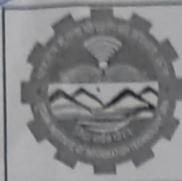


23257



Indian Institute of Information Technology, Una [HP]

(An Institute of National Importance under MoE)

Saloh, Una [HP]-177 209, India

Website: www.iiituna.ac.in

AY 2022-23

School of Basic Sciences

CURRICULUM: IIITUGECE22

End Semester Examination

04, April' 2023

Degree	B. Tech.	Branch	Electronics and Communication Engineering
Semester	First		
Subject Code & Name	PHC122: Electricity, Magnetism, and Quantum Mechanics		
Time: 180 Minutes	Answer All Questions	Maximum: 100 Marks	

Q.1a- Let $\mathbf{F}_1 = x^2 \hat{\mathbf{k}}$ and $\mathbf{F}_2 = x\hat{\mathbf{i}} + y\hat{\mathbf{j}} + z\hat{\mathbf{k}}$. Calculate the divergence and curl of \mathbf{F}_1 and \mathbf{F}_2 . 5

- i) Which one can be written as the gradient of a scalar?
- ii) Which one can be written as the curl of a vector?

Q.1b- Write down the Lagrange's equation of motion for a particle of mass 'm' falling freely under gravity near the surface of earth. 5

Q.1c- A clock keeps correct time. With what speed should it be moved relative to an observer so that it may seem to lose 2 minutes in 24 hours? 5

Q.1d- The rest mass of a proton is 1.67×10^{-27} kg. Find its mass and momentum, when it is moving with 2.7×10^8 m/sec velocity. If it collides with a stationary nucleus of mass 2.7×10^{-26} kg and coalesces, find the velocity of the combined particle. 5

Q.2a- Compute the probability current density for a Gaussian wave packet: $\psi(x) = Ae^{-\frac{x^2}{a^2} + \frac{i}{\hbar} p_0 x}$ and compare with the classical relation $J = \rho v$. $= \frac{1}{\hbar} (\psi^* \nabla \psi - \psi \nabla \psi^*)$. 5

Q.2b- The dispersion relation for sound waves in air is $\omega = \sqrt{\frac{\gamma RT}{M}} k$, Find the phase velocity and the group velocity. $\frac{\omega}{k} = vg$. $v_p = \sqrt{\rho}$. 5

Q.2c- An electron trapped in an infinitely deep potential well of width 0.5 nm. Find the value of wave number 'k' in the ground state. $k = \frac{2\pi}{\lambda}$. 5

- ii) What is the density of states at $E = 3$ eV?

Q.2d- An operator \hat{A} is defined as $\hat{A} = \alpha \hat{x} + i\beta \hat{p}$, where α, β are real numbers. Calculate the commutators: $[\hat{A}, \hat{x}], [\hat{A}, \hat{A}]$ and $[\hat{A}, \hat{p}]$. 5

Q.3a- Compare the relative probabilities of spontaneous and stimulated emission in an equilibrium system at room temperature ($T = 300$ K) for transitions that occur in the visible ($h\nu = 2.0$ eV) and the microwave regions ($h\nu = 10^{-4}$ eV) of the spectrum. 5

Q.3b- A Josephson junction consists of two super conductors separated by a very thin insulating layer. When a DC voltage is applied across the junction an AC current is produced, a phenomenon called Josephson effect. Calculate the frequency of the AC current produced when a DC voltage of $1.8 \mu V$ is applied. 5

Q.3c- Estimate the temperature at which the root-mean-square of nitrogen molecule in earth's atmosphere equals the escape velocity from earth's gravitational field. Take the mass of nitrogen molecule = 23.24 amu, and radius of earth = 6,400 km. 5

Q.3d- Make use of Fermi-Dirac distribution, and Calculate the probability that an allowed state is occupied if it lies above the Fermi level by kT , by $7kT$, by $14kT$. 5

Q.4a- The Hall coefficient and electrical conductivity of silicon are $-7.3 \times 10^{-5} \text{ m}^3/\text{C}$ and $2 \times 10^7 \text{ mho/m}$, respectively. 5

i) Calculate the magnitude of the mobility of the electrons.

ii) What is the type of semiconductor?

iii) How many charge carriers are there in the silicon sample?

