QUESTION BANK IN PHYSICS (UP TO JUN 2015)

(EM WAVES AND DIELECTRICS)

1. Write Maxwell's equations in differential form. (2) {JUN 15 [GNE]}
2. Derive Maxwell's electromagnetic wave equation for a non-conducting medium. (4) {JUN 15 [GNE]}
3. Show that electrostatic field is equal to the negative of potential gradient and hence show that electrostatic field is conservative. (4) {JUN 15 [GNE]}
4. What is the physical significance of divergence of of a vector field? (2) {JUN 15 [PTU]}
5. Show that divergence of curl of a vector always vanishes. (2) {JUN 15 [PTU]}
6. What is Poynting vector and give its significance? State and prove Poynting vector theorem. (6) {JUN 15 [PTU]}
7. Write differential form of Maxwell's equations applicable in material medium. (2) {JUN 15 [PTU]}
8. What do you mean by displacement current? (2) {DEC 14 [GNE]}
9. Show that velocity of plane electromagnetic waves in free space is given by $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. (4) {DEC 14 [GNE]]}
10. Using Maxwell's equations prove that $\vec{\nabla}.\vec{J} + \frac{\partial \rho}{\partial t} = 0$. (4) {DEC 14 [GNE]}
11. What is the physical significance of gradient of a scalar field? (2) {DEC 14 [PTU]}
12. What information does the quantity Poynting vector furnish? (2) {DEC 14 [PTU]}
13. State and prove Poynting vector theorem. Give significance of each term. (4) Give a brief account of BCS theory of superconductivity. (3) {JUN 15 [PTU]}
14. Discuss various kinds of polarizations induced in the dielectric when it is placed in external electric field. (4) {JUN 15 [PTU]}
15. Derive differential form of ampere's circuital law for (i) steady currents and (ii) varying currents. (4) {JUN 14 [GNE]}
16. Derive Maxwell's electromagnetic wave equation for linear, isotropic and homogeneous medium. Hence prove that these waves can travel in vacuum. (4) {JUN 14 [GNE]}
17. Define Poynting vector. Give its significance. (2) {JUN 14 [GNE]}
18. What is the origin of displacement current density? (2) {JUN 14 [GNE]}
19. State and explain Ampere's law and express it in differential form. Further explain how Maxwell modified this law to accept this as one of the Maxwell's equations. (6) {JUN 14 [PTU]}
20. Give one example for each of a solenoidal and irrotational vector field. (2) {JUN 14 [PTU]} (2) {JUN 14 [PTU]}
21. Differentiate between steady current and static current. (2) {Dec 2013 [PTU]}
22. What do you mean by optical wave function? (2) {Dec 2013 [PTU]}
23. Define skin depth. (2) {Dec 2013 [PTU]}

24. List various types of polarization. (2) {Dec 2013 [PTU]}
25. What is meant by stationary current? Prove that for stationary current $\vec{\nabla}.\vec{J}=0$. (4) {Dec 2013 [PTU]}
26. Solve Maxwell's equations in free space to show that (i) $\vec{E},\vec{B}$ & direction of propagation form a set of orthogonal vectors. (ii) Energy flows with the velocity of light. (4) {Dec 2013 [PTU]}
27. State Faraday's laws of electromagnetic induction. (2) {Dec 2013 [PTU]}
28. State and prove Gauss's law of electrostatics. (4) {Dec 2013 [PTU]}
29. (i) Write down Maxwell's equations in free space. (ii) Explain introduction of displacement current by Maxwell. (iii) Show that the velocity of plane electromagnetic waves in free space is given by $c=\frac{1}{\sqrt{\mu_0\varepsilon_0}}$. (4) {Dec 2013 [PTU]}
30. What is dielectric polarization? (2) {Dec 2013 [GNE]}
31. Derive Maxwell's electromagnetic wave equation and hence find the velocity of light in vacuum. (4) {Dec 2013 [GNE]}
32. The surface charge density of a charging capacitor is increasing with time as $\sigma=3t^2Cm^{-2}$. What will be the value of displacement current at $t=2\cdot5s$. Given that the area of each plate is $2cm^2$. (4) {Dec 2013 [GNE]}
33. What do you understand by electromagnetic spectrum? (2) {Jun 2013 [PTU]}
34. Define Poynting vector. (2) {Jun 2013 [PTU]}
35. Differentiate between conduction current and displacement current by taking suitable example(s). (2) {Jun 2013 [PTU]}
36. Show that the equation of continuity $\vec{\nabla}.\vec{J}+\frac{\partial\rho}{\partial t}=0$ is contained in the Maxwell's equations. (4) {Jun 2013 [PTU]}
37. Give an example of lamellar and solenoidal vector fields. (2) {Jun 2013 [GNE]}
38. Define divergence of a vector field. Write its expression in terms of Cartesian coordinates and discuss its physical significance. (4) {Jun 2013 [GNE]}
39. Use Maxwell's equations to deduce wave equations in terms of $\vec{E}$ & $\vec{H}$ field vectors for free space. (4) {Jun 2013 [GNE]}
40. What is the significance of divergence and curl of a vector? (2) {Dec 2012 [GNE]}
41. What is dielectric polarization? Explain. (2) {Dec 2012 [GNE]}
42. Write Maxwell's equations and discuss their significance. (4) {Dec 2012 [GNE]}
43. In an electric field, the potential is given as $V(x,y,z)=\sqrt{4x^2+3y^2+9z^2}$ Volt. Calculate electric field at the point (1,2,3). (4) {Dec 2012 [GNE]}
44. Write the physical significance of gradient of a scalar unction. (2) {Dec 2012}
45. A parallel plate capacitor is filled with insulating material of dielectric constant K. What effect does this have on the capacitance? (3) {Dec 2012}
46. "Maxwell's equations are reformulation of existing laws." Comment and justify your answer. (5) {Dec 2012}
47. What is the utility of Maxwell's equations in reference to electromagnetic waves? (2) {June 2012}

