

Rekha V.V.I. Questions for 2023 Examination

*Answer of below mentioned V.V.I. questions are present in your
Rekha Examination Guide and Guess Part - I Physics - 1*

Short Answer type Questions

- | | | |
|---|-------|----|
| 1. State and prove Stoke's theorem. | ..... | 7 |
| 2. Discuss curl of a vector field and give its physical significance. V.V.I. | ..... | 8 |
| 3. Show that Gradient of a Scalar is vector. | ..... | 8 |
| 4. Define Surface Tension and Surface Energy. V.V.I. | ..... | 10 |
| 5. Define different elastic constants. How elasticity depends upon temperature ? | ..... | 10 |
| 6. State and prove Bernoulli's theorem. V.V.I. | ..... | 12 |
| 7. Explain the term Viscosity and Coefficient of Viscosity. Give the dimension of Coefficient of Viscosity. | ..... | 14 |
| 8. Describe streamline flow and turbulent flow. | ..... | 15 |
| 9. Why is rain drop spherical in shape? | ..... | 15 |
| 10. What are the postulates of the Special Theory of Relativity ? | ..... | 16 |
| 11. Discuss the concept of length contraction from Special Theory of Relativity. V.V.I. | ..... | 16 |
| 12. Discuss in brief the relativistic Doppler effect. V.V.I. | ..... | 17 |
| 13. Distinguish among free, forced and damped oscillation. What is resonance ? V.V.I. | ..... | 18 |
| 14. State Fourier's theorem. What are its limitations ? V.V.I. | ..... | 19 |
| 15. Explain Sabine's formula. What are the acoustical demands of a good building ? | ..... | 20 |

GROUP-A

(Mathematical Physics & Properties of Matter)

- | | | |
|--|-------|----|
| 1. Define and explain the following terms: | | |
| (i) Line Integral. | ..... | 21 |
| (ii) Surface Integral. | ..... | 21 |
| (iii) Volume Integral. | ..... | 22 |
| (iv) Vector field. | ..... | 22 |
| (v) Divergence of a Vector field. | ..... | 22 |
| 2. What is meant by Curl of a vector field? Show that $\text{Curl } \vec{V} = \nabla \times \vec{V}$. | ..... | 23 |
| 3. Define and set up a partial differential equation obtain its solution by separation of variables. | ..... | 25 |
| 4. State and prove Gauss' theorem. V.V.I. | ..... | 26 |
| 5. State and prove Gauss divergence theorem? V.V.I. | ..... | 28 |
| 6. Write short notes on the following: | ..... | 30 |
| (a) Green's Theorem. (b) Curvilinear coordinates. | | |
| (c) Cylindrical co-ordinates (d) Poisson's equation. | | |

7. Deduce the relations among the elastic constants Y , K , η and σ .
Or, Prove the following relations :

$$Y = 3K(1-2\sigma) = 2\eta(1 + \sigma) = \frac{9K\eta}{3K + \eta} \text{ and } \sigma = \frac{3K - 2\eta}{6K + 2\eta} \quad \dots 37$$
8. Define various elastic constants. Establish a relationship between them. **V.V.I.** 40
9. Describe the statical method for determining modulus of rigidity of a wire. 44
10. Deduce an expression for the couple required to twist a uniform solid cylinder. Show that the hollow cylinder has a greater torsional rigidity than a solid cylinder of same mass, length and material. **V.V.I.** 45
11. Derive an expression for the couple required to bend a uniform straight metallic strip into an arc of a circle of small curvature. 48
12. Derive an expression for the depression produced at the loaded end of a light beam clamped horizontally at one end and loaded at the other.
Or, A uniform beam is clamped at one end and loaded at the other. Obtain the relation between the load and the depression at the loaded end when the weight of the beam can be neglected. **V.V.I.** 50
13. What is a flat spiral spring ? Deduce the theory of measuring modulus of rigidity of a material in the form of a flat spiral spring. Find the ratio between the depression due to torsion and vertical shear. **V.V.I.** 52
14. Deduce Poiseuille's formula for the flow of a liquid through a capillary tube. State clearly the assumptions made. 56
15. Define Viscosity and Coefficient of Viscosity of a liquid. 59
16. Define velocity gradient and coefficient of viscosity. Describe with theory the Rankin's method to determine the viscosity of air (or gas). 60
17. Define Surface Tension and Surface Energy. Also derive the relation between Surface Tension and Surface Energy. 64
18. (a) Obtain an expression for the excess of pressure inside a soap bubble. 65
 (b) Describe a method of determining the surface tension of soap solution by the method of bubble. 66
19. Calculate the difference of pressure across an element of the curved surface of a liquid in terms of surface tension and the principal radii of curvature of the element. 67