Q.4b- At what angle will a diffracted beam emerge from the (222) planes of a face centered cubic crystal of unit cell length 0.5 nm? Assume diffraction occurs in the first order and that the X-ray wavelength is 0.3 nm. 5

Q.4c- What are the origins of magnetic field. Describe the B-H hysteresis curve for the paramagnetic, diamagnetic, and ferromagnetic materials with proper diagrams. 5

Q.4d- The refractive index of core material of the optical fiber is 1.48. Find the refractive index of cladding material such that light rays incident at an angle greater than 12° are not reflected at the core-cladding interface and therefore not guided along the optical fiber system. 5

Q.5a- Suppose that the Fermi level in a semiconductor lies more than a few kT below the bottom of the conduction band and more than a few kT above the top of the valence band, then find the product of the number of free electrons and the number of free holes per cm^3 . 5

Q.5b- A dielectric cube of side a , centered at the origin, carries a 'frozen-in' polarization $\mathbf{P} = kr$, where k is a constant. Find all the bound charges, and check that they add up to zero. 5

Q.5c- Consider an electromagnetic wave with its E -field in the y -direction. Apply the relation $\frac{\partial E_y}{\partial x} = -\frac{\partial B_z}{\partial t}$, to the harmonic wave : $\mathbf{E} = E_0 \cos(kx - wt)$, $\mathbf{B} = B_0 \cos(kx - wt)$; 5
and show that $E_0 = c B_0$.

Q.5d- Show that at any point in the electromagnetic field the energy density stored in the electric field is equal to that stored in the magnetic field. 5

****GOOD LUCK***



Indian Institute of Information Technology Una
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AY 2022-23

School of Electronics

Curriculum: IIITUGECE22

End Semester Exam

April 03, 2023

Degree	B.Tech
Branch	ECE
Semester	I
Subject code/name	MAC121/ Mathematics-I
Time	180 minutes
Maximum Marks	100

Answer all the questions.

Q. No.	Questions	Marks
1(a)	Give the conditions of consistency for a non-homogeneous system of linear equations. Determine all the solutions for the system of equations given by: $\begin{bmatrix} 1 & -1 & 3 \\ 2 & 3 & 1 \\ 3 & 2 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ 5 \end{bmatrix}$	5
1(b)	Obtain the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$. What can be stated about the algebraic multiplicity and geometric multiplicity for the eigen values?	5
1(c)	Transform the quadratic form $Q = 7x_1^2 + 6x_1x_2 + 7x_2^2$ to the Canonical form and find its rank, signature and index.	5
1(d)	Consider $A = \begin{bmatrix} 1 & -1 & 3 \\ 2 & 3 & 1 \\ 3 & 2 & 4 \end{bmatrix}$. Identify whether the matrix A is diagonalizable. If so, construct the matrix P such that $P^{-1}AP$ is a diagonal matrix.	5
2(a)	Find the values of x for which the power series $\sum_{n=2}^{\infty} \frac{(-1)^n x^n}{n(\log n)^{1/2}}$ converges.	5

2(b)	Discuss the convergence of the following series: $\sum_{n=1}^{\infty} \left(\sin \frac{1}{2n} - \sin \frac{1}{2n+1} \right).$	5
2(c)	For what values of a , does the series given below converge? $\sum_{n=1}^{\infty} \left(\frac{a}{n+2} - \frac{1}{n+4} \right)$	5
2(d)	Define conditionally convergent series. Determine if the series $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1}$ is conditionally convergent or not.	5
3(a)	Determine the points (x, y) in the plane where the function: $f(x, y) = \sin \frac{1}{xy}$ is continuous.	5
3(b)	Examine the uniform continuity of the function $f : (0, 1) \rightarrow \mathbb{R}$ defined by $f(x) = \cos \left(\frac{\pi}{x} \right).$	5
3(c)	Evaluate the double integral $\iint_R xy \, dA$ where R is the region bounded by the x -axis, the line $y = 2x$ and the parabola $y = x^2$.	5
3(d)	Identify the local extreme values (if any) of the function $f(x, y) = y^2 - x^2$.	5
4(a)	Explain whether $W = \{(x_1, x_2, x_3) : x_1 + x_2 + x_3 = k; x_1, x_2, x_3, k \in \mathbb{R}\}$ is a subspace of \mathbb{R}^3 ?	5
4(b)	Consider V as the vector space of $n \times n$ matrices over the field \mathbb{R} . Let W_1 and W_2 be subspaces of V containing $n \times n$ symmetric and skew-symmetric matrices, respectively. Show that V is the direct sum of W_1 and W_2 .	5
4(c)	Examine the subset $S = \{(1, 1, 1, 0), (3, 2, 2, 1), (1, 1, 3, -2), (1, 2, 6, -5), (1, 1, 2, 1)\}$ of \mathbb{R}^4 for linear dependence or linear independence.	5
4(d)	Let V be the vector space of 3×3 real diagonal matrices. Construct the basis of V and write its dimension.	5
5(a)	Show that $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$ defined by $T(x, y) = (x - y, x + 2y, y)$ is a linear transformation.	5

$$\cos \left(\frac{A+B}{2} \right) \sin \left(\frac{A-B}{2} \right)$$

$$\cos(A+B) \geq 0$$

5(b) Define range space of a linear transformation. Find the null space, rank and nullity of the linear transformation T defined in question 5(a). 5