48. What do you mean by displacement current? (2) {June 2012}
49. Deduce Maxwell's equation Faraday's laws of electromagnetic induction. (4) {June 2012}
50. In free space, the electric field variation due to electromagnetic waves is given by: $E(x,t) = 50\cos[(\omega t - \beta x)a_y]\ Vm^{-1}$. Find the average power crossing a circular area of radius 5mm in the plane $x = \text{constant}$. (4) {June 2012}
51. Write Maxwell's equations for free space. (2) {Dec 2011}
52. What do you mean by electromagnetic spectrum? (2) {Dec 2011}
53. What is modified Ampere's law? Discuss its significance in terms of Maxwell's theory and obtain an expression for displacement current density. (5) {Dec 2011}
54. Curl of a vector field represents whirling/rotational features of the field. Justify. (3) {Dec 2011}
55. Write Maxwell's equations in differential form. (2) {June 2011}
56. Write down Maxwell's equations and explain their significance. (4) {June 2011}
57. A solenoid is 1m long and 3cm in diameter. It has five layers of windings of 850 turns each and carries a current of 5A. What is B at its centre? (4) {June 2011}
58. What is the differential form of Gauss's Law? (2) {Dec 2010}
59. Write down Maxwell's equations and explain their physical significance. (4) {Dec 2010}
60. Show that the velocity of plane electromagnetic wave in free space is given by $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. (4) {Dec 2010}
61. What does permittivity of a medium signify? Write its value for free space. (2) {June 2010}
62. State and explain Ampere's circuital law and express it in differential form. Further explain how Maxwell modified this law to accept this as one of the Maxwell's equations. (5) {June 2010}
63. The electrostatic potential in a certain region is given as $V(x,y,z) = 3x + 4y - 6z$. Obtain the expression for corresponding electric field strength. (3) {June 2010}
64. Explain the term permittivity. (2) {Dec 2009}
65. Explain the significance of Maxwell's Equations. (4) {Dec 2009}
66. Explain the term current density and calculate the expression for it. (4) {Dec 2009}
67. Explain emf (electromotive force) and electric field. (2) {June 2009}
68. Derive the relations for Maxwell's equations. (8) {June 2009}
69. Derive the relation between dielectric constant and electric susceptibility. (2) {Dec 2008}
70. Give the physical significance of Maxwell's equations. (4) {Dec 2008}
71. Calculate the expression for the magnetic field inside a toroidal solenoid. (4) {Dec 2008}
72. What is the cause of producing displacement current? (2) {Dec 2008}
73. What is the significance of gradient of a scalar? (2) {May 2008}
74. Is displacement current like conduction current a source of magnetic field? (2) {May 2008}
75. What is dielectric polarization? Explain it for a parallel plate capacitor having a dielectric in between. (5) {May 2008}

76. State and explain Ampere's circuital law. (3) {May 2008}
77. Find the electric field strength for a uniform charge distribution. (2) {Dec 2007}
78. What is polarization? (2) {Dec 2007}
79. Prove Gauss's Law in integral form $\oiint \vec{E}.\vec{ds} = \frac{1}{\varepsilon_0}\iiint \rho dV$. What do you mean by Gaussian surface? Derive Coulomb's law from Gauss's Law. (4) {Dec 2007}
80. Deduce Maxwell's electromagnetic wave equation for free space and prove that the electromagnetic waves are transverse in nature. (4) {Dec 2007}
81. State Ampere's circuital law and discuss why it was modified to include the displacement current? (2) {May 2007}
82. What is meant by polarization in dielectric materials? (2) {May 2007}
83. State and prove Gauss's Law. Find electric field due to infinitely long charged cylinder at an external point. Also show the variation of electric field intensity with distance. (8) {May 2007}
84. Show that isolated magnetic poles do not exist. (2) {Dec 2006}
85. A thin metallic spherical shell of radius a carries a charge q_1. Concentric with it is another thin metallic shell of radius $b\,(b>a)$ carrying a charge q_2. Use Gauss's Law to find the electric field strength at radial distance r where (i) $r<a$ (ii) $a<r<b$ (iii) $r>b$. (5) {Dec 2006}
86. State Ampere's law and hence use it to calculate the magnetic flux density within a long solenoid carrying current. (5) {Dec 2006}
87. Write Maxwell's equations and give their significance. (3) {Dec 2006}
88. State Ampere's Circuital Law. (2) {May 2006}
89. What do you understand by electric displacement, susceptibility and permittivity? Obtain an expression for the potential at a point due to an electric dipole. (4) {May 2006}
90. Using Gauss's Law find electric field due to uniformly charged solid sphere at a point outside it, inside it. (4) {May 2006}
91. What is dielectric Polarization? (2) {Dec2005}
92. Write Maxwell's equations and explain the significance of each equation. (5) {Dec2005}
93. Using Gauss's Law, find the electric field due to a uniformly charged solid sphere at a point inside the sphere. (3) {Dec2005}
94. State Ampere's circuital law in electromagnetism. (2) {May 2005}
95. What is meant by the term dielectric polarization? Define the terms Electric intensity $\left(\vec{\mathrm{E}}\right)$, Polarization vector $\left(\vec{\mathrm{P}}\right)$, and electric displacement vector $\left(\vec{\mathrm{D}}\right)$ and establish the $\vec{\mathrm{D}} = \varepsilon_0 \vec{\mathrm{E}} + \vec{\mathrm{P}}$, where ε_0 is absolute permittivity of vacuum. (2,3,3) {May 2005}
96. State Faraday's Laws of electromagnetic induction. (2) {Dec 2004}
97. What is Dielectric Polarization? (2) {Dec 2004}

98. State and prove Gauss's law of electrostatics and express it in differential form $\vec{\nabla} . \vec{E} = \frac{\rho}{\varepsilon_0}$; where symbols have their usual meanings. (5,3) {Dec 2004}
99. Why are electric field lines normal to an equipotential surface at all the points? (2) {May 2004}
100. Explain how a dielectric inserted between the plates of a capacitor increases its capacitance? (2) {May 2004}
101. Write down the Maxwell's equations. (2) {May 2004}
102. State and explain Gauss's law of electrostatics. Use it to find the capacitance of a parallel plate capacitor. (6) {May 2004}
103. The electric potential in a certain region is given by: $V(x) = 10x^2 + 20y + 5z^3$ in SI units. Calculate the electric field at a point P(2,3,1) in SI units. Is this field uniform? (2) {May 2004}
104. Explain the meaning of gradient of a scalar field. (2) {Dec2003}
105. Will the Gauss's law hold if the electrostatic force between the two charges varied inversely the cube of the distance between them? (2)
106. If a charged particle moving through a region of space goes undflected, what can you conclude about the presence of electric and magnetic fields in the resion? (2) {Dec2003}
107. Describe the behaviour of a dielectric in a static electric field. Explain the meaning of Polarization vector and electric displacement vector. Also find the relation between these. (5) {Dec2003}
108. The atomic weight and the density of sulfur are 32 and $2 \cdot 08 gcm^{-3}$ respectively. The electronic polarizability of the atom is $3 \cdot 28 \times 10^{-40} Fm^2$. If the solid sulfur has cubical symmetry, what will be its relative permittivity? (3) {Dec2003}
109. State and explain Ampere's law. Use it to find the magnetic induction due to long solenoid. (5) {Dec2003}
110. Write down Maxwell's equations and state the laws of electrodynamics to which these correspond. Deduce the wave equation for electromagnetic waves in free space. (3) {Dec2003}

