: $$x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = x.$$	2
1(c)	Considering $p = \frac{dy}{dx}$, obtain the solution of the ordinary differential equation $x = y + a\log(p)$.	2
2(a)	Find the value of the constant λ such that the differential equation given below is exact: $$(2xe^y + 3y^2)\,dy + (3x^2 + \lambda e^y)\,dx = 0$$	1
2(b)	For the computed value of λ, determine the solution of the differential equation given in question 2(a).	2

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2(b)	For the computed value of λ, determine the solution of the differential equation given in question 2(a).	2

2(c)	Obtain the orthogonal trajectories of the following family of curves: $$x^2 + y^2 + 2fy - 1 = 0,$$ f being a parameter.	2
3(a)	Find the Laplace transform of $f(t) = 1$.	1
3(b)	Evaluate $\mathcal{L}(t^3 - 4t + 5 + 2\sin 3t)$.	2
3(c)	Obtain the integrating factor for the ordinary differential equation given below: $$y(x^2y^2 + 2)dx + x(2 - 2x^2y^2)dy = 0$$	2
4(a)	State the second shifting theorem of Laplace transform.	1
4(b)	Prove that $\mathcal{L}\left(\frac{\sin \alpha t}{t}\right) = \cot^{-1}\left(\frac{s}{\alpha}\right)$.	2
4(c)	Express the function below in terms of unit step function and hence find its Laplace transform. $$f(t) = \begin{cases} 0, & 0 < t < 1 \\ t - 1, & 1 < t < 2 \\ 1, & t > 2 \end{cases}$$	2

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

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AY 2022-23

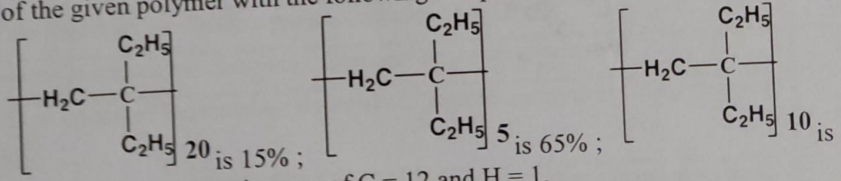
SCHOOL OF ELECTRONICS

CURRICULUM: IIITUGECE22

Cycle Test – I

05, Jun.'23

Degree	B. Tech.	**Branch**	ECE
Semester	Second		
Subject Code & Name	CYC222: Engineering Chemistry		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	**Questions**	**Marks**
1.a	What is hardness of water? How is it classified?	(1)
1.b	Two litres of water obtained from a bore well in Bavikonda near Visakhapatnam gave the following analysis for salts: $CaSO_4$ = 20 mg, $MgSO_4$ = 15 mg, $MgCl_2$ = 40 mg, $Ca(HCO_3)_2$ = 50 mg, $Mg(HCO_3)_2$ = 25 mg, KCl = 10 mg, and NaCl = 5 mg. Find out the temporary hardness, permanent hardness, and total hardness of water.	(2)
1.c	Calculate the number-average ($\overline{M_n}$) and weight-average ($\overline{M_w}$) molecular mass of the given polymer with the following composition:  20 is 15% ; 5 is 65% ; 10 is 20%. Given that atomic mass of C = 12 and H = 1.	(2)
2.a	Identify and draw the structure of monomers used in the fabrication of the following polymers: (i) Teflon (ii) Dacron	(1)
2.b	What is reverse osmosis? Explain the process of desalination using reverse osmosis.	(2)

2.c A water sample on analysis gave the following data: $Ca^{2+} = 20$ mg/l, $Mg^{2+} = 24$ mg/l, HCl = 100 mg/l, $CO_2 = 30$ mg/l, $HCO_3^- = 150$ mg/l, and $K^+ = 10$ mg/l. Calculate the lime (87% pure) and soda (91% pure) required to soften 2 million litres of the water sample. (2)

3.a Illustrate the differences between chain growth and step growth polymerization. What is the minimum functionality required for a monomer to form cross-linked polymer? (1)

3.b Explain the detailed mechanism of free radical polymerization to form polyethylene. (2)

3.c 30 ml of standard hard water (containing 25 g $CaCO_3$ per litre) required 50 ml of EDTA solution for end point. 100 ml of water sample required 25 ml EDTA solution, while same water after boiling required 15 ml EDTA solution. Calculate the permanent hardness and temporary hardness of the given water sample. (2)

4.a Outline the differences between biological oxygen demand and chemical oxygen demand in water. (1)

4.b Describe the utility of calgon and phosphate conditioning to overcome the boiler feed water problem. (2)

4.c A protein sample consists of an equal weight of molecules with hemoglobin ($M = 10{,}000$ Kg mol^{-1}) and ribonuclease ($M = 20{,}000$ Kg mol^{-1}). Apply the concept of number average ($\overline{M_n}$) and weight average ($\overline{M_w}$) molecular masses to determine the Polydispersity Index (PDI) of the polymer. (2)

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

CaO+H2O
40+2+32
74

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AY 2022-23

School of Computing

CURRICULUM: IIITUGECE22

Cycle Test – I

06, June'23

(09:00 AM – 10:00 AM)