5(c) Let $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be defined by $T(x, y, z) = (2x - 3y + 4z, 5x - y + 2z, 4x + 7y)$ be a linear transformation. Determine the matrix representation of T . 5

5(d) Consider the following two bases of \mathbb{R}^2 5

$$B_1 = \{(1, 0), (0, 1)\} \text{ and } B_2 = \{(1, 2), (2, 3)\}.$$

Find the transition matrices P and Q from basis B_1 to B_2 and B_2 to B_1 , respectively. State and prove the relation between P and Q .



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School of Basic Sciences
CURRICULUM: IIITUGCSE20
End Semester Exam
5, Apr.' 23

Degree	B. Tech.	Branch	ECE
Semester	First		
Subject Code & Name	EVC 103 & Basic Environmental Science and Engineering.		
Time: 180 Minutes	Answer All Questions		Maximum: 100 Marks

- | SL No. | Question | Marks |
|--------|---|--|
| 1.a | Write about energy conservation act and its importance. | (5) |
| 1.b | How do industries and transport pollute the environment. Give example. | (5) |
| 1.c | Construct diagram of nuclear power plant and its negative impact on environment. | (5) |
| 1.d | Write about environment issues of various non-conventional power plants. | (5) |
| 2.a | Define international solar alliance and types of solar energy. | (5) |
| 2.b | Solar insolation on a rectangular module ($1.5\text{m} \times 2.0\text{m}$) of photovoltaic cells is 500W/m^2 . If the efficiency of the cell is 12%. What is the power output of the module. | (5) |
| 2.c | A wind mill has cross-sectional area 25m^2 . The wind speed is 6.0 m/s . What will be the power generated by the wind mill in the Betz limit. | (5) |
| 2.d | Describe bioethanol, biomethanol, biodiesel and biogas plant. | $\frac{ML^2T^{-2}}{T}$
ML^2T^{-3} |

- 3.a Draw and explain vertical profile of soil. (5)
- 3.b Illustrate the 12 parameters of national ambient air quality and name all the methods used for measurement. (5) →
- 3.c What is Kyoto protocol and also discuss its mechanism. (5)
- 3.d What are the causes of noise pollution and its control measures. (5)
- 4.a Write about major scientists and their discoveries related to impact of organism on the environment. (5) —
- 4.b Write about staining techniques and its types. Give example. (5)
- 4.c What are the universal rules of nomenclature. Give example. (5) ←
- 4.d Draw ray diagram of dark field microscope and phase contrast microscope. (5)
- 5.a Compare biofertilizers and biopesticides. Give example. (5)
- 5.b Construct well labelled diagram of sewage treatment plant and explain moving bed bioreactor. (5)
- 5.c Write about bioremediation and phytoremediation techniques for polluted environment. (5)
- 5.d Explain trickling filter and its types with proper labelling. (5) —



School of Electronics

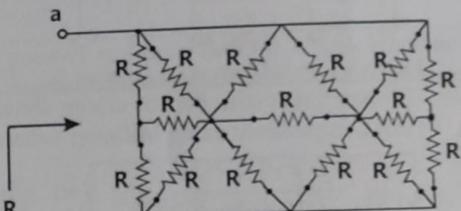
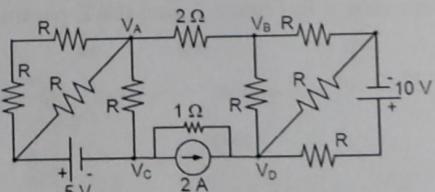
CURRICULUM: IIITUGECE22

End Semester Examination

April 07, 2023

22257

Degree	B. Tech.	Branch	ECE
Semester	I		
Subject Code & Name	ECC104 Electrical Circuits and Networks		
Time: 180 Minutes	Answer All Questions		Maximum: 100 Marks