MAGNETIC MATERIALS

1. Name some applications of Ferrites. (2) {JUN 15 [GNE]}
2. Write a short note on magnetostriction and magnetic anisotropy. (4) {JUN 15 [GNE]}
3. Discuss the origin of dia-, para- and ferromagnetism on atomic basis. (5) {JUN 15 [PTU]}
4. Define magnetic susceptibility and give its unit. (2) {DEC 14 [GNE]}
5. What are ferrites? How these are different from ferromagnetic materials? Write some applications of ferrites. (4) {DEC 14 [GNE]}
6. What is the atomic origin of diamagnetism exhibited by certain materials? (2) {DEC 14 [PTU]}

7. Describe how ultrasonic waves are generated using the method of magnetostriction. (5)
8. What do you mean by magnetic anisotropy? (2) {JUN 14 [GNE]}
9. Write short note on Magnetic Anisotropy. (4) {JUN 14 [PTU]}
10. What are ferromagnetic domains? Explain their existence in terms of atomic dipole moments. (4) {JUN 14 [PTU]}
11. What do you mean by Magnetostriction? (2) {JUN 14 [PTU]}
12. What does permeability of a medium signifies? State its value for free space. (2) {JUN 14 [PTU]}
13. Write the expression for magnetic susceptibility of a magnetic material. (2) {JUN 14 [PTU]}
14. A magnetizing field of 1200A/m produces a magnetic flux of $2 \cdot 4 \times 10^{-5} Wb$ in an iron bar of cross sectional area $0 \cdot 2cm^2$. Calculate permeability and susceptibility of the bar. (4) {Dec 2013 [PTU]}
15. Define magnetic susceptibility. Give its dimensions. (2) {Dec 2013 [PTU]}
16. Explain magnetic flux density B, magnetic flux intensity H and magnetization M. How are these related to each other? (4) {Dec 2013 [PTU]}
17. Discuss the domain theory of ferromagnetic materials. Explain the reasons for the strong ferromagnetic property found in iron, nickel and cobalt. (4) {Dec 2013 [PTU]}
18. A magnetic circuit is made of a ferromagnetic material of $\mu = 7 \cdot 3 \times 10^{-3} \text{Hm}^{-1}$. The average length of the circuit is 1m and the area of cross section is 90cm^2. The magnetic binding has 90 turns. Calculate the magnetizing current in order to produce a magnetic flux density of $0 \cdot 2\text{Wbm}^{-2}$. (4) {Jun 2013 [PTU]}
19. Define magnetic permeability and magnetic susceptibility and develop a relation between them. (4) {Jun 2013 [PTU]}
20. How ultrasonic waves are produced using the phenomenon of magnetostriction? (4) {Jun 2013 [GNE]}
21. What do you understand by magnetic anisotropy? (2) {Dec 2012 [GNE]}
22. What do you understand by Magnetostriction Effect? (2) {Dec 2012}
23. Define remanance and coercivity. (2) {Dec 2012}
24. Discuss domain structures in ferromagnetic materials. (4) {Dec 2012}
25. What do you understand by Magnetic anisotropy? (2) {June 2012}
26. The speed of storing and reading out information from a computer core is less than a microsecond. Why is it necessary to use ferrite for this application? (2) {June 2011}
27. Explain the following terms: (i) magnetic anisotropy (ii) magnetostriction and (iii) magnetic domains. (6) {June 2011}
28. What are ferrites? Give some of its useful applications. (2) {June 2011}
29. What do you mean by Ferromagnetic Domain? (2) {Dec 2010}
30. What are ferrites? How are they superior to ferromagnetic materials? (3) {Dec 2010}
31. Write a short note on magnetostriction. (2)
32. Define magnetic susceptibility and relative magnetic permeability and establish the relation between them. (3) {Dec 2010}

33. Which type of magnetic materials have permanent magnetic dipole associated with them? (2) {June 2010}
34. What is Bohr's magneton? (2) {June 2010}
35. What are ferromagnetic domains? Explain their existence in terms of atomic dipole moments. (3) {June 2010}
36. How do you distinguish between hard and soft magnetic materials? (3) {June 2010}
37. What do you mean by magnetostriction? (2) {June 2010}
38. Differentiate between Hard and Soft magnetic materials. (5) {Dec 2009}
39. Mention some applications of Ferrite Materials. (3) {Dec 2009}
40. Explain what are Ferrites? Mention some applications of Ferrite materials. (8) {June 2009}
41. Define the term Hysterisis. Draw the Hysterisis curve for soft iron and steel. (2) {Dec 2008}
42. Explain the term magnetostriction effect, hard magnetic materials, hysterisis loss. (4) {Dec 2008}
43. Explain the term permeability and susceptibility and derive the relation between them. (4) {Dec 2008}
44. Why ferromagnetism is lost on heating? (2) {May 2008}
45. Discuss Domain theory of ferromagnetism. (4) {May 2008}
46. What are ferrites? Give their applications. (4) {May 2008}
47. Define coercive force and hysterisis. (2) {Dec 2007}
48. Prove that the area of B-H curve is $\frac{1}{4\pi}$ times the energy dissipated per cm^3 of the metal during each magnetic cycle. (4) {Dec 2007}
49. Find out the expression for magnetic dipole moment due to orbital and spin motion of the electron. (4) {Dec 2007}
50. What are ferrites materials? (2) {May 2007}
51. Classify the magnetism and write their properties. Also explain hard and soft magnetic materials. (8) {May 2007}
52. An 80cm long wire carries a current of 10A and lies perpendicular to a uniform magnetic field. The magnetic force acting on the wire is $0 \cdot 2N$. Calculate the magnitude of the magnetic induction B. (2) {Dec 2006}
53. State Ampere's circuital law and hence use it to calculate the magnetic flux density within a long solenoid carrying current I . (6) {Dec 2006}
54. Write Maxwell's equations. (2) {Dec 2006}
55. Explain Magnetic Anisotropy. (2) {May 2006}
56. What are magnetic materials? Distinguish between hard and soft magnetic materials? Name the factors, on which the shape of B-H curve depends. (6) {May 2006}
57. Write a short note on ferrites. (2) {May 2006}
58. What are ferrites? (2) {Dec2005}
59. Explain the following terms (i) Magnetic domain (ii) Magnetic Anisotropy (iii) Magnetostriction (6) {Dec2005}
60. What is the difference between soft and hard magnetic materials? (2) {Dec2005}
61. Define magnetic induction and magnetization. (2) {May 2005}

62. Give some applications of ferrites. (2) {May 2005}
63. Discuss the complete classification of magnetic materials. What are the differences between soft and hard magnetic materials? (5,3) {May 2005}
64. Define magnetic intensity and magnetization. (2) {Dec 2004}
65. Give the classification of magnetic materials. What are the differences between hard and soft magnetic materials? (5,3) {Dec 2004}

