Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

End Semester/~~Re~~-examination 2024-25

Program: F.Y.B.Tech (Civil) Sem I 3/11/24 **Duration: 3 Hours**

Course Code: BS-BTC101 **Maximum Points: 100**

Course Name: Differential Calculus and Complex Numbers

Semester: I

Note:

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

		Questions	Points	CO	BL	Module
1	a	If $\alpha = i+1,\ \beta = 1-i$ & $\tan\phi = \frac{1}{x+1}$, prove that $\frac{(x+\alpha)^n - (x+\beta)^n}{\alpha-\beta} = \sin n\phi \cdot \operatorname{cosec}^n\phi$	6	2	BL5	3
	b	Find the root of the equation $x^3 - 5x - 7 = 0$ that lies between 2 and 3, correct to four places of decimals using Regula falsi method	6	3	BL3 ,5	5
	c	If $z = x^n f\left(\frac{y}{x}\right) + y^{-n} g\left(\frac{x}{y}\right)$, prove that $x^2\frac{\partial^2 z}{\partial x^2} + 2xy\frac{\partial^2 z}{\partial x \partial y} + y^2\frac{\partial^2 z}{\partial y^2} + x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = n^2 z$	8	1	BL3	1
2	a	If $y = \sin x \cdot \sin 2x \cdot \cos 3x$, find y_n	6	1	BL5	SL
	b	If $x^2 = a\sqrt{u} + b\sqrt{v}$ and $y^2 = a\sqrt{u} - b\sqrt{v}$; where a and b are constants prove that $\left(\frac{\partial u}{\partial x}\right)_y \cdot \left(\frac{\partial x}{\partial u}\right)_v = \frac{1}{2}$	6	1	BL2	1
	c	If $\sin^4\theta \cdot \cos^3\theta = a_1\cos\theta + a_3\cos 3\theta + a_5\cos 5\theta + a_7\cos 7\theta$, Prove that $a_1 + 9a_3 + 25a_5 + 49a_7 = 0$	8	2	BL3	3

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3	a	If $y=\frac{x^2+3x+5}{(x+2)^4}$, find y_n	6	1	BL4	SL
	b	If $x+iy=\tan\left(\frac{\pi}{6}+i\alpha\right)$, Prove that $x^2+y^2+\frac{2x}{\sqrt{3}}=1$	6	2	BL5	4
	c	Solve the following system of Equation using Gauss Seidel's Iterative method $28x+4y-z=32$ $x+3y+10z=24$ $2x+17y+4z=35$	8	3	BL5	5
4	a	Prove that $\frac{\sin 6\theta}{\sin 2\theta}=16\cos^4\theta-16\cos^2\theta+3$	6	2	BL5	3
	b	Evaluate $\int_0^6 \frac{1}{\sqrt{x^4+1}}dx$ by (i) Trapezoidal rule (ii) Simpson's $\frac{1}{3}^{rd}$ rule (iii) Simpson's $\frac{3}{8}^{th}$ rule	6	3	BL3	5
	c	If $z=x\log(x+r)-r$, where $r^2=x^2+y^2$, Prove that $\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial y^2}=\frac{1}{x+r}$	8	1	BL3	1
5	a	If $\tan(x+iy)=\sin(u+iv)$, Prove that $\frac{\sin 2x}{\sinh 2y}=\frac{\tan u}{\tanh v}$	6	2	BL4 ,5	4
	b	Find the root of the equation $e^x=2x+1$, correct to four places of decimals using Newton Raphson method	6	3	BL4	5
	c	A rectangular box with open top has volume v. Find the dimension of the box requiring least material	8	1	BL2 BL4	2