Sl. No.	Question	Marks
1.a	For the circuit shown in Figure 1, find the R_{ab} if $R=300\Omega$.  Figure 1: Circuit Diagram for Question 1a.	5
1.b	How many steps are required to solve a given circuit using nodal analysis? Assume any circuit and mention all the steps in detail for the circuit.	5
1.c	Find the voltage difference between V_C and V_D , for given $V_A - V_B = 6V$ as shown in Figure 2.  Figure 2: Circuit Diagram for Question 1c.	5
1.d	What is meant by Network Graph? Explain the subgraph and its types. What are different matrices associated with Network graph?	5 (1+2+2)
2.a	Using the concepts of mesh analysis, Find the loop currents for the circuit diagram shown in Figure 3.	5

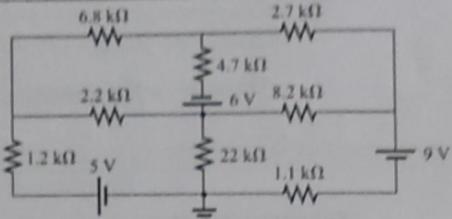


Figure 3: Circuit Diagram for Question 2a.

Find the resistance R_T using star-delta method for circuit shown in Figure 4.

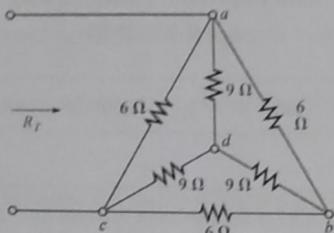


Figure 4: Circuit Diagram for Question 2b.

Find the thevenin's equivalent across the terminal A and B for the circuit shown in Figure 5.

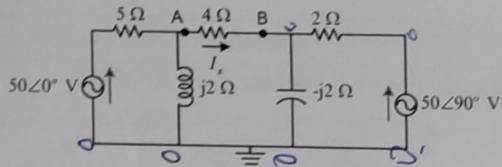


Figure 5: Circuit Diagram for Question 2c.

State and explain the Millman's theorem. For the circuit shown in Figure 6 find the current through $(6+j8)\Omega$, impedance using Millman's theorem.

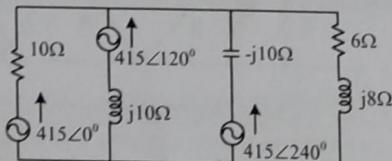


Figure 6: Circuit Diagram for Question 2d.

3.a Explain Tellegen's theorem. What are its application in real-time electrical circuits.

5

For the circuit diagram shown in Figure 7, find the Z-parameters.

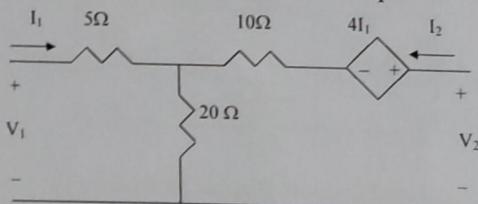


Figure 7: Circuit Diagram for Question 3b.

3.c What are ABCD parameters? Derive the expression for each parameter in terms of voltage and current for a two-port network. Draw neat and labelled diagram of the two-port network.

5

3.d Find the Y-parameters of the network for the circuit diagram shown in Figure 8.

5

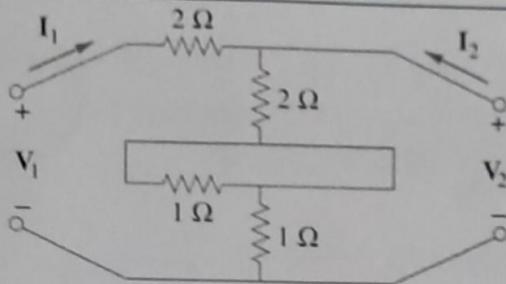


Figure 8: Circuit Diagram for Question 3d.

4.a	State and differentiate between the network functions of one-port network and two-port network.	5
4.b.	Explain the term "Driving Point function". What are the properties of the driving point function?	5
4.c	A second-order system has a pair of complex conjugate poles $s = -2 \pm j3$ and a single zero at the origin with a gain of 10 in s-plane. Find the transfer function and use the pole-zero plot to evaluate the transfer function at $s = 0 + j5$.	5
4.d	Given the transmission parameters: $T = \begin{bmatrix} 3 & 20 \\ 1 & 7 \end{bmatrix}$	5
5.a	Find other five two-port parameters.	5
5.b	Explain the term "Positive-real Function". What are the necessary and sufficient conditions for a function to be positive real?	5
5.c	Realize the positive real function $Z(s)$ given as: $Z(s) = \frac{(s+1)(s+3)}{s(s+2)}$	5
5.d	Consider the given positive real function $Z(s)$. Check whether it forms a Hurwitz polynomial. If yes, express the function in continued fraction and draw the circuit diagram.	5
5.d	For the impedance function $Z(s)$ given in question 5(b), Realize the Cauer-I and Cauer-II form.	5