SUPERCONDUCTIVITY

1. Explain Meissner effect, type-I and type-II superconductors. (4) {JUN 15 [GNE]}
2. What is isotope effect? (2) {JUN 15 [PTU]}
3. Give a brief account of BCS theory of superconductivity. (3) {JUN 15 [PTU]}
4. Give a brief account of occurrence of superconductivity using BCS theory. (3) {JUN 15 [PTU]}
5. What is the wavelength of an electromagnetic photon, which can break a Cooper pair in a material having critical temperature of 4K? (2) {Dec 14 [GNE]}
6. Derive London's equations and give their significance.(4) {Dec 14 [GNE]}
7. Give a brief account of occurrence of superconductivity using BCS theory. (3) {Dec 14 [PTU]}
8. Derive London's equations and show that these equations can account for perfect diamagnetism property of an ideal superconductor. (4) {JUN 14 [GNE]}
9. What is the effect of magnetic field on superconductivity? Given a type-I superconductor with $T_C = 7K$ and slope $\frac{dH_C}{dt} = -5\times10^{-4} A/m$ at T_C. Estimate its critical field at 6K. (4) {JUN 14 [GNE]}
10. What do you mean by Meissner effect? (2) {JUN 14 [PTU]}
11. A superconducting state behaves according to which type of magnetic material in presence of applied magnetic field having magnitude less than critical value. (2) {JUN 14 [PTU]}
12. What do you understand by superconducting state? Under what conditions one can achieve it? (4) {Dec 2013 [PTU]}
13. Why are type I superconductors poor current carrying conductors? (2) {Dec 2013 [PTU]}
14. What is Meissner effect? (2) {Dec 2013 [PTU]}
15. Derive London equation and discuss how its solution led to Meissner effect. (4) {Dec 2013 [PTU]}
16. The penetration depth of mercury at $3\cdot5K$ is about 750Å. What will be the penetration depth at 0K, if the critical temperature for mercury is $4\cdot2K$? (4) {Dec 2013 [PTU]}
17. Enumerate the factors affecting superconductivity. (2) {Dec 2013 [GNE]}
18. The critical magnetic field for a superconductor at absolute zero is $9\times10^4 Am^{-1}$ and at 6K is $5\times10^4 Am^{-1}$. Find the critical temperature and energy required to break Cooper pair at absolute zero. (4) {Dec 2013 [GNE]}
19. Derive London's equations and hence explain Meissner's effect and flux penetration. (4) {Dec 2013 [GNE]}

20. What is Cooper pair? (2) {Jun 2013 [GNE]}
21. Deduce London equations and define London penetration depth. (4) {Jun 2013 [GNE]}
22. What is Meissner Effect? Explain type-I and type-II superconductors. (4) {Dec 2012 [GNE]}
23. For a specimen of V_3Ga, the critical fields are $1{\cdot}4\times10^5$ A/m & $4{\cdot}2\times10^5$ A/m at 14K and 13K respectively. Calculate the transition temperature and critical fields at 0K and $4{\cdot}2K$. (2) {Dec 2012 [GNE]}
24. Outline some experimental facts about superconductivity. (4) {Dec 2012}
25. What arte type-II superconductors? (2) {June 2012}
26. What is the physical phenomenon behind superconductivity? How successful is this in today's context? (4) {June 2012}
27. Elaborate the main features of BCS theory. (4) {June 2012}
28. What are important features of BCS theory? (2) {Dec 2011}
29. What is the physical mechanism behind Meissner Effect? (3) {Dec 2011}
30. Discuss London's theory of superconductivity. (5) {Dec 2011}
31. What are the conditions for a material to be superconductor? (2) {June 2011}
32. Explain BCS theory of superconductivity. (4) {June 2011}
33. What are London Equations? Find the expression for penetration depth of a superconductor. (4) {June 2011}
34. What is Meissner Effect? (2) {Dec 2010}
35. Explain the difference between type-I and type-II superconductors. (3) {Dec 2010}
36. Give the salient features of BCS theory of superconductors. (3) {Dec 2010}
37. Superconductors are perfectly diamagnetic. Explain. (2) {Dec 2010}
38. What is Cooper pair? (2) {June 2010}
39. Discuss the important differences between type-I and type-II superconductors with the help of example and plots of magnetization (M) Vs magnetic field (H). (3) {June 2010}
40. What is Meissner Effect? Further explain the effect of magnetic field on the superconducting state. (3) {June 2010}
41. Define London Penetration depth and write its expression. (2) {June 2010}
42. Draw graphs for hard and soft superconductors. (2) {Dec 2009}
43. Explain BCS theory of superconductivity. (5) {Dec 2009}
44. Calculate the expression for penetration depth in superconductors. (3) {Dec 2009}
45. Write down the relation between critical field and critical temperature in superconductors. (2) {June 2009}
46. Plot the graphs for type-I and type-II superconductors. (2) {June 2009}
47. Derive & explain the London equations and calculate the expression for the Penetration Depth. (8) {June 2009}
48. What do you mean by field penetration in the superconductors? (2) {Dec 2008}
49. What do you mean by coherence length? Write down the expression for it. (2) {Dec 2008}
50. Define Levitation effect and explain the various factors that can destroy the superconductivity. (4) {Dec 2008}
51. Explain the BCS theory of superconductivity. (4)
52. Why superconductors are perfectly diamagnetic in nature? (2) {May 2008}

53. What is critical field? Write down the expression for H_c and differentiate between type-I and type-II superconductors. (4) {May 2008}
54. Derive first London's equation and give its physical significance. (4) {May 2008}
55. State Meissner effect of superconductivity. (2) {Dec 2007}
56. What is London's penetration depth? How does it vary with temperature? (4) {Dec 2007}
57. Define Cooper Pair. Calculate the wavelength of a photon, which will be required to break a Cooper Pair in a superconductor (Zr) for which $T_C = 0 \cdot 56K$. (4) {Dec 2007}
58. Write the formula for variation of magnetic field intensity with temperature. (2) {May 2007}
59. What is superconductivity? What are the differences between type-I and type-II superconductors? A type-I superconductor with $T_C = 7K$ has slope $\frac{dB_C}{dT} = -25mTK^{-1}$ at T_C. Estimate its critical field at 6K. (8) {May 2007}
60. What are Cooper Pairs? (2) {Dec 2006}
61. Derive London's equations for A.C. & D.C. fields. (5) {Dec 2006}
62. What are type I and type II superconductors? Explain. (3) {Dec 2006}
63. For Hg (mercury), the critical temperature at which the superconductivity ensues with zero applied magnetic fields is $4 \cdot 15K$. The critical applied magnetic field at which superconductivity will not take place at any temperature is $0 \cdot 041T$. Find the applied magnetic field that will stop the superconductivity at $2 \cdot 2K$. (3) {Dec 2006}
64. What is Meissner Effect? (2) {May 2006}
65. What do you understand by type-I and type-II superconductors? (6) {May 2006}
66. Discuss London's theory of superconductivity. (2) {May 2006}
67. What are Cooper pairs? (2) {Dec2005}
68. What do you understand by type-I and type-II superconductors? Give BCS theory of superconductivity. (8)
69. What is the effect of magnetic field on superconductivity? (2) {May 2005}
70. What is Meissner Effect? Show how London equations lead to this effect. (1,4) {May 2005}
71. A type-I superconductor with $T_C = 7K$ has slope $\frac{dB_C}{dT} = -25mTK^{-1}$ at T_C. Estimate its critical field at 6K. Also calculate the jump in the specific heat at T_C. (3) {May 2005}
72. What is Meissner effect? (2) {Dec 2004}
73. What is superconductivity? What are the differences between type-I and type-II superconductors? A type-I superconductor with $T_C = 7K$ has slope $\frac{dB_C}{dT} = -25mTK^{-1}$ at T_C. Estimate its critical field at 6K. Also calculate the jump in the specific heat at T_C. (2,3,3) {Dec 2004}

