



B.Sc. V Semester (CBCS) Degree Examination, August/September - 2022

PHYSICS - V

5.1 : Atomic and Molecular Physics

100177

Time : 3 Hours

Maximum Marks : 70

Note : Write answers to **Section - A** questions in first **two** pages only.

SECTION - A

Answer **all** the following.

15x1=15

1. What is the specific charge of an electron ?
2. Compare the radius of the atom with that of nucleus.
3. Who discovered Nucleus of an atom ?
4. Mention any one failure of Sommerfeld's model of an atom.
5. State Pauli's exclusion principle.
6. What is the importance of principal quantum number ?
7. What is Stark effect ?
8. Mention types of Molecular Spectra.
9. What is phosphorescence ?
10. State Frank-Condon principle.
11. Mention any one use of Raman effect.
12. What is the composition of Ruby rod ?
13. What is Rayleigh scattering ?
14. What is population inversion ?
15. What is recorded on the holography ?



P.T.O.

SECTION - BAnswer **any five** of the following.**5x5=25**

16. Describe the construction and working of Dempster's mass spectrograph.
17. Discuss Thomson's and Rutherford model of atom.
18. Explain the concept of space quantisation.
19. Discuss J-J coupling scheme.
20. What is Fluorescence ? Explain it in brief. Mention any one use of fluorescence.
21. Describe experimental set-up used in study of Ramann effect.
22. Explain the principle, constructions and working of He-Ne-Laser.

SECTION - CAnswer **any three** of the following.**3x10=30**

23. (a) Explain J-J Thomson's method of determining the specific charge of an electron. **6+4**
(b) In a determination of e/m by Dunnington's method, frequency of AC = 20MHz and $\theta = 315^\circ$. If the successive value for B for which the current is minimum are 1.67×10^{-4} and 1.293×10^{-3} Weber/m³. Find e/m .
24. (a) Derive an expression for the radius of the n^{th} orbit of electron of the hydrogen atom. **6+4**
(b) Calculate the ionisation potential of hydrogen atom.
25. (a) Derive an expression for pure rotational spectral energy of a diatomic molecule treating it as a rigid rotator. **5+5**
(b) Explain the experimental set-up to study normal Zeeman effect.
26. (a) Explain Stern-Gerlach experiment. **5+5**
(b) Explain normal Zeeman effect.
27. (a) Give five application of Lasers. **5+5**
(b) Describe Frank-Hertz experiment.

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**B.Sc. V Semester (CBCS) Degree Examination,
August/September - 2022**

PHYSICS - VI

5.2 : Statistical Mechanics, Quantum Mechanics and Electronics - I

Time : 3 Hours

Maximum Marks : 70

Instructions : Answer All Sections.

SECTION - A

Answer **all** questions, each carry **one** mark.

15x1=15

1. What is phase space ?
2. What are matter waves ?
3. What is zero point Energy ?
4. Define wave function.
5. What are Eigen functions ?
6. Mention the particles involved in Compton scattering.
7. What is Zener Breakdown Voltage ?
8. Mention the Relation between α & β .
9. Define Energy gap of Semiconductor.
10. Why LED emits light ?
11. What is Liquid crystal ?
12. Define Electrical Conductivity of Conductor.
13. What is photo Diode ?
14. What is CE-mode Transistor ?
15. Mention the value of Energy gap of Insulator.



P.T.O.

SECTION - B

Answer **any five** of the following.

5x5=25

16. Derive Boltzman Equipartition Theorem. **5**
17. Derive Time-Independent wave Equation. **5**
18. With neat diagram explain Division and Germer Experiment. **5**
19. Derive Expression for Energy gap of semiconductor. **5**
20. Distinguish between P-type and n-type semiconductors. **5**
21. With neat diagram explain 7-segment display. **5**
22. Explain construction and working of solar cell. **5**

SECTION - C

Answer **any three** of the following.

3x10=30

23. (a) Derive Expression for Compton Shift. **7+3**
(b) Find the Energy of a Neutron in eV whose wavelength is 1\AA .
24. (a) Derive Expression for Energy of a infinite potential well. **7+3**
(b) Find the lowest Energy of an Electron moving in 1D of an infinitely high potential box of width 1\AA .
25. With neat diagram explain Hall effect and derive expression for Hall Co-efficients. **10**
26. With neat diagram explain Half Wave Rectifier and derive expression for Ripple Factor of a Half Wave Rectifier. **10**
27. (a) Compare Maxwell Boltzman and Fermi-Dirac Distribution Functions. **5+5**
(b) Compare LED and LCD.

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B.Sc. V Semester Degree Examination, August/September - 2022

5.1: CHEMISTRY - V

(NEW CBCS)

100222

Time : 3 Hours

Maximum Marks : 70

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- Instructions** (i) *Section-A contains questions from Inorganic, Organic and Physical Chemistry.*
Section-B contains questions from Inorganic Chemistry.
Section-C contains questions from Organic Chemistry.
Section-D contains questions from Physical Chemistry.
- (ii) *Answer all the four Sections A, B, C and D.*
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SECTION - A

Answer **any ten** of the following.

