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 - II
February 13, 2023

Degree	B.Tech
Branch	ECE
Semester	I
Subject code/name	MAC121/ Mathematics-I
Time	60 minutes
Maximum Marks	20

Answer all the questions.

Q. No.	Questions	Marks
1(a)	Consider the statement: The power series $$x - \frac{x^2}{\sqrt{2}} + \frac{x^3}{\sqrt{3}} - \frac{x^4}{\sqrt{4}} + \ldots + \infty$$ is convergent for all values of x. State if the given statement is true or false. Give reasons for the answer.	1
1(b)	Test the series given below for absolute convergence: $$\sum_{n=2}^{\infty} \frac{(-1)^n}{n(\log n)^2}.$$	2
1(c)	Find the radius and interval of convergence for the series: $$\sum_{n=0}^{\infty} \frac{(x-\sqrt{2})^{2n+1}}{2^n}.$$	2
2(a)	Let $f(x,y) = \frac{y}{x}$. Find $\lim_{(x,y)\to(0,0)} f(x,y)$, if exists.	1
2(b)	Consider $f(x) = \begin{cases} 1, & x \text{ is rational} \\ -1, & x \text{ is irrational} \end{cases}$. What can be concluded about the existence of $\lim_{x\to x_0} f(x)$, $x_0 \in \mathbb{R}$?	2

2(c)	Show that $f(x) = \frac{1}{x}$ is continuous on $(0, 1]$ but is not uniformly continuous on $(0, 1]$.	2
3(a)	Determine the first order partial derivatives of $z = \sin(x^2y^2)$.	1
3(b)	Examine the continuity of the function f defined by $$f(x) = \lim_{n\to\infty} \frac{e^x - x^n \sin x}{1 + x^n}, 0 \le x \le \frac{\pi}{2},$$ at $x = 1$.	2
3(c)	Illustrate that the function $$f(x) = \begin{cases} \frac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$ is discontinuous at $x = 0$. Mention the kind of discontinuity at $x = 0$.	2
4(a)	Identify and mention the condition of the Leibnitz's test which is not satisfied by the series $$\frac{1}{3} - \frac{1}{2} + \frac{1}{9} - \frac{1}{4} + \frac{1}{27} - \frac{1}{8} + \ldots + \infty.$$	1
4(b)	Determine whether or not the vectors $$u = (1, 1, 2), v = (2, 3, 1), w = (4, 5, 5)$$ in $\mathbb{R}^3$ are linearly dependent.	2
4(c)	Find the dimension and a basis of the solution space W of the following homogeneous system: $$\begin{aligned} x - 2y - 3z &= 0 \\ 2x + y + 3z &= 0 \\ 3x - 4y - 2z &= 0. \end{aligned}$$	2

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AY 2022-23

School of Basic Sciences

CURRICULUM: IIITUGECE22

Cycle Test – II

13, Feb.' 2023

Degree	B. Tech.	**Branch**	Electronics and Communication Engineering
Semester	First		
Subject Code & Name	PHC122: Electricity, Magnetism, and Quantum Mechanics		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Q.1a- Show that the quantum state (3, 5, 5) and its degenerate states will have the same energy. [1]

Q.1b- A beam of identical particles going in the x-direction is represented by the wave function:

$$\psi(x,t) = Ae^{\frac{i}{\hbar}(px-Et)},$$

Find the probability current density associated with it. [2]

Q.1c- Calculate $\langle p_x \rangle$ for $\psi(x) = (|\psi_1\rangle + |\psi_2\rangle)/\sqrt{2}$ where $|\psi_1\rangle$ and $|\psi_2\rangle$ are the ground state and the first excited state wave functions of a particle in an infinitely deep potential well. [2]

Q.2a- What is the quantum tunneling effect ? [1]

Q.2b- Show that the exception value $\langle x \rangle$ of the position of a particle trapped in potential box of 10 nm wide, is the same for all the quantum states. [2]

Q.2c- Electrons with energies of 2.0 eV and 12.0 eV are incident on a barrier 10.0 eV high and 0.50 nm wide. Find their respective transmission probabilities. [2]

Q.3a- Define the fermion and the boson particles and mention how these particles are different from each other ? [1]

Q.3b- Make use of the commutator algebra, and show that the x and y components of linear momentum associated with a moving particle can be measured, while its position along the x-axis and the x component of linear momentum can not be measured, simultaneously with arbitrary precision. [2]

Q.3c- Make use of the relation between the group velocity and the phase velocity of a wave packet, and show that the group velocity is equal to the phase velocity in the non-dispersive medium. [2]

Q.4a- Show that the ratio of Einstein's coefficients (A_{ji} and B_{ji}) is actually one third of the total density of standing waves of all frequencies in a cavity. [1]

Q.4b- Explain the following terms related to LASER with proper energy level diagrams: [2]
i) Spontaneous Emission,
ii) Stimulated Emission.