74. Metals, which are very good conductors at normal temperatures do not show superconducting behaviour. Why? (2) {May 2004}
75. Distinguish between type-I and type-II superconductors. Briefly discuss the BCS theory of superconductivity. (5) {May 2004}
76. State and explain Meissner Effect. How do London equations account for this effect? (3) {May 2004}
77. What are Cooper pairs? (2) {Dec2003}

X-RAYS

1. Why X-rays are most suitable for study of crystal structure? (2) {JUN 15 [GNE]}
2. Distinguish between origin of characteristic and continuous X-ray spectrum. (2) {JUN 15 [PTU]}
3. A beam of X-rays with $\lambda = 0{\cdot}842\,\text{Å}$ is incident on a crystal at a grazing angle of $8^{\circ}35'$ when first order Bragg's reflection occurs. Calculate the glancing angle for third order reflection. (4) {DEC 14 [GNE]}
4. How X-rays are produced? Discuss the origin of continuous and characteristic X-rays. (5) {DEC 14 [PTU]}
5. What are X-rays? Differentiate between continuous and characteristic X-ray spectra. Calculate the angle of diffraction for (110) plane of a simple cubic crystal $(d = 2{\cdot}814\,\text{Å})$ corresponding to 2^{nd} order diffraction maxima for X-rays of wavelength $0{\cdot}710\,\text{Å}$. (4) {JUN 14 [GNE]}
6. What is Bragg's law and how it is used for crystallographic studies? (3) {JUN 14 [PTU]}
7. Find the maximum frequency present in the radiation from an X-ray tube whose accelerating potential is $4\times10^{4}V$. (4) {Dec 2013 [PTU]}
8. What are the characteristics of X-rays? Describe the X-ray energy level diagram for an atom. (4) {Dec 2013 [PTU]}
9. Calculate the minimum applied potential required to produce X-rays of $1\,\text{Å}$ wavelength. (2) {Dec 2013 [PTU]}
10. What is X-ray diffraction? Deduce Bragg's law of X-ray diffraction in a crystal. What are Bragg's conditions for X-ray diffraction? (4) {Dec 2013 [PTU]}
11. Monochromatic X-rays of wavelength $1{\cdot}4\,\text{Å}$ are incident on a crystal having $1{\cdot}5\,\text{Å}$ interatomic spacing. Find the various orders in which the diffraction takes place. (4) {Dec 2013 [PTU]}
12. What is the difference between X rays and Gamma rays? (2) {Dec 2013 [GNE]}

13. How continuous X-ray spectra is different from characteristic spectra? Also find the expression for cut off wavelength of continuous X-ray spectra. (4) {Dec 2013 [GNE]}
14. Discuss the importance of excitation and absorption limit in the X-ray spectra. (4) {Jun 2013 [PTU]}
15. A beam of electrons is accelerated by 350V and then reflected from a crystal. The first reflection maxima occurs when the glancing angle is 30°. Determine the spacing of the crystal. (4) {Jun 2013 [PTU]}
16. What is the origin of X-rays? Explain. (2) {Dec 2012 [GNE]}
17. Explain Bragg's law in X-ray diffraction. Explain how it is used to find the wavelength of X-rays. (4) {Dec 2012 [GNE]}
18. If the first order beam emerged at an angle of 10° relative to the incident beam on a crystal having interplannar spacing $2 \cdot 81\text{Å}$, what is the wavelength of X-rays used? (4) {Dec 2012 [GNE]}
19. The first order Bragg's maxima of electron diffraction in crystal having inter atomic spacing of $0 \cdot 99\text{Å}$ occurs at a glancing angle of 65°. Calculate the de-Broglie wavelength of the electrons and their velocities. (4) {Dec 2012}
20. What do you mean by radiography? (2) {June 2012}
21. A beam of X-rays with $\lambda = 0.842\text{Å}$ is incident on a crystal at a grazing angle of $8^{\circ}35'$ when first order Bragg's reflection occurs. Calculate the glancing angle for third order reflection. (4) {June 2012}
22. What are X-rays? How are these produced? (4) {June 2012}
23. Give important properties of X-rays. (2) {Dec 2011}
24. What are continuous and characteristic X-rays? How is the continuous X-ray spectrum and short wavelength limit explained? (5) {Dec 2011}
25. An X-ray photon is found to have its wavelength doubled on being scattered through 90°. Find the energy of incident photon. (3) {Dec 2011}
26. What is the significance of Bragg's Law? (2) {June 2011}
27. How does X-rays differ from Gamma rays? (2) {June 2011}
28. What thickness of lead will attenuate a beam of $0 \cdot 4MeV$ X-rays by a factor of 2? Given $\mu = 2 \cdot 3cm^{-1}$. (3)
29. Why X-rays are preferred for crystal structure determination? Derive an expression for Bragg's law. How Bragg's law is used in crystallography? (5) {June 2011}
30. An X-ray tube is operated at 25kV. Find the minimum wavelength of X-rays emitted from it. (2) {Dec 2010}
31. What is Moseley' Law? How can it be explained on the basis of Bohr's theory? What is its importance? (6) {Dec 2010}
32. How will it affect the cut off wavelength of X-rays if the separation between the cathode and target is doubled? (2) {Dec 2010}
33. What is Moseley's Law? Give its significance. (2) {June 2010}
34. Discuss the origin of continuous and characteristic X-rays. (3) {June 2010}
35. The first maxima for Bragg's diffraction from KCl crystal ($d = 0.314nm$) appears to be at 14°. Calculate the energy of incident X-rays. (3) {June 2010}