20. Show that the excess pressure inside a spherical bubble of air of radius R formed in a liquid is $2T/R$, where T is surface tension of the liquid. 68
21. Derive expression for the difference of pressure on the two sides of a spherical surface. 69
22. Answer the following:
 - (a) What is the effect of temperature on surface tension? 70
 - (b) Mercury sprinkled on a glass plate separates out into spherical drops whereas water easily spreads over it. Why? 71
 - (c) Why does a large drop of mercury flatten out on a horizontal glass plate while a small drop is almost spherical? 71
23. State and explain the principle of virtual work and apply it to find the excess pressure over the curved liquid membrane. **V.V.I.** 72
24. Distinguish between ripples and gravity waves. Describe with theory, the ripple method for determining the surface tension of a liquid. **V.V.I.** 74

Group-B

(Special theory of relativity, Oscillation and waves and acoustics)

1. Describe with theory, the Michelson-Morley experiment and give the explanation of negative result obtained. **V.V.I.** 79
2. State the basic postulates of special theory of relativity and derive Lorentz Transformation Equations. 82
3. On the basis of Lorentz transformation discuss the following kinematical effects: (a) Length contraction (b) Time dilation. 86
4. Obtain Relativistic velocity addition formula. 87
5. Derive an expression for the variation of mass of a particle moving with velocity. Discuss how the result has been verified experimentally ? **V.V.I.** 88
6. Establish Einstein's mass-energy relation. How this relation is put to experimental test ? **V.V.I.** 90
7. What are free, damped and forced oscillations. Explain with examples, the phenomenon of resonance. **V.V.I.** 92
8. Set up the differential equation for damped simple harmonic motion of a particle and obtain a solution for it. **V.V.I.** 94
9. Prove that for one-dimensional wave, the most general differential equation is

$$\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 y}{\partial x^2}$$

- Discuss the solutions of the above equation for a bound system with boundary conditions $y = 0$ at $x = 0$ and $y = 0$ at $x = l$ 98
10. Distinguish between progressive and stationary wave. Establish differential equations of wave in extended gaseous medium. **V.V.I.** 100
11. What are group velocity and phase velocity (wave velocity)? Obtain an expression for the group velocity in a dispersive medium. **V.V.I.** 102
12. (a) Give an analytical treatment of forced vibrations (or oscillations). 105
 (b) Deduce condition for amplitude resonance and explain sharpness of resonance. 107
13. Analyse a triangular wave into its simple harmonic components with the help of Fourier's theorem. 110
14. State Fourier's theorem. What are its limitations? Also write about its importance in sound waves ? 113
15. State and explain Fourier's theorem and apply it to analyse a square wave. 115
16. What do you mean by intensity of sound ? Define Loudness, Bel, Decibel and Phon. 118
17. Define the term intensity of sound. Describe a method of determining the intensity of sound. 120
18. Write an essay on acoustic of buildings.
Or, What are the different acoustic defects of a hall and how can they be minimised? 122
19. Deduce Sabine's formula for reverberation time. Discuss its importance. **V.V.I.** 123

PHYSICS - 1 (Hons.) (2022)

Selecting two from each groups in which **Q.No.-1** is compulsory.

Answer any five questions.