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6	a	Prove that $\tan\left[i\log\left(\frac{a-ib}{a+ib}\right)\right]=\frac{2ab}{a^2-b^2}$	6	2	BL5	4
	b	Find the maximum and minimum values of the function $f(x,y)=x-2y+5z$ on the sphere $x^2+y^2+z^2=30$, using the method of Lagrange's multipliers	6	1	BL3	2
	c	Solve the following system of Equation using Gauss Jacobi's Iterative method $10x+2y+z=9$ $x+10y-z=-22$ $-2x+3y+10z=22$	8	3	BL3 BL5	5
7	a	If $z=f(u,v), u=\log(x^2+y^2), v=\frac{y}{x}$, prove that $x\frac{\partial z}{\partial y}-y\frac{\partial z}{\partial x}=(1+v^2)\frac{\partial z}{\partial v}$	6	1	BL2 BL3	1
	b	: If $y=\cos(m\sin^{-1}x)$, prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}+(m^2-n^2)y_n=0$	6	1	BL5	SL
	c	Show that $\log(e^{i\alpha}+e^{i\beta})=\log\left[2\cos\left(\frac{\alpha-\beta}{2}\right)\right]+i\left(\frac{\alpha+\beta}{2}\right)$	8	2	BL1 BL3	3

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END SEM/~~RE-EXAM~~ EXAMINATION JANUARY 2025

Program: F.Y. B.Tech Civil Sem I

Course Code: BS-BTC-102

Course Name: Engineering Chemistry

Duration: 180 Min

Maximum Points: 100

Semester: I

Instructions:

1 Question No (Q6) is compulsory
2 Attempt any 4 from Q1, Q2,Q3, Q4,Q5
3 Write the chemical reactions wherever necessary

Q.No.	Questions	Points	CO	BL	Mod. No.
Q1					
a	Write the difference between hard and soft water	5	1	1	3
b	Explain BOD method for detection of organic matter content with chemical reaction	5	1	2	3
c	Describe zeolite process with chemical reaction and explain reverse-osmosis better than other method	10	1,2	2	3
Q2					
a	Explain the concentration cell corrosion	5	1	2	1
b	Write the difference between dry and wet corrosion	5	1	1	1
c	Explain wet corrosion with a suitable reaction, diagram, and mechanism	10	1,2	2	1
Q3					
a	Explain the anodic current protection method for protection of metal from the corrosion process.	5	2,4	1	2
b	How designing protect metal from corrosion process	5	2,4	2	2
c	Explain methods for application of metal coating	10	1,3	2	2
Q4					
a	Define polymer with suitable examples	5	1,3	2	4

END SEM/RE-EXAM EXAMINATION JANUARY 2025

b	Explain free radical polymerization mechanism	5	1,3	2	4
c	What are conducting polymers? explain their different types with chemical reaction	10	1,4	2	4
Q5					
a	Describe the anodic coating process with a suitable diagram and highlight its advantages.	**5**	**1**	**2**	**2**
b	How silicon nitride is chemically synthesized	5	1,2	3	4
c	Write factor related to metal and factors related to environment affecting rate of the corrosion process	10	1	1	1
Q6					
a	50 mL standard hard water containing 1.0mg/mL CaCO3 consumed 50 mL of EDTA. 50mL of the unknown hard water sample consumed 25 ml of EDTA using EBT as an indicator. After boiling, filtration of the same hard water 50mL) consumed 10 mL of EDTA using EBT as an indicator Calculate total, permanent and temporary hardness of water	5	1	4	3
b	Calculate the temporary , permanent and total hardness for water sample contain $Mg(HCO_3)_2$=25mg/L, $CaSO_4$= 15mg/L $CaCl_2$= 10mg/L	5	1	3	3
c	A 50 ml of sewage water sample was reflexed with 20ml of 0.25N $K_2Cr_2O_7$ in presence of dilute H_2SO_4 And Hg_2SO_4. The unreacted dichromate required 25mL of 0.25N Ferrous Ammonium sulphate Solution. 20ml of $K_2Cr_2O_7$ and 50ml of distilled water under same condition as the sample required 45ml of 0. 25N ferrous ammonium sulphate solution. Calculate the COD of the sample	5	1	1	3
d	Convert the unit 30 PPM in to ^{0}Fr, ^{0}Cl, mg/L 20 ^{0}Cl in to ^{0}Fr , ppm, mg/L	5	1	4	3

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END-SEM / ~~RE-EXAMINATION~~ January 2025