36. Differentiate between hard and soft X-rays. (4) {Dec 2009}
37. Differentiate between continuous and characteristic X-rays. (4) {June 2009}
38. Show that the production of X-rays is based on inverse photo electric effect and differentiate between characteristic and continuous X-rays. (4) {Dec 2008}
39. Calculate the wavelength of K_α line for an atom having atomic number $Z = 90$, given that Rydberg constant is $R = 1{\cdot}1 \times 10^7 m^{-1}$. (4) {Dec 2008}
40. Derive Bragg's equation for diffraction of X-rays and discuss its application in X ray crystallography. (5) {May 2008}
41. Calculate the ratio of λ_{K_α} & λ_{L_α} for a target having atomic number $Z = 90$. Given Rydberg's constant $R = 1{\cdot}097 \times 10^7 m^{-1}$. (3) {May 2008}
42. State Bragg's Law. (2) {Dec 2007}
43. Explain why continuous spectrum has a sharp point at short wavelength side? (4) {Dec 2007}
44. State Moseley's law. (2) {May 2007}
45. State and derive Bragg's Law. Write its applications in crystallography. (4) {May 2007}
46. The mass absorption coefficient for aluminium for X-rays having wavelength $0{\cdot}32\,\text{Å}$ is $0{\cdot}6 cm^2 g^{-1}$. The density of aluminium is $2{\cdot}7 gcm^{-3}$. Find the thickness of the absorber needed to cut down the intensity of the beam to $\left(\frac{1}{20}\right)^{th}$ of the initial value. (4) {May 2007}
47. What is the origin if X-rays? Explain. (2) {Dec 2006}
48. Differentiate between continuous and characteristic spectra. (3) {Dec 2006}
49. State and explain Moseley's Law? (2) {May 2006}
50. Differentiate between continuous and characteristic X-ray spectra. How Bragg's Law is used in crystallography? (6) {May 2006}
51. What is the origin of X-rays? (2) {May 2006}& {Dec2005}
52. Explain and deduce Bragg's law in X-ray diffraction. Describe Bragg's spectrometer and explain how it is used to determine the wavelength of X-rays. (6) {Dec2005}
53. An X-ray tube works at 18kV. Find the maximum speed of the electrons striking the anti-cathode. (2) {Dec2005}
54. What is Moseley's law? (2) {May 2005}
55. Explain the production characteristic X-ray spectra. An X-ray tube operated at 40kV emits a continuous X-ray spectrum with a short wavelength limit $\lambda_{min} = 0{\cdot}310\,\text{Å}$. Calculate the value of Planck's constant. (5,3) {May 2005}& {Dec 2004}
56. What is Bragg's Law? (2) {Dec 2004}
57. State and explain Moseley's law. (2) {May 2004}
58. The wavelength of L_α X-ray line of platinum (atomic number 78) is $1{\cdot}321\,\text{Å}$. An unknown substance emits L_α X-ray of wavelength $4{\cdot}174\,\text{Å}$. Calculate the atomic

number of the unknown substance. Given that the screening constant for L_α lines is 7·4. (3) {May 2004}

59. Derive Duane hunt law for short wavelength limit of X-rays produced by a Coolidge tube. (2) {Dec2003}

CRYSTAL PHYSICS

1. A beam of X-rays is incident on a system of parallel planes, having Miller indices (0 3 4). If the wavelength of X-rays is 0·4Å and lattice constant is 4Å (cubic system), then find the angle of diffraction for 2nd order maximum. (4) {JUN 15 [GNE]}
2. How Bravais lattice is different from simple lattice? Hence write the values of lattice parameters ($a,b,c,\alpha,\beta,\gamma$) for any two crystal systems. (4) {JUN 15 [GNE]}
3. Discuss the shape of diamond unit cell and derive its atomic packing fraction. (5) {JUN 15 [PTU]}
4. A diffraction pattern of a cubic crystal structure of lattice parameter 3·16Å is obtained with monochromatic X-ray beam of wavelength 1·54Å. The first line on this pattern was observed at 20·3°. Determine the interplanar spacing and Miller indices of the reflecting plane. (3) {JUN 15 [PTU]}
5. What do you understand by crystallography? (2) {DEC 14 [GNE]}
6. Derive expression for separation between lattice planes for a cubic crystal system. (4) {DEC 14 [GNE]}
7. What are the essential conditions for a unit cell to be called as a primitive unit cell? (2) {DEC 14 [PTU]}
8. For an orthorhombic crystal, the lattice constants are in the ratio $a:b:c$ = 0·428:1:0·376. Find Miller indices of the faces with intercepts 0·214:1:0·188. (3) {DEC 14 [PTU]}
9. Find the Miller indices of a set of parallel planes, which makes intercepts in the ratio 3a:4b with first two crystallographic axes and parallel to the third axis. (4) {JUN 14 [GNE]}
10. What is the difference between primitive and non-primitive unit cell? (2) {JUN 14 [GNE]}
11. Calculate packing fraction for body centered cubic unit cell. (3) {JUN 14 [PTU]}
12. What do you mean by a primitive unit cell? (2) {JUN 14 [PTU]}
13. Differentiate between primitive and non primitive unit cells. (2) {Dec 2013 [GNE]}
14. A lattice plane intersects three crystallographic axes at $(-2a,0,0,0)$, $(0,5b,0)$ and $(0,0,6c)$. Find Miller indices of the plane. (4) {Dec 2013 [GNE]}
15. What do you understand by crystallography? (2) {Jun 2013 [PTU]}
16. What do you mean by a primitive unit cell? (2) {Jun 2013 [GNE]}
17. Find the Miller indices for a set of planes parallel to Z axis in a cubic lattice with X and Y intercepts in the ratio 3a:4b. (3) {Jun 2013 [GNE]}

18. Define atomic packing fraction and calculate its value for face centered cubic (FCC) unit cell. (5) {Jun 2013 [GNE]}
19. What do you mean by space lattice? (2) {Dec 2012}
20. What is Bravais Lattice? Discuss with suitable examples. (4) {Dec 2012}