1. Answer any Three of the following :
 - (a) Define Line, Surface and volume integral of a vector. 21
 - (b) Show that gradient of a scalar is vector. 8
 - (c) Discuss the concept of length contraction from special theory of relativity. 16
 - (d) Explain the term viscosity and co-efficient of viscosity. Give the dimension and unit of coefficient of viscosity. 14
 - (e) A hall of volume 5500 m^3 is found to have reverberation time of 2.3 seconds. The sound absorbing surface of the hall has an area of 750 m^2 . Calculate the average absorption coefficients.

Group–A

2. Prove that in any orthogonal curvilinear Co-ordinate System, $\text{div curl } \mathbf{A} = 0$ and $\text{curl grad } \phi = 0$.
3. Establish relation between different elastic constants. 37
4. Why is there excess pressure inside a concave surface. Derive an expression for the excess pressure inside a curved surface in terms of radius of curvature and surface tension. 67
5. (a) Describe the Rankine's method for measuring the co-efficient of viscosity of gas. 60
- (b) A Square plate of 0.1 metre Side moves parallel to another plate with a velocity of 0.1 m/s. Both plates being immersed in water. If the viscous force between them is $2 \times 10^{-3} \text{ N}$ and the viscosity of water is 0.001 kg/ms . Then calculate their separation.

Group–B

6. State the basic postulates of special theory of relativity and derive Lorentz transformation equation. 82
7. Obtain relativistic formula for the addition of velocities. Hence show that the velocity of light is an absolute constant independent of the frame of reference. 87
8. State and explain Fourier's theorem and apply it to analyse a square wave. 115
9. Define the term Intensity of sound. Deduce an expression for the intensity of sound in terms of pressure amplitude. 120

PHYSICS - 1 (Hons.) (2021)

1. Answer any three of the following:
 - (a) State and prove Gauss's divergence theorem. 28
 - (b) Differentiate between free and forced vibration. When does resonance take place? 18
 - (c) Calculate the work done in stretching a wire. 16
 - (d) What do you mean by Surface energy and Surface tension? 10
 - (e) What are the postulates of special theory of relativity? 16

Group-A

2. Derive an expression for the depression produced at the loaded end of a light beam clamped horizontally at one end and loaded at the other. 50
3. Deduce Poiseuille's for the flow of liquid through a capillary tube. State clearly the corrections made. 56
4. Distinguish between gravity waves and ripples. Describe with theory, the ripple method of determining surface tension in a liquid. 74
5. State and Prove Stoke's theorem.

Group-B

6. Establish Einstein's mass energy relation. How this relation is put to experimental test? 90
7. Describe Michelson-Morley experiment and give the explanation of negative result obtained. 79
8. Set up the differential equation for damped harmonic oscillation of a particle and obtain a solution for it. 94
9. What is Reverberation? Deduce Sabine formula for the time of reverberation. 123

PHYSICS - 1 (Hons.) (2020)

1. Answer any three of the following :
 - (a) Discuss curl of a vector field and give its physical significance. 8
 - (b) Define different elastic constants and establish relation between them. 40
 - (c) Explain the term viscosity and coefficient of viscosity. Give the dimension of coefficient of viscosity. 14
 - (d) Discuss the concept of length contraction from special theory of relativity. 16
 - (e) Discuss, in brief, the relativistic Doppler effect. 17

Group-A

2. State and prove Gauss divergence theorem. 28
3. Calculate the torque on a solid cylinder and describe a method for measuring torsional rigidity. 45

4. Define coefficient of viscosity. Describe the Rankine's method for measuring the coefficient of viscosity of a gas. 60
5. State and explain the principle of virtual work and apply it to find the excess pressure over the curved liquid membrane. 72

Group - B

6. What are group velocity and phase velocity? Obtain an expression for the group velocity in a dispersive medium. 102
7. Derive an expression for the variation of mass of a particle moving with velocity. Discuss how the result has been verified experimentally. 88
8. State and explain Fourier's theorem and apply it to analyse a square wave. 115
9. State the basic postulates of special theory of relativity and derive Lorentz transformation equations. 82