F.Y. B.Tech Civil sem I

Program: B.Tech (Civil) **Duration: 3 Hr**

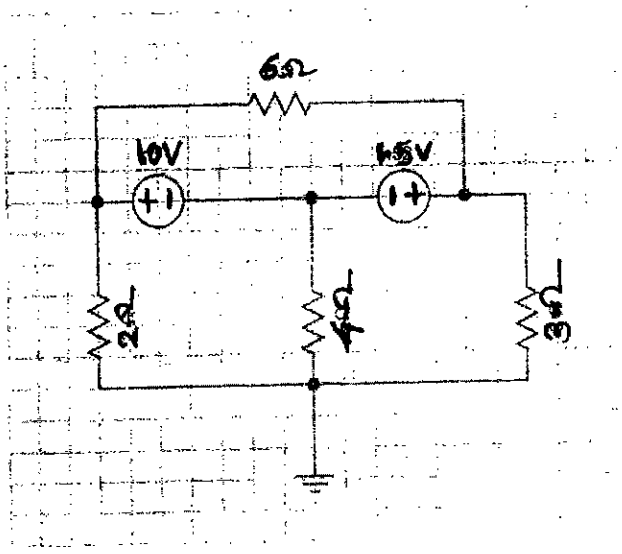
Course Code: ES-BTC101 **Maximum Points: 100**

Course Name: Basic Electrical and Electronics Engineering **Semester: I**

Notes: 1) Q 1 is compulsory

2) Assume Suitable data if required and justify the same.

3) Solve any four from Q.2 to Q.7.

Q.No.	Questions	Points	CO	BL	Module No.
1a	Explain in details any one type of sensor.	05	04	01	05
1b	Explain working principle of a single phase induction Motor.	05	02	01	03
1c	What is the use of filter? With waveforms explain effect of filter on output of a full wave rectifier.	05	03	01	04
1d	In a three phase AC system derive relation between line and phase voltages if the system is star connected.	05	01	02	02
2a	Using Mesh Analysis determine current through 3 ohm resistor 	10	01	02	01

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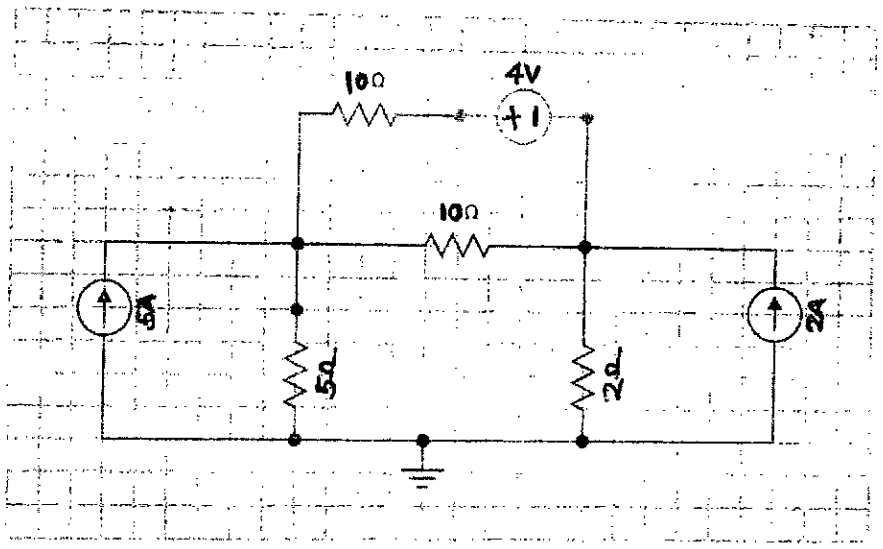
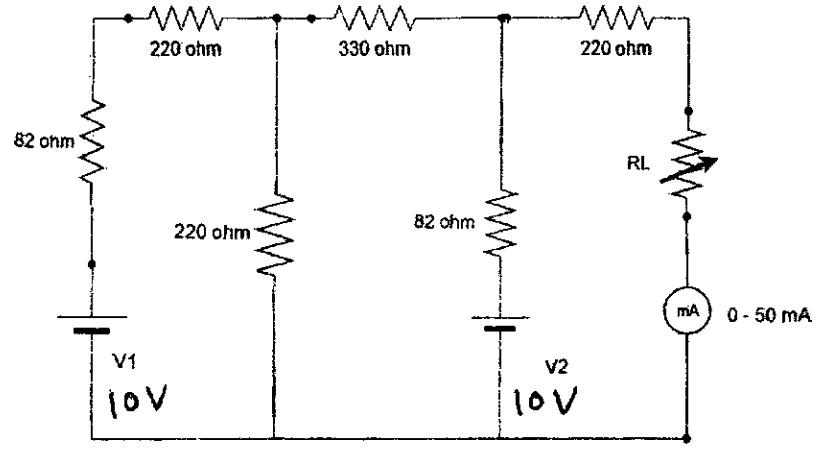
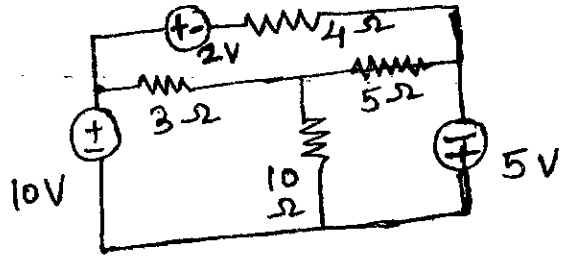
END-SEM / ~~RE~~ EXAMINATION January 2025