LASERS

1. Name some properties, which make laser light different from ordinary light. (2) {JUN 15 [GNE]}
2. The output power of a given laser is 1mW and the emitted wavelength is 630nm. Calculate the number of photons emitted per second. If the area of laser beam is $10^{-6} m^2$, then find intensity of laser beam. (4) {JUN 15 [GNE]}
3. What is four level Laser? Hence explain theory and working of any four level laser. (4) {JUN 15 [GNE]}
4. Discuss various pumping methods used in the Lasers for obtaining population inversion. (2) {JUN 15 [PTU]}
5. Discuss the construction and working of Ruby Laser. (4) {JUN 15 [PTU]}
6. Give the distinguishing features of holography from conventional photography. (4) {JUN 15 [PTU]}
7. Name four methods for pumping a laser. (2) {DEC 14 [GNE]}
8. In a Laser, the total number of lasing particles (ions, electrons, holes etc.) are $2 \cdot 8 \times 10^{19}$. If the Laser emits radiation of wavelength $7000\,\text{Å}$, then calculate the energy of one emitted photon and total energy available per pulse. Assume the efficiency of Laser to be 100%. (4) {DEC 14 [GNE]}
9. Discuss the principle of operation of He-Ne Laser. Draw the energy level diagram and indicate the wavelengths of three lasing transitions. (4) {DEC 14 [GNE]}
10. Differentiate between spontaneous and stimulated emissions. (2) {DEC 14 [PTU]}
11. Discuss the construction and working of Ruby Laser. (4) {DEC 14 [PTU]}
12. Give qualitative idea of formation and reconstruction of a hologram. (4) {DEC 14 [PTU]}
13. Discuss in detail the construction, theory and working of He-Ne laser. (4) {JUN 14 [GNE]}
14. What is holography? Differentiate between holography and photography. (4) {JUN 14 [GNE]}
15. Although the efficiency of a four level laser is less than that of a three level laser, still the four level laser is better than the three level laser. Comment. (2) {JUN 14 [GNE]}
16. Calculate ratio of transition swrates of spontaneous emission to the stimulated emission for light of wavelength $10^{4} m$ and cavity temperature 100K and hence determine which type of emission will dominate? (3) {JUN 14 [PTU]}
17. Specify three types of possible energy transitions between two atomic energy levels and derive conditions for Einstein's coefficients. (5) {JUN 14 [PTU]}
18. Why a three level laser normally provides pulsed output? (2) {JUN 14 [PTU]}
19. Explain the concept of optical pumping. (2) {Dec 2013 [PTU]}

20. Differentiate between three and four level lasers by taking suitable examples(s). (4) {Dec 2013 [PTU]}
21. Explain the concept and utility of holograms. (4) {Dec 2013 [PTU]}
22. Explain the role of Helium in Helium Neon laser. (2) {Dec 2013 [PTU]}
23. What do you mean by the terms stimulated absorption, spontaneous emission and stimulated emission? (4) {Dec 2013 [PTU]}
24. Draw the energy level diagram of Helium Neon laser. Explain the operation principle of He-Ne laser. How this laser is superior to ruby laser? (4) {Dec 2013 [PTU]}
25. How holography is different from photography? (2) {Dec 2013 [GNE]}
26. What is coherence? Name its types. (2) {Dec 2013 [GNE]}
27. Derive the relationship between various Einstein's coefficients. What are the necessary conditions for the laser action to take place? (4) {Dec 2013 [GNE]}
28. Using well labeled energy level diagram, explain the **working** of Helium Neon laser. (4) {Dec 2013 [GNE]}
29. Explain the concept of population inversion. (2) {Jun 2013 [PTU]}
30. What are Einstein's coefficients? Discuss their significance in context of Laser operations. (5) {Jun 2013 [PTU]}
31. He-Ne Laser is superior to Ruby Laser. Comment. (3) {Jun 2013 [PTU]}
32. Specify major components of a Laser. (2) {Jun 2013 [GNE]}
33. Briefly discuss the construction and working of a helium neon laser with the energy level diagram. (4) {Jun 2013 [GNE]}
34. Discuss the basic principle of recording a hologram and write its applications. (4) {Jun 2013 [GNE]}
35. Can we obtain light amplification in the absence of stimulated emission? Explain. (2) {Dec 2012 [GNE]}
36. Determine the SI units of Einstein's coefficients A_{21}, B_{12} & B_{21}. (2) {Dec 2012 [GNE]}
37. Discuss the principle and working of He-Ne laser with the help of a diagram. (4) {Dec 2012 [GNE]}
38. What is the difference between spontaneous and stimulated emission? Explain. (4) {Dec 2012 [GNE]}
39. Are all holograms same? (2) {Dec 2012}
40. Differentiate between three level and four level lasers by giving suitable example(s). (5) {Dec 2012}
41. What is the difference between ordinary image and a hologram? (3) {Dec 2012}
42. What are the main components of a laser system? (2) {June 2012}
43. Draw the energy level diagram and discuss the working of He-Ne laser. (5) {June 2012}
44. What is the concept of Holography? (3) {June 2012}
45. How does a hologram differ from a photograph? (2) {Dec 2011}
46. Find the coherence length of white light. The wavelength of white light lies in the range 400nm to 700nm. (3) {Dec 2011}
47. Differentiate between spontaneous and stimulated emission by taking suitable examples. Which of them is applicable to laser action and why? (5) {Dec 2011}
48. Define spontaneous and stimulated emission. (2) {June 2011}

49. Differentiate between three level and four level lasers. Give the construction and working of He-Ne laser. (5) {June 2011}
50. What is Holography? (3) {June 2011}
51. What is the fundamental principle of hologram? (2) {Dec 2010}
52. Discuss with suitable diagrams, the principle, construction, working and theory of Helium Neon Laser. Explain the role of Helium atoms in this Laser. How it is superior to Ruby Laser. (6) {Dec 2010}
53. What are the differences between the terms spontaneous and stimulated emission? (2) {Dec 2010}
54. Which Laser gives output radiation having frequency in the visible and as well as IR region? (2) {June 2010}
55. Why a three level; laser normally provides pulsed output? (2)
56. Specify three possible types of transitions between two atomic energy levels and derive relations between Einstein's coefficients. (5) {June 2010}
57. Calculate the ratio of rates of spontaneous emission to the stimulated emission for the light of wavelength $10^{-6}m$ and cavity temperature $T=100K$ and hence determine which type of emission will dominate? (3) {June 2010}
58. Define LASER. (2) {Dec 2009}
59. What is the wavelength of Helium Neon Laser and Semiconductor Laser? (2) {Dec 2009}
60. Discuss the importance of doping in semiconductors. (2) {Dec 2009}
61. Explain the construction, working and energy level diagram of Ruby Laser. (5) {Dec 2009}
62. Explain the term Spatial and Temporal coherence. (3) {Dec 2009}
63. Define population inversion in Lasers. (2) {June 2009}
64. Define the process of doping in the semiconductors. (2) {June 2009}
65. What is the wavelength of light in CO_2 Laser & Ruby Laser? (2) {June 2009}
66. Explain the working, construction and energy level diagram for He-Ne Laser. (6) {June 2009}
67. Explain the term spiking in the Ruby Laser. (2) {June 2009}
68. What do you mean by coherence length? Write down the expression for it. (2) {Dec 2008}
69. Define Holography. (2) {Dec 2008}
70. What do you mean by spatial and temporal coherence? (2) {Dec 2008}
71. Explain the construction, working and principle of Ruby Laser. (4) {Dec 2008}
72. Define the Einstein's coefficients for Lasers and explain their significance. (4) {Dec 2008}
73. What is population inversion? How it is achieved? (2) {May 2008}
74. Explain spiking in a ruby laser. (2) {May 2008}
75. Why focusing of Laser Light is better than ordinary light? (2) {May 2008}
76. Explain construction and working of a Helium Neon Laser. (5) {May 2008}
77. Why we prefer four level laser over three level laser even if its efficiency is low? (3) {May 2008}
78. Write physical significance of Einstein's coefficients. (2) {Dec 2007}
79. Define Holography. (2) {Dec 2007}