PHYSICS - 1 (Hons.) (2019)

1. Answer any three of the following :
 - (a) State and prove Stoke's theorem. 7
 - (b) Show that gradient of a scalar is vector. 8
 - (c) What do you mean by Surface energy and surface tension? 10
 - (d) What are the postulates of special theory of relativity? 16
 - (e) Distinguish among free, forced and damped vibration. What is resonance? 18
 - (f) State Fourier's theorem: What are its limitations? 19

Group - A

2. Derive an expression for the depression produced at the loaded end of a light beam clamped horizontally at one end and loaded at the other. 50
3. Distinguish between gravity waves and ripples. Describe, with theory, the ripple method of determining surface tension of a liquid. 74
4. Deduce Poiseuille's formula for the flow of a liquid through a capillary tube. State clearly the assumptions made. 56
5. What is a flat spiral spring? Deduce the theory of measuring modulus of rigidity of a material in the form of a flat spiral spring. 52

Group - B

6. Establish Mass Energy relations. How this relation is put to experimental test? 90
7. What is Reverberation? Deduce Sabine's formula for the times of reverberation. 123
8. Set-up the differential equation for damped harmonic oscillation of a particle and obtain a solution for it. 94
9. Describe Michelson-Morley experiment and give the explanation of negative result obtained. 79



Rekha V.V.I. Questions for 2023 Examination

*Answer of below mentioned V.V.I. questions are present in your
Rekha Examination Guide and Guess Part - I Physics - 2*

Short Answer Type Questions

- | | | |
|--|-------|----|
| 1. Define degrees of freedom. State the law of equipartition of energy. V.V.I. | ..... | 7 |
| 2. What do you mean by mean free path of a gas molecule? V.V.I. | ..... | 7 |
| 3. What is Entropy? Give its physical significance. V.V.I. | ..... | 8 |
| 4. Distinguish between R.M.S. and most probable velocity. | ..... | 8 |
| 5. Distinguish between perfect (Ideal) gas and a real gas. | ..... | 9 |
| 6. What is black body radiation? State and discuss the importance of Kirchhoff's law of radiation. | ..... | 10 |
| 7. Distinguish between isothermal and adiabatic process. Deduce adiabatic relation between P, V and T for ideal gas. V.V.I. | ..... | 11 |
| 8. State and explain the Second Law of Thermodynamics. | ..... | 13 |
| 9. What is meant by electric field and electric potential? V.V.I. | ..... | 13 |
| 10. Express Gauss's law in differential form. How Coulomb's law is obtained from this law? | ..... | 14 |
| 11. Explain the terms emissive and absorptive powers. | ..... | 16 |
| 12. Calculate the work done in stretching a wire. | ..... | 16 |
| 13. Define Electric polarisation (Polarisation vector). V.V.I. | ..... | 17 |
| 14. State and prove Ampere's law (Ampere's circuital law) in electromagnetism. V.V.I. | ..... | 17 |
| 15. Distinguish between relative permeability and magnetic susceptibility. V.V.I. | ..... | 18 |
| 16. What is Electromagnetic Induction? State and explain Faraday's laws of Electromagnetic Induction. | ..... | 19 |
| 17. Distinguish between Self and Mutual inductance. V.V.I. | ..... | 20 |

GROUP-A

(Thermal Physics)

- | | | |
|--|-------|----|
| 1. Explain what do you mean by entropy of a substance. Discuss the principle of increase of entropy.
Or, Define entropy. What is its physical significance? Show that the entropy of a perfect gas remains constant in a reversible process whereas it increases in an irreversible process. | | 22 |
| 2. Derive Maxwell's law of distribution of velocity and discuss briefly its experimental verification. V.V.I. | ..... | 24 |
| 3. (a) Explain the three states of matter on the basis of Kinetic Theory. | ..... | 29 |
| (b) State the basic assumptions of Kinetic Theory of a gas. | ..... | 30 |