2b	Using superposition theorem, calculate the current through 2 ohm resister 	10	01	02	01
3a	Determine the maximum power that can be delivered to a resistor RL 	10	01	02	01
3b	Determine current through 10 ohm resistor. 	10	01	02	01

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END-SEM / RE-EXAMINATION January 2025

4a	A resistor of 10Ω is connected in series with a 5mH inductor. This circuit is connected to a 120V, $60H_Z$ supply. Find a) impedance b) current c) power factor d) phase angle e) voltage across resistor and voltage across inductor.	10	01	02	02
4b	A Capacitor of 50 μf is connected in series with a variable resistor. The circuit is connected to a $50H_Z$ supply. Find the value of resistance for a condition when voltage across capacitor is half of the supply voltage.	10	01	02	02
5a	Two impedances Z_1=50∠30° And Z_2=25∠60°, are connected in series across a single phase 230V, $50H_Z$ Source. Find a) current drawn b) power factor c) Real, Reactive and apparent power	10	01	02	02
5b	A star connected resistive load is connected to a 400 V, 50 Hz three phase system. Draw the phasor diagram showing all line and phase quantities. Calculate line and phase current though the load.	10	01	02	02
6a	Explain Zener diode characteristic and its application as a voltage regulator. Explain Characteristics of a BJT.	10	03	02	04
6b	Explain working principle of full wave rectifier with neat diagram and waveforms. Derive the expression for- average output current and voltage, RMS value of the current, efficiency and peak inverse voltage.	10	03	02	04
7a	Explain working principle of a transformer. Compare it with three phase induction motor with single phase induction motor.	10	02	01	03
7c	List four different types of sensors and their applications. Explain any four characteristics of sensor/ transducer in detail.	10	04	01	05

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END SEMESTER/~~RE~~-EXAMINATION (R23) JANUARY/~~FEBRUARY~~ 2025

Program: UG First Year A Term Civil Sem I

Course Code: ES-BTC102

Course Name: Engineering Mechanics - I

10/1/25

Duration: 3 Hours

Maximum Points: 100

Semester: I

Notes:

- **Solve any five main questions**
- Assume **suitable data** if necessary and **state it clearly**
- Clearly write units everywhere. Points will be deducted in each place units are missing
- Figure on right indicate **maximum points** for the given question, **course outcomes attained, Bloom's Taxonomy Level** and **Performance Indicators**

Q. No.			Points	CO	BL
1	a	For the cantilever beam shown in Figure 1, determine the support reactions	10	1	3
	b	For the compound beam shown in Figure 2, determine the reactions at A and F if CD is an internal hinge.	10	1	3
2	a	A weightless beam AB is attached to the wall by weightless cable BC as shown in Figure 3. If the tension in cable BC is 725 N, determine the resultant of the forces at point B.	5	1	3