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



AY 2022-23

School of Electronics and Communication Engineering

END-SEM EXAM

7th April 2023

Degree	B. Tech.	Branch	ECE
Semester	I		
Subject Code & Name	ENC 125: Communication Skills		
Time: 3 Hours	Answer All Questions		Maximum: 100 Marks

S. No.	Question	Marks
1.a	What is non-verbal communication? Explain at least four types of non-verbal communication.	5
1.b	Explain the meaning of the following idioms and construct a meaningful sentence: i. A blessing in disguise. ii. Birds of a feather flock together. iii. He's a chip off the old block. iv. Take a rain check. v. The whole nine yards	5
1.c	Define and differentiate between Homophones, Homonyms and Homographs with examples.	5
1.d	Correct the tense of the following words: i. I lived in Calcutta since 1930. ii. She died before her husband came.	5

iii. I have written a letter to her last Monday.

iv. I am reading Kalidasa for the last six days.

v. The new hotel has been opened last Saturday.

vi. He had gone to Madras last week.

vii. The train leave the station before I reached there.

viii. I wish my men had been coming quickly and find us.

ix. At the moment the baby sleep in the cradle.

x. He goes out for ten minutes.

Read the following sentences and rewrite without errors. If there are no errors, you may write "no errors" as your answer.

2.a

i. Ronald is married with Jennifer.

ii. The price of living is very high in London.

iii. I saw Richard when I'm on the flight.

iv. Laugh is the best medicines.

v. Bread and butter are Sheldon's favourite breakfast.

5

Fill appropriate phrasal verbs in the following sentences:

i. His father always taught him not to ____ those people with less. (look up to / look down on)

ii. Stop complaining and ____ your work! (get on with / get over)

iii. The boss wants you to ____ your figures for this month to him. (hand out / hand in)

iv. We're going to have to ____ our trip to Spain until September. (put up/ put off)

2.b

v. I ____ Amir today at the supermarket. It was great to see him. (ran out of / ran into)

vi. I'm so tired of Sophie ____ her engagement ring all the time. (showing off, showing up)

vii. The police would not ____ to the kidnapper's demands. (give up/ give in)

viii. I thought I would ____ for a cup of coffee. Is that okay? (drop off/ drop in)

ix. Have you ever ____ such an unusual piece of art? (come forward/come across)

x. It's important to ____ on time. (show up / show off)

5

2.c	<p>Write down at least two synonyms and one antonym for the following words:</p> <ol style="list-style-type: none"> 1. Oblique 2. Tranquil 3. Spurious 4. Felicitous 5. Discretion 6. Cajole 7. Florid 8. Calumny 9. Austere 10. Vilify 	5
2.d	<p>Give one-word substitution for the following words:</p> <ul style="list-style-type: none"> • ✓ 1. The strong and unreasonable belief that your own country or race is the best. • ✓ 2. A tube containing mirrors and pieces of colored glass or paper, whose reflections produce changing patterns when the tube is rotated. • ✓ 3. A drug which makes one see things that are not really there. 4. The act of killing one's wife. 5. The study or collection of coins. 6. Those who do malicious damage. 7. A four footed animal. 8. A group of three powerful people. 9. A person who helps even a stranger in difficulty. ✓ 10. A person who travels to a sacred place as an act of religious devotion. 	5
3.a	<p>Committees are the operating system of an association. Explain at least four types of committees with examples.</p>	5
3.b	<p>Explain Intrapersonal, Interpersonal and Small Group Communication with examples. (Word limit: 150-200 words)</p>	5
3.c	<p>Define Formal Report. Provide at least five different features of a Formal Report over other writings.</p>	5
3.d	<p>Draft a complaint letter to the management of your society related to the parking facility and some cases of disparity.</p>	5
4.a	<p>You are a frequent library visitor of your college. Frequently, it is undergoing some or other maintenance work from past many months. Write a letter to the Librarian notifying him/her of the issue. In the letter, describe the situation, explain the problems, and how you would like the situation resolved.</p>	5