4. Discuss Brownian motion. Describe Langevin's theory of translational Brownian motion and mention its importance. 31
5. What do you mean by Transport phenomena ? On the basis of kinetic theory of gases derive an expression of the viscosity of a gas. **V.V.I.** 35
6. Define thermal conductivity and electrical conductivity. Obtain Wiedemann-Franz law for the thermal and electrical conductivity of metal. **V.V.I.** 38
7. Deduce Van der Waals' equation of state. **V.V.I.** 40
8. (a) Point out the defects and limitation of Van der Waals' equation of state. 43
- (b) Define critical constants and critical co-efficients of a gas. **Or,** Find the values of critical volume, pressure and temperature in terms of the constants of Van der Waals' equation. 44
9. Write note on Triple point. 46
10. Starting from Van der Waals' equation of state, deduce the reduced equation of state. What is the law of corresponding states ? 47
11. Set up the different equation for the flow of heat along a thin metallic bar. Solve the equation for the steady state of the bar.48
12. Explain the concept of "internal energy" of a system. What is thermodynamics? Formulate the first law of thermodynamics and explain its physical significance. 52
13. State and prove Kirchoff's law of radiation and discuss its importance. 54
14. State and prove Stefan-Boltzmann's law of black-body radiation. Describe an experiment to verify it. **Or,** On the basis of thermodynamic considerations explain Stefan-Boltzmann law of radiation. **V.V.I.** 56
15. Explain the concepts of "Temperature" and "Thermal Equilibrium." State and explain the Zeroth law of thermodynamics. 59
16. Prove that—
 (a) $C_p - C_v = R$ (b) $\frac{\partial T}{\partial V} = \frac{C_v - C_p}{\alpha V C_v}$ 60
17. What is a Carnot's cycle? Describe Carnot's reversible heat engine and find an expression for its efficiency. Explain why Carnot's cycle is not a practical possibility. **V.V.I.** 62

18. State and explain the Second Law of Thermodynamics. 67
19. State and prove Carnot's theorem. Use it to define a thermodynamical Scale of temperature and compare this scale with a perfect gas scale. Is a negative temperature possible on this scale? 69
20. Define thermodynamic potential functions U, F, H and G. Derive Maxwell's third and fourth relation using these thermodynamic potential functions. 70
21. Establish Gibbs-Helmholtz equation and indicate its importance. 72
22. Give a brief account of thermodynamical functions and deduce Maxwell's thermodynamic relations. **V.V.I.** 74
23. What is Joule-Thomson effect ? Obtain an expression for temperature of inversion for such a gas. 76
24. Deduce the Clausius-Clapeyron equation $\frac{dP}{dt} = \frac{L}{T(V_2 - v_1)}$ 80
25. Deduce Maxwell's four thermodynamic relations. Hence deduce Clausius-Clapeyron equation. **V.V.I.** 81

GROUP-B

(Electrostatics and Magnetism)

1. What is Scalar potential? Prove that $\vec{E} = -\vec{\nabla} V = -\text{grad } V$ 85
2. Deduce Poisson's and Laplace's equation in cartesian co-ordinates. 86
3. (a) Solve Laplace's equation in cartesian system of co-ordinates. **V.V.I.** 88
 (b) Use Laplace's equation to obtain the expression for the capacity of a parallel plate condenser. 90
4. (a) State and explain Gauss's law for magnetism. 91
 (b) What do you understand by magnetic dipole? Find the magnetic dipole moment of a current loop. 92
 (c) Obtain an expression for the potential energy of a magnetic dipole placed in an external magnetic field. 92
5. What is electric dipole and dipole moment ? Define electric potential and electric field strength at a point in the electric field. Obtain an expression for the potential and field due to an electric dipole. 93
6. What do you mean by electric multipoles and electric quadrupole moment. Obtain expression for electric potential and field at a point due to a quadrupole. **V.V.I.** 99