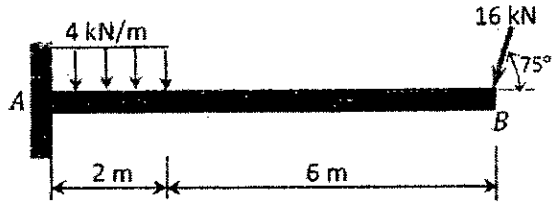


Figure 1

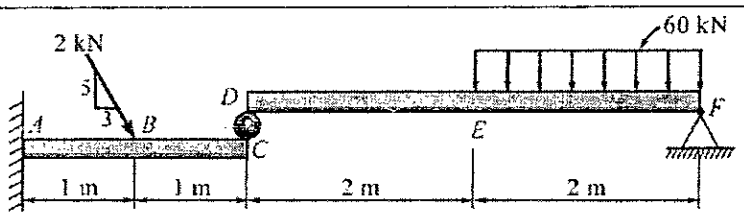


Figure 2

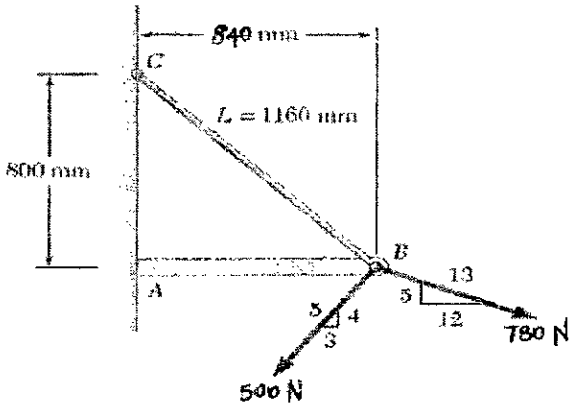
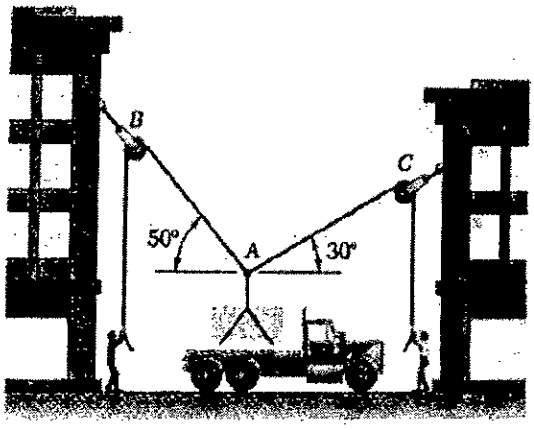
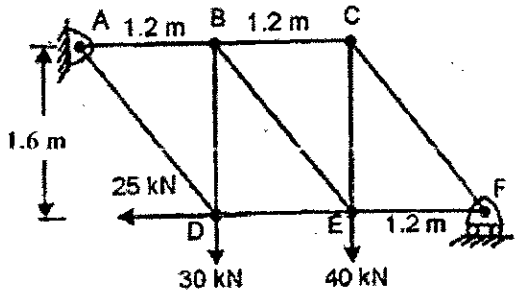
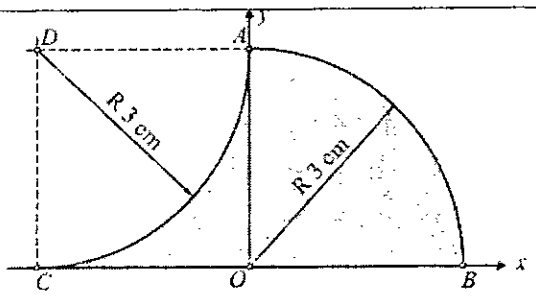
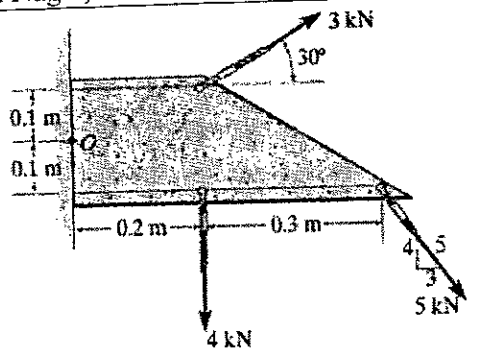
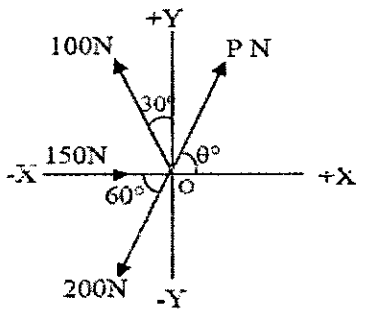
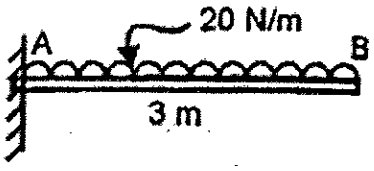