Degree	B. Tech.	**Branch**	ECE
Semester	II		
Subject Code & Name	CSC 204: Basics of Programming in C		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Which part of CPU is responsible for performing mathematical calculations?	(1)
1.b	State and explain any four input devices of computer.	(2)
1.c	What are the top five applications of C programming language?	(2)
2.a	Differentiate between Data, Information, and Actionable Intelligence with example.	(1)
2.b	Write a program in C to print sum of all even number upto n, where n is entered by user.	(2)
2.c	Draw the flowchart for the same program mentioned in Q. 2.b.	(2)
3.a	Computing Machines are ubiquitous. Comment on the statement.	(1)
3.b	What is an operator? Explain the relational and logical operators in C language with example.	(2)
3.c	Write a program in C to find the sum of n natural numbers without using any loops.	(2)
4.a	What is meant by library functions in C programming language?	(1)
4.b	Two numbers are input through the keyboard into two locations C and D. Write a program to interchange the contents of C and D without using any temporary variable.	(2)
4.c	If a four-digit number is input through the keyboard, write a program to obtain the sum of the first and last digit of this number.	(2)

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AY 2022-23
School of Basic Sciences
CURRICULUM: IIITUGECE22
Cycle Test – 1
06, Jun.'23

Degree	B. Tech.	**Branch**	ECE
Semester	II		
Subject Code & Name	BIC203: Introduction to Biotechnology		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	What is the limit of resolution of a microscope with numerical aperture 1.45 and wavelength 600 nm?	(1)
1.b	i. Find the polarity and complementary strand of the DNA during replication process as follows: 5'-ATGCAGTGGCGCAACGTCCTTAGG-3'	(1+1=2)
	ii. Find the mRNA sequence if the coding strand of DNA is as follows: 5'-AATTCAAATTAGG-3'.	
1.c	Which staining technique will identify the bacteria based on their cell wall property? And write down the sequential steps of the staining technique employed for the identification of the bacteria.	(2)
2.a	Estimate the chlorophyll contents of two plant leaves, neem and banyan, with their spectroscopic absorbance values of A_{650} are 0.5 and 0.1, respectively.	(1)
2.b	i. How does the genetic code of sickle-cell hemoglobin differ from normal hemoglobin and what causes this molecular mutation?	(1+1=2)
	ii. Calculate the percentage of guanine concentration if the percentage of adenine concentration present in a given organism is 30%.	
2.c	Demonstrate how the DNA is proved experimentally the blueprint of life?	(2)
3.a	How are bacterial DNA protected from their own restriction enzymes?	(1)
3.b	Which DNA vector will be chosen to clone a human insulin gene of 1.425 kb? How is the screening of recombinant DNA done from the non-recombinant DNA?	(1+1=2)
3.c	Demonstrate the process of plasmid isolation and classify plasmid based on their confirmation.	(2)
4.a	Draw the separation pattern of three different DNA molecules of sizes 10 kb, 10.5 kb, and 10.2 kb in the agarose gel electrophoresis.	(1)
4.b	Illustrate the importance of Protein A in the purification of antibodies by affinity chromatography.	(2)
4.c	Demonstrate the working principle of PCR and its parameters for the optimal performance of DNA amplification.	(2)

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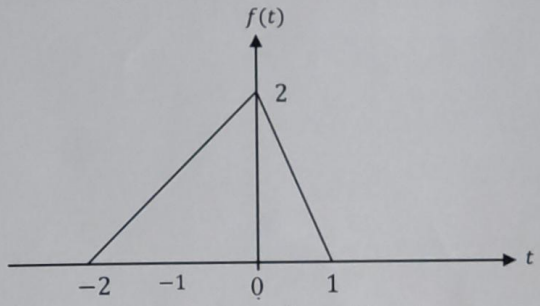
School of Electronics
CURRICULUM: IIITUECE22
Cycle Test – I
07, June'23

Degree	B. Tech.	**Branch**	ECE
Semester	II		
Subject Code & Name	ECC205: Signals and Systems		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Sketch the graph for signal $p(t)$ represented by the equation; $p(t) = 4\,r(t+3) - 4\,r(t+1) - 4\,r(t-1) + 4\,r(t-3)$	(1)
1.b	Is the signal $x(t) = \lvert sint\rvert + \lvert cost\rvert$ periodic or not? If it is periodic, find its fundamental period.	(2)
1.c	Sketch the even and odd part of the signal $f(t)$ shown in Figure 1.  Figure 1. Signal for problem 1.c	(2)
2.a	A signal $f[n]$ is defined as; $f[n] = \begin{matrix} 0 & n < -2 \text{ and } n > 5 \\ 1 & otherwise \end{matrix}$ What are the values of n for which $f[-n+4]$ is assured to be zero.	(1)
2.b	Find the power of $f(-2t+3)$ by assuming $f(t) = B.u(t)$.	(2)
2.c	Consider the system $y(t) = x^2(t - t_0) + 2$. Determine whether the system is (i) linear (ii) stable (iii) causal (iv) time invariant. Justify the answer.	(2)
3.a	The input-output relationship for a discrete-time system is expressed as: $y[n] = x[n]x[n-2]$ Find out the output of the system when the input is $A\,\delta[n]$, where A is any real or complex number.	(1)