Q.4c- Write down the two Heisenberg uncertainty relations, one involving energy and one involving momentum. Explain the meaning of each term. Estimate the kinetic energy (in MeV) of a neutron confined to a nucleus of diameter 10 fm. [2]

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AY 2022-23
School of Basic Sciences
CURRICULUM: IIITUGCSE22
Cycle Test – II
14, Feb.' 23

Degree	B. Tech.	**Branch**	ECE
Semester	First		
Subject Code & Name	EVC103: Basic Environmental Science and Engineering		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. No.	**Question**	**Marks**
1.a	Explain Y-shape energy flow model.	(1)
1.b	Outline the diagram of major pressure belts and explain it.	(2)
1.c	Classify e-waste management techniques.	(2)
2.a	Explain commensalism and give one example.	(1)
2.b	Compare fabric filter and electrostatic precipitator.	(2)
2.c	Illustrate the 12 parameters of national ambient air quality and name the methods for measurement of SO_2 and NO_2.	(2)
3.a	Define biosensors and its components.	(1)
3.b	Explain secondary waste water treatment with respect to trickling filter.	(2)
3.c	Describe different types of biopesticides.	(2)
4.a	Construct well labelled diagram of effluent treatment plant.	(1)
4.b	Explain four phases of landfill site.	(2)
4.c	Draw and explain up-flow anaerobic sludge blanket system.	(2)

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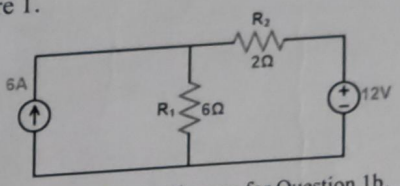
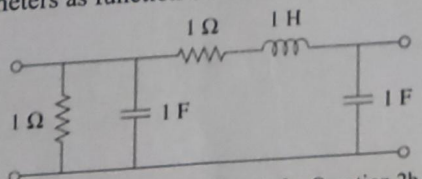
School of Electronics

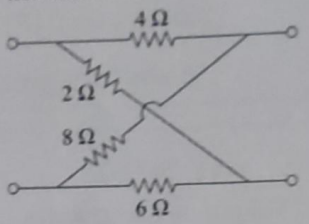
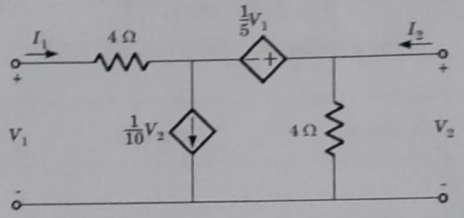
Cycle Test – II

14, February '23

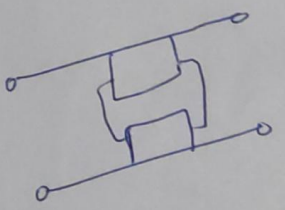
Curriculum – IIITUGECE22

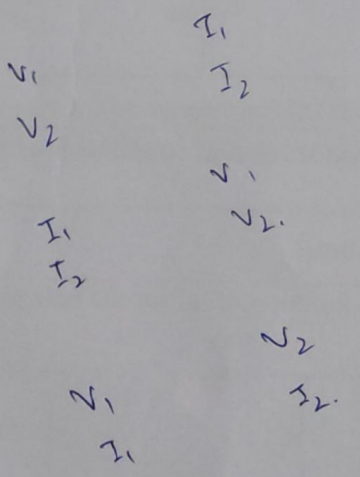
Degree	B. Tech.	**Branch**	ECE
Semester	I		
Subject Code & Name	ECC104: Electrical Circuits and Networks		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Define stability of the network using concept of pole and zero.	(1)
1.b	Using Tellegen's theorem, find the voltage across 6A current source for the circuit shown in Figure 1.  Figure 1: Circuit Diagram for Question 1b.	(2)
1.c	What are the symmetrical and reciprocal conditions for all types of two port networks?	(2)
2.a	What is a positive real function?	(1)
2.b	Obtain the Z-parameters as function of 's' for the network shown in Figure 2.  Figure 2: Network Circuit for Question 2b.	(2)
2.c	Construct a two-port network that realizes the following Z parameters: $Z = \begin{bmatrix} 1 + 3/s & 1/s \\ 1/s & 2s + 1/s \end{bmatrix}$	(2)
3.a	How will the 'real' part of the complex frequency appear in the time-domain?	(1)

3.b	Obtain the Z parameters for the network shown in Figure 3.  Figure 3: Network Circuit for Question 3b.	(2)
3.c	Find the T parameters for the network shown in Figure 4.  Figure 4: Network Circuit for Question 3c.	(2)
4.a	Find the driving point admittance of the network whose driving point impedance is $\frac{s+5}{(s^2+5s+1)}$.	(1)
4.b	A system has a pair of complex conjugate poles p1, p2 = −1 ± j2, a single real zero z1 = −4, with a gain K=4. Find the transfer function and plot the points graphically on a pole-zero plot.	(2)
4.c	Define Transfer Function. What are the properties of a Transfer Function.	(2)

*****GOODLUCK*****





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AY 2022-23
School of Electronics and Communication Engineering
Cycle Test – II
15th February 2023

Degree	B. Tech.	**Branch**	ECE
Semester	I		
Subject Code & Name	ENC 125: Communication Skills		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. No.	Question	Marks
1.a	Explain the term "Call to Order". (Word limit: 50-80)	(1)
1.b	What are the functions of Bylaws Committee? Mention any four. (Word limit: 100-120)	(2)
1.c	Who has given AIDAS theory and why? (Word limit: 50-80)	(2)
2.a	Write at least two important features of the Special Report.	(1)
2.b	What is a Physical Barrier in communication? Provide at least two examples.	(2)
2.c	Draft a newspaper report on the major earthquake received by Turkey and Syria. (Word limit: 120-150)	(2)
3.a	Apply the rules of Present Indefinite to the following sentences: 1.Srijita has ground the spices. 2. I think his method stank.	(1)
3.b	Write down at least two formal words for the following words: 1. Also 2. Really 3.Abode	(2)

	4.Thanks	
3.c	Give one-word substitution for the following words: 1.One whose motive is merely to get money 2.Governed by a sense of duty 3.Group of people living together in the same locality 4. A den for small animals	(2)
4.a	What is Transcribing? Write down at least two examples.	(1)
4.b	Describe at least four features of the Notice of the Meeting. (Word limit: 100-120)	(2)
4.c.	Write down at least two synonyms for the following words: 1. Insurgent 2. Involve 3. Efface 4. Mollify	(2)