	<p>Change the voice of the following sentences:</p> <ol style="list-style-type: none"> 1. Please maintain silence in this room. 2. Please post the letter. 3. Did the mechanic fix your car? 4. You should do your homework. 5. Lock the door 6. You must not come late to the class. 7. Who has seen the wind? 8. How did you find that out? 9. Is he not speaking the truth? 10. Mr. Sham teaches French. 11. I like you. 	
4.b		
4.c	<p>Assume yourself as the Joint Secretary of the SCA of your college and you have conducted a successful meeting on the upcoming conference on "Research Writing". Draft minutes of the meeting and the document should also include other agendas too.</p>	5
4.d	<p>Draft an effectual Sales Letter for the sale of a headgear. (Word limit: 200-250 words)</p> <p>Pencil a sonorous tag line for your product. (Word limit: 10-12 words)</p>	5
5.a	<p>Describe the following note making techniques with the help of examples:</p> <ol style="list-style-type: none"> 1. Tropicalizing 2. Copying 3. Transcribing 4. Schematising 	5
5.b	<p>Draft a telephonic conversation of at least 250 to 300 words between a student and the SHO (Station House Officer), requesting him to take a strict action against verbal abuse conducted by a local vendor.</p>	5
5.c	<p>Read the passage and then choose the best answer to the question. Answer the question based on what is stated or implied in the passage.</p> <p>Sportsmanship can be conceptualized as an enduring and relatively stable characteristic or disposition such that individuals differ in the way they are generally expected to behave in sports situations. In general, sportsmanship refers to virtues such as fairness, self-control, courage, and persistence, and has been associated with interpersonal concepts of treating others and being treated fairly, maintaining self-control if dealing with others, and respect for both authority and opponents. Sportsmanship is also looked at as being the way one reacts to a sport/game/player. The four elements of sportsmanship are often shown being good form, the will to win, equity and fairness. All four elements</p>	5

are critical and a balance must be found among all four for true sportsmanship to be illustrated. These elements may also cause conflict, as a person may desire to win more than play in equity and fairness and thus resulting in a clash within the aspects of sportsmanship. This will cause problems as the person believes they are being a good sportsman, but they are defeating the purpose of this idea as they are ignoring two key components of being sportsman like. When athletes become too self-centred, the idea of sportsmanship is dismissed.

Today's sporting culture, in particular the base of elite sport, places great importance on the idea of competition and winning and thus sportsmanship takes a back seat as a result. In most, if not all sports, sportsmen at the elite level make the standards on sportsmanship and no matter whether they like it or not, they are seen as leaders and role models in society.

Since every sport is rule driven, the most common offence of bad sportsmanship is the act of cheating or breaking the rules to gain an unfair advantage. A competitor who exhibits poor sportsmanship after losing a game or contest is often called a "sore loser", while a competitor who exhibits poor sportsmanship after winning is typically called a "bad winner". Sore loser behaviour includes blaming others for the loss, not accepting responsibility for personal actions that contributed to the defeat, reacting to the loss in an immature or improper fashion, making excuses for the defeat, and citing unfavourable conditions or other petty issues as reasons for the defeat. A bad winner acts in a shallow fashion after his or her victory, such as by gloating about his or her win, rubbing the win in the face(s) of the opponent(s), and lowering the opponent(s)'s self-esteem by constantly reminding the opponent(s) of "poor" performance in comparison (even if the opponent(s) competed well). Not showing respect to the other team is considered to be a bad sportsman and could lead to demoralizing effects; as Leslie Howe describes: "If a pitcher in baseball decides to pitch not to his maximum ability suggest that the batter is not at an adequate level, [it] could lead to the batter to have low self-confidence or worth.

Q1. Is it necessary to strike a balance between all the four elements of sportsmanship?

- A. No
- B. Yes
- C. Any 2 can be balanced
- D. Only 1 is sufficient

Q2. Why has sportsmanship taken a backseat today?

- A. Due to lack of balance between the elements
- B. Due to the emphasis on winning
- C. Due to drug abuse
- D. None of the above

Q3. If one does not accept responsibility for one's defeat, one is called a:

- A. Sore loser
B. Bad winner
C. Good sportsman
D. Prudent sportsman

Q4. From the last paragraph, give the opposite of the word 'deep':

- A. Competitor
B. Pitch
 C. Immature
 D. Shallow

Q5. When does the spirit of sportsmanship die?

- A. When the sportsman becomes too self-centred
B. When the player loses the will to play
C. When the sportsman behaves badly
D. None of the above

5d
Describe the role of the President, Secretary & Treasurer in a meeting. (Word limit: 150-200 words)