10×1=10

1. Calculate the expected magnetic moment for Fe^{+3} ion of spin magnetic moment.
2. Define magnetic susceptibility.
3. What is spectrochemical series ?
4. Write the structures of borazine.
5. Mention the compound which is used as reference in NMR spectra.
6. What are equivalent protons ?
7. Write the IUPAC name of $\text{C}_2\text{H}_5\text{-S-H}$.
8. What is meant by essential amino acids ?
9. State Grothus - Drapers law.
10. What is phosphorescence ?
11. What is chemiluminescence ?
12. Define dipole moment.



P.T.O.

SECTION - B

Answer **any two** of the following.

2x10=20

13. (a) Give a brief account of diamagnetism, ferromagnetism and antiferromagnetism.
(b) Write a note on temperature independent paramagnetism.
14. (a) Discuss the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.
(b) Write a note on charge transfer spectra.
15. (a) Write the preparation, properties and structure of S_4N_4 .
(b) Write a note on structure of silicates.

SECTION - C

Answer **any two** of the following.

2x10=20

16. (a) Describe the principle and applications of NMR spectra.
(b) Write a note on spin-spin coupling.
17. (a) Explain the principle and applications of IR spectra.
(b) Give two methods of preparation of ethane thiol.
18. (a) Give any two methods of synthesis of α - amino acids.
(b) Give any two methods of preparation of diethyl sulphide.

SECTION - D

Answer **any two** of the following.

2x10=20

19. (a) What is Quantum yield ? Give the reason for :
(i) High Quantum yield
(ii) Low Quantum yield.
(b) Give the differences between photochemical and thermochemical reactions.
20. (a) State and explain Lambert's law.
(b) Explain :
(i) Photoinhibitor
(ii) Photosensitisation
21. (a) Write a note on orientation polarisation.
(b) Give Clausius-Mossotti equation and write its importance.

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B.Sc. V Semester Degree Examination, August/September - 2022

**5.2 : CHEMISTRY - VI
(NEW-CBCS)**

100265

Time : 3 Hours

Maximum Marks : 70

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- (i) **Section-A** contains questions from Inorganic, Organic and Physical Chemistry.
Section-B contains questions from Inorganic Chemistry
Section-C contains questions from Organic Chemistry
Section-D contains questions from Physical Chemistry.
- (ii) Answer all the four Sections A, B, C and D.
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SECTION - A

Answer **any ten** of the following questions.

10x1=10

1. Define accuracy.
2. Define Protic Solvent.
3. Define Nuclear Fusion.
4. What is mass defect ?
5. Write the Haworth structure of glucose.
6. Write the composition of oil.
7. Write one use of Nylon.
8. What is Bismarck brown ?
9. How does specific conductance varies with dilution ?
10. What is ionic conductance ?
11. State Hittorf's rule.
12. Define degree of Polymerization.



P.T.O.

SECTION - B**2x10=20**Answer **any two** of the following questions.

13. (a) Discuss briefly determine errors.
(b) Write a note on methods of reporting analytical data.
14. (a) Describe the general properties of non-aqueous solvents.
(b) Give any two chemical reactions of liquid ammonia.
15. (a) Discuss the shell model of the nucleus.
(b) Explain nuclear stability on the basis of N/P ratio.

SECTION - C**2x10=20**Answer **any two** of the following questions.

16. (a) Explain Keto-enol tautomerism in Ethyl acetoacetate.
(b) Describe the terms Epimerisation and Mutarotation.
17. (a) Describe the elucidation of open-chain structure of D-Glucose.
(b) How do you synthesize sodium lauryl sulfate ?
18. (a) Explain the manufacture of soap by Hydrolyser process.
(b) Explain thermosetting and thermoplastic polymers with suitable examples.

SECTION - D**2x10=20**Answer **any two** of the following questions.

19. (a) State and explain Kohlrausch's law. Write its application.
(b) Explain equivalent conductance and molar conductance with their units.
20. (a) Describe the method of determination of molecular weight of Polymer by Viscosity method.
(b) Explain briefly conductometric acid-base titrations.
21. (a) Describe the experimental method of determination of transport number by Hittorf's method for non-attackable electrodes.
(b) The resistance of N/10 solution of an electrolyte was found to be 210 ohms at 25°C. Calculate equivalent conductance of the solution at 25°C (cell constant = 0.88).

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**B.Sc. V Semester (CBCS) Degree Examination,
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100111

MATHEMATICS - X

5.2 : Applied Mathematics

Time : 3 Hours

Maximum Marks : 70

Instruction : Answer *all* the Sections.