7. What is dielectric ? Establish a relation between dielectric polarization \vec{P} , electric field strength \vec{E} and electric displacement \vec{D} 103
8. Discuss the boundary conditions at the surface of separation of the two dielectrics and hence explain the refraction of lines of forces. 105
9. What is an electrical image ? A point charge q is placed in front of an infinite conducting plane connected to earth. Derive an expression for the electric field. **V.V.I.** 107
10. Explain Biot-Savart Law. With its help derive an expression for the magnetic field at any point on the axis of a current carrying circular loop. **V.V.I.** 109
11. Explain Biot-Savart-Laplace law. Use this law to obtain the magnetic induction \vec{B} due to current flowing in a straight wire. **Or**, What is Biot-Savart's law ? Derive an expression for the magnetic field at a point due to an infinitely long, straight current carrying conductor. **V.V.I.** 113
12. Define Electric Flux. State and prove Gauss's theorem in electrostatics. **V.V.I.** 115
13. Define electric field. Find an expression for the electric field due to a uniformly charged long straight wire carrying charge q per unit length. 117
14. What is a magnetic circuit ? Establish its analogy with an electric circuit. Use this concept to obtain the magnetic flux in the air gap of an electromagnet. **V.V.I.** 119
15. Explain the three magnetic vectors and establish a relation between them. 123
16. (a) Define and explain the terms
 (i) Retentivity (ii) Coercivity
 (iii) Hysteresis (iv) Hysteresis loop. 124
 (b) Derive an expression for the energy dissipated in the hysteresis is cycle. **V.V.I.** 125
17. Explain hysteresis. Show that hysteresis loss per unit volume per cycle of magnetisation is given by the area of B–H loop. 127

PHYSICS - 2 (Hons.) (2022)

Answer any five questions selecting two from each group,
in which **Q.No.-1** is compulsory.

1. Answer any Three questions of the following :
 - (a) Distinguish between a perfect gas and a real gas. 9
 - (b) Distinguish between r.m.s and most probable speed. 8
 - (c) State the second law of thermodynamics. Give the physical significance of this law. 13
 - (d) Express Gauss's law in differential form. How Coulomb's law is obtained from this law ? 14
 - (e) Show that the energy density in a magnetic field of intensity H is $\frac{1}{2} \mu H^2$.

Group–A

2. What is Brownian motion ? Derive Einstein's relation for Brownian motion. 32
3. Define thermal conductivity. Discuss Fourier's equation for rectilinear flow of heat in a long bar. 48
4. What is Joule-Thomson effect ? Obtain Thermodynamically an expression for Joule-Thomson cooling. 76
5. Use Maxwell's relations to obtain $C_p - C_v = R$ for an ideal gas. Where C_p and C_v are molar specific heats at constant pressure and constant volume respectively. 60

Group–B

6. What is Laplace's equation ? Give the solutions of this equation in cartesian co-ordinates. 86
7. Establish a relation between dielectric Polarization \vec{P} , electric field strength \vec{E} , and electric induction \vec{D} . Give the significance of the relation. 103
8. Discuss the boundary conditions at the surface of separation of the two dielectrics and hence explain the refraction of lines of force. 105
9. State Faraday's law of electromagnetic induction and give the integral form of the Law. Prove that Faraday's Law of electromagnetic induction can be expressed in the differential form $\text{Curl } \vec{E} = \vec{\nabla} \times \vec{E} = \frac{\partial \vec{B}}{\partial t}$ and give the physical meaning of the equation. 19

PHYSICS - 2 (Hons.) (2021)

Answer any five questions selecting two from each group,
in which **Q.No.-1** is compulsory.

1. Answer any three questions of the following:
 - (a) Explain degrees of freedom and state the law of equipartition of energy. 7
 - (b) Explain why gases have two specific heats? Which one is greater and why? 8
 - (c) What is Entropy? Give its physical Significance. 18
 - (d) Distinguish between relative permeability and magnetic Susceptibility. 125
 - (e) What is meant by a B - H Curve? Give an account for energy loss in hysteresis.