Figure 3

	b	State Lami's theorem. Determine the tensions in cables AB and AC shown in Figure 4 using Lami's theorem. Assume weight of the packet hanging from A as 736 N. Assume the cables to be weightless and pulleys to be frictionless. Verify the values by using equations of equilibrium.	 Figure 4	15	1	2,3
3	a	Using method of joints, determine the forces in members BE and BC for the truss shown in Figure 5.	 Figure 5	10	2	3
	b	Find the centroid of the shaded area shown in Figure 6.	 Figure 6	10	3	3

4	a	Replace the forces acting on the lamina shown in Figure 7 by a resultant force and couple system at point O.	 **Figure 7**	5	1	3
	b	List different types of supports, illustrate with neat sketches and show the internal reactions generated at these supports.		5	1	2
	c	For the beam shown in Figure 1, determine the support reactions using the principle of virtual work.		10	4	3
5	a	A system of 4 forces as shown in Figure 8 has a resultant of 50 N acting along +X axis. Determine the magnitude of P (in N) and angle θ.	 **Figure 8**	5	1	3
	b	Illustrate with a neat sketch: coplanar and concurrent forces acting on a particle collinear forces acting on a body coplanar non-concurrent forces acting on a surface State parallelogram law of forces and state its use.		5	1	2
	c	Using method of sections, determine the forces in members BE and BC for the truss shown in Figure 5.		10	2	3
6	a	A simply supported beam AB has length of 4 m and a 20 kN/m UDL acting vertically downwards on the entire beam. Illustrate with a neat sketch and determine the support reactions.		5	1	3
	b	Differentiate between a perfect and imperfect truss. Illustrate with examples		5	2	2

	c	For the beam shown in Figure 9, determine the support reaction using principle of virtual work	 Figure 9	10	4	3
7		For the plane area shown in Figure 10, find the centroid. Also determine its moment of inertia about both centroidal axes parallel to x and y.		20	3	3

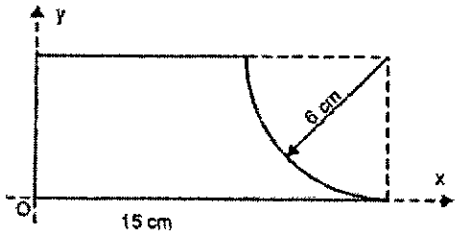


Figure 10

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END SEM/~~RE-EXAM~~ EXAMINATION ~~DEC/~~JAN 2024-25

Program: F.Y.B.Tech.-Civil Sem I
Course Code: BS-BTC103
Course Name: BIOLOGY FOR ENGINEERS (R23)

13/1/25

Duration: 2 Hrs.
Maximum Points: 50
Semester: I

Notes: All questions are compulsory.

Q.No.	Questions	Points	CO	BL	Module No.
1.	Give the general properties of enzymes and factors affecting their activity?	5	1	1	1
2.	Give the significance of Mitosis.	5	2	1	2
3.	Describe the micro- and nanostructures of a lotus leaf that contribute to its hydrophobic properties. How can these structures be replicated in engineering applications?	5	3	3	4
4.	Evaluate the environmental benefits of using self-healing bio-concrete in sustainable construction.	5	4	4	5
5.	Describe the process of DNA replication in eukaryotic cells, highlighting the roles of key enzymes and proteins involved.	6	4	2	3
6.	Explain Mendel's Law of Independent Assortment and how it applies to dihybrid crosses.	8	2	2	2
7.	Describe how echolocation has been mimicked in technology, providing examples of its applications.	8	3	2	4
8.	A food company wants to standardize the flavor profile of a newly launched juice product. How can an electronic tongue and nose assist in this process?	8	3	2	5