SECTION - A

Answer **any five** of the following questions :

5x2=10

1. Define Divergence of a Vector function.
2. Prove that $\text{Curl} (\text{grad } \phi) = 0$
3. If $\phi = x^2 - y^2$ show that $\nabla^2 \phi = 0$.
4. Define Stationary function and write the solution of Euler's equation when 'f' is independent of y.
5. State Gauss divergence theorem.
6. Solve : $r + 3s + 2t = 0$.
7. Define a homogeneous Linear partial differential equation of second order.

SECTION - B

Answer **any five** of the following questions :

5x6=30

8. Find the equation of the tangent plane to the surface $z = x^2 - y^2$ at the point (2, -1, 3)
9. Prove that $\text{Curl} (\text{curl } \vec{f}) = \text{grad} (\text{div } \vec{f}) - \nabla^2 \vec{f}$
10. Show that $\text{Curl} [\vec{r} \times (a \times \vec{r})] = 3\vec{r} \times a$ where a is a Constant Vector.



P.T.O.

11. Verify Green's theorem in the plane for $\oint_C [xy+y^2]dx + x^2dy$; where C is the closed curve bounded by $y = x$ and $y = x^2$.
12. Evaluate $\oint_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F} = 2y\mathbf{i} + 3x\mathbf{j} - z^2\mathbf{k}$. Using Stoke's theorem, where 'C' is the boundary of upper half of the surface of the sphere $x^2 + y^2 + z^2 = 9$.
13. Find the curve on which the functional $I = \int_0^1 \left[\left(\frac{dy}{dx} \right)^2 + 12xy \right] dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremised.

SECTION - C

Answer **any five** of the following questions :

5x6=30

14. Solve : $(D^2 - (D^1)^2 - 3D + 3D^1) Z = xy$
15. Solve : $[D^2 + DD^1 - 6(D^1)^2] Z = \cos(2x + y)$
16. Solve : $(D^2 - DD^1) Z = \sin x \cos 2y$
17. Solve : $[D^2 + DD^1 + D^1 - 1] Z = \sin(x + 2y)$
18. Reduce the equation $\frac{\partial^2 z}{\partial x^2} + x^2 \frac{\partial^2 z}{\partial y^2} = 0$ into a Canonical form.
19. Obtain the solution of one-dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by using the method of Separation of Variables.

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**B.Sc. V Semester (CBCS) Degree Examination,
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MATHEMATICS - XI

100087

5.3 (New) : Graph Theory - I (Optional)

Time : 3 Hours

Maximum Marks : 70

Instruction : Answer *all* sections.

SECTION - A

Answer **any FIVE** of the following :

5x2=10

1. Define degree of a vertex of a graph with an example.
2. Define complete graph and draw K_4 .
3. Define spanning sub graph with an example.
4. Define Line graph.
5. Define binary tree with an example.
6. Find point connectivity of $K_{m,n}$ where $(1 \leq m \leq n)$.
7. Define Eulerian cycle with an example.

SECTION - B

Answer **any FIVE** of the following :

5x6=30

8. If a simple (p, q) graph G is connected then prove that $p \leq q + 1$.
9. Prove that a graph G is bipartite if and only if all its cycles are even.
10. Show that every $u-v$ walk contains a $u-v$ path.



P.T.O.

11. If G is a (p, q) graph whose vertices have degree d_i then show that $L(G)$ has q vertices and q_L edges where $q_L = \sum_{i=1}^p d_i^2 - q$.
12. Prove that every self complementary graph has $4n$ or $4n+1$ vertices.
13. Suppose a tree T has N_1 vertices of degree 1, N_2 vertices of degree 2, N_3 vertices of degree 3, _____ N_k vertices of degree k , prove that $N_1 = 2 + N_3 + 2N_4 + 3N_5 + \text{_____} + (K-2) N_k$.
14. Prove that an edge e of a graph G is a bridge if and only if e lies on no cycle of G .

SECTION - C

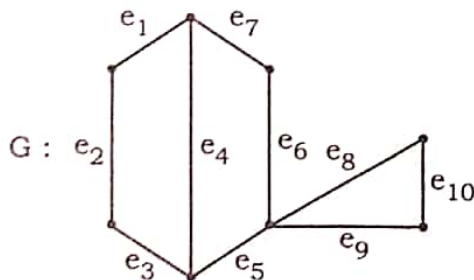
Answer **any Five** of the following :

5x6=30

15. Define Incidence matrix and draw the graph G which has adjacency matrix.

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

16. Define cycle matrix and find cycle matrix of the graph G .



17. State and prove Whitney's theorem.
18. Explain Konigberg's seven bridge problem.



19. If a connected graph G is Eulerian then prove that edges of G can be partitioned into cycles.
20. If G is a graph with $p \geq 3$ vertices such that $\delta(G) > \frac{p}{2}$ then prove that G is Hamiltonian.
21. Draw the graphs.
- (i) Graph with both Eulerian circuit and Hamiltonian cycle.
 - (ii) Graph with Eulerian circuit but not Hamiltonian cycle.
 - (iii) Graph which is neither Eulerian nor Hamiltonian.

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