Group-A

Answer any two questions:

2. Deduce Vander waals equation of State. How it is experimentally verified? 40
3. What do you mean by Transport Phenomena? On the basis of Kinetic theory of gases derive an expression for the viscosity of a gas. 35
4. Explain the working of Carnot's engine and obtain expression for its efficiency. 62
5. Deduce Maxwell's four thermodynamic relations and obtain Clausius- clapeyron latent heat equation. 81

Group-B

Answer any two of the following:

6. What is a Quadrupole? Calculate the potential and intensity at a point due to a linear quadrupole. 99
7. Explain Biot - Savart Law-with its help derive an expression for the magnetic field at any point on the axis of a current carrying straight wire 113
8. Define Electric flux. State and prove Gauss's theorem in electrostatics. Explain any one of its applications. 115
9. What is Electrical Image? Apply it to obtain an expression for electric field due to a point charge near an earthed spherical Conductor. 107

PHYSICS - 2 (Hons.) (2020)

Answer five questions selecting two from each

Group, in which Q. No.1 is compulsory.

1. Give an account of any three of the following :
 - (a) What is meant by electric field intensity and potential?
Establish the relation $dv = -\vec{E} \cdot d\vec{v}$ 13
 - (b) What is meant by mean free path of the molecules of a gas?
How mean free path depends upon the diameter of gas molecules?7
 - (c) State Ampere's circuit law and deduce it from Biot-savart-Laplace law. 17
 - (d) Distinguish between isothermal and adiabatic processes.
Deduce adiabatic relation between P, V. and T for ideal gas. 11
 - (e) What is electromagnetic induction? State and explain Faraday's law of electromagnetic induction. 19
 - (f) What is black body radiation ? Explain the terms emissive and absorptive powers.10,16

Group-A

2. Obtain Maxwell's law of distribution of velocity for the molecules of gas within velocity range C and C + dc. 24
3. Define thermal conductivity and electrical conductivity.
Obtain Weidman- Franz law for the thermal and electrical conductivity of metal. 38
4. On the basis of thermodynamic considerations, explain Stefan-Boltzmann law of radiation. 56
5. What is Joule-Thomson effect? Obtain thermodynamically an expression for Joule-Thomson Cooling. 76

Group-B

6. What do you understand by Dielectric Polarization and Electric Displacement Vector? Show that $\vec{D} = \vec{E} + 4\pi \vec{P}$, where the symbols have their usual meanings. 103
7. Explain Biot-Savart Law. With its help derive an expression for the magnetic field at any point on the axis of a current carrying circular loop. 109
8. What is Laplace's equation? Give the solutions of this equation in Cartesian Coordinates. 88
9. Discuss the boundary conditions at the surface of separation of the two dielectrics and hence explain the refraction of lines of force. 105

PHYSICS - 2 (Hons.) (2019)

Answer five questions, selecting two from each
Group, in which Q. No.1 is compulsory.

1. Answer any three questions of the following :
 - (a) Distinguish between a perfect gas and a real gas.
 - (b) Express Gauss's law in differential form. How Coulomb's law is obtained from this law? 14
 - (c) State the second law of thermodynamics. Give the physical significance of this law. 13
 - (d) Define polarization vector. 17
 - (e) Distinguish between self and mutual inductance. 20
 - (f) Distinguish between relative permeability and magnetic susceptibility. 18

Group-A

2. Deduce van der Waal's equation of state. What are the critical constants? 40,44
3. What do you mean by Transport phenomena? On the basis of Kinetic theory of gases derive an expression for the viscosity of a gas. 35
4. Explain the working of Carnot's engine, and obtain expression for its efficiency. 62
5. Give a brief account of thermodynamical functions and deduce Maxwell's thermodynamic relations. 74

Group-B

6. Explain the term 'electric dipole, and 'dipole-moment'. Obtain expression for potential and field due to an electric dipole. 93
7. What is a magnetic circuit? Establish its analogy with an electric circuit. Use this concept to obtain the magnetic flux in the air gap of an electromagnet. 119
8. Define Electric Flux. State and prove Gauss's theorem in electrostatics. Explain any one of its applications. 115
9. What is Electric Image ? Apply it to obtain expression for electric field due to a point charge near an earthed spherical conductor. 107