80. Explain the action of He-Ne Laser. How it is superior to Ruby Laser? (4) {Dec 2007}
81. In a Ruby Laser, the total number of Cr^{+3} ions is $2 \cdot 8 \times 10^{19}$. If the Laser emits radiation of wavelength $7000\,\mathring{A}$, then calculate the energy of one emitted photon and total energy available per pulse. (4) {Dec 2007}
82. What do you mean by spontaneous and stimulated emission? (2) {May 2007}
83. Establish the relation between Einstein's coefficients. Explain the energy level diagram for Ruby and Helium Neon Lasers. (8) {May 2007}
84. What is the difference between stimulated and spontaneous emission? (2) {Jan 2007}
85. Discuss the principle of operation of Helium Neon Laser. Draw the energy level diagram and indicate the wavelength of the radiation. (5) {Dec 2006}
86. Can we obtain light amplification in the absence of stimulated emission? Explain. (3) {Dec 2006}
87. Name four methods of pumping a Laser. (2) {May 2006}
88. What is the difference between spontaneous and stimulated emission? (2) {May 2006}
89. What are three level and four level lasers? Describe the construction and working of Ruby Laser. (6) {May 2006}
90. Determine the SI units of energy density $u(\omega)$, Einstein's coefficients A & B. (2) {May 2006}
91. Can we obtain amplification in the absence of stimulated emission? Explain. (2) {Dec2005}
92. What are Einstein's coefficients? How are these co-related? (2) {Dec2005}
93. Discuss the principle of operation of He-Ne laser. Draw the energy level diagram and indicate the wavelength of the radiation. (6) {Dec2005}
94. What is holography? (2) {May 2005}
95. Explain the terms spontaneous and stimulated emission. Explain the construction and working of Ruby Laser with necessary diagrams. (2,6) {May 2005}
96. What is spontaneous and stimulated emission? (2) {Dec 2004}
97. What do you understand by Holography? Derive the relation between Einstein's coefficients. (2,6) {Dec 2004}
98. What is the difference between ordinary image and a hologram? (2) {May 2004}
99. Explain with suitable diagrams, the difference between spontaneous and stimulated emission. How will you achieve higher probability of stimulated emission? (3) {May 2004}
100. Describe the construction and working of a He-Ne Laser. (5) {May 2004}
101. What is population inversion? How is it achieved? (2) {Dec2003}

FIBRE OPTICS

1. What do you mean by splicer and connector? Give one example of each. (2) {JUN 15 [GNE]}
2. Why single mode fiber is preferred for long distance communication? (2) {JUN 15 [GNE]}

3. Define and derive expression for numerical aperture. Hence explain why numerical aperture is small for a graded index fiber in comparison to an identical step index fiber. (4) {JUN 15 [GNE]}
4. Write names of various losses taking place in the optical fiber. If the length of optical fiber is 2km and output power is 1/100 of input power, then find fiber loss and attenuation coefficient. (4) {JUN 15 [GNE]}
5. What are various signal attenuation and losses in optical fiber? (2) {JUN 15 [PTU]}
6. What is an optical fiber? Give the basic principle3 of light guidance through the optical fiber. Derive an expression for numerical aperture of an optical fiber. (6) {JUN 15 [PTU]}
7. What are splicers and couplers? (2) {JUN 15 [PTU]}
8. Why do we prefer small numerical aperture for long distance communication? (2) {DEC 14 [GNE]}
9. Differentiate single mode and multimode fiber. (2) {DEC 14 [GNE]}
10. A step index fiber with core diameter of $30\mu m$ and $n_1 = 1{\cdot}530$ and $n_2 = 1{\cdot}515$ show absorption of 0.0002% of incident power at each reflection on the core-clad boundary. Find the attenuation in dB/km for a ray suffering 10^6 reflections in a fiber length of 1km. Assume that there are no other losses. (4) {DEC 14 [GNE]}
11. What do you mean by pulse dispersion? Discuss its various types and its role in the functioning of optical fiber. (4) {DEC 14 [GNE]}
12. What is the basic principle of guiding light through an optical fiber? (2) {DEC 14 [PTU]}
13. What are different kinds of optical fibers? Discuss various kinds of dispersions produced when light propagates through optical fiber. (5) {DEC 14 [PTU]}
14. Give three applications of optical fibers. (3) {DEC 14 [PTU]}
15. Define acceptance angle and numerical aperture and hence derive mathematical relation between the two. (4) {JUN 14 [GNE]}
16. The core of a glass fiber has refractive index $1{\cdot}5$, while its cladding is doped to give a fractional change in refractive index equal to $0{\cdot}005$. Find (i) refractive index of clad (ii) critical internal reflecting angle (iii) acceptance angle and (iv) numerical aperture. (4) {JUN 14 [GNE]}
17. Why data carrying capacity of optical fiber is more than that of radio waves? (2) {JUN 14 [GNE]}
18. A step index fiber with refractive index of core 1.458 and numerical aperture 0.3 is to be used at 850nm. Find the core radius if the normalized frequency is 75. (3) {JUN 14 [PTU]}
19. Describe construction of optical fiber with the help of diagram. Further describe different factors responsible for loss of signal propagating through optical fiber. (5) {JUN 14 [PTU]}
20. What do you understand by $10{\cdot}5 dB/km @ 850nm$? (2) {JUN 14 [PTU]}
21. A glass fiber has a core material of refractive index $1{\cdot}46$ and cladding material has a refractive index of $1{\cdot}42$. If it is surrounded by air, compute the critical angle (i) at core cladding boundary (ii) at cladding air boundary. (4) {Dec 2013 [PTU]}
22. Discuss merits and demerits of single mode optical fibers. (4) {Dec 2013 [PTU]}

23. What do you mean by index profile of optical fiber? (2) {Dec 2013 [PTU]}
24. What is meant by modes? Compare a single mode and multimode fiber. (4) {Dec 2013 [PTU]}
25. An optical fiber has a numerical aperture of $0\cdot20$ and cladding refractive index of $1\cdot59$. Determine the acceptance angle for the fiber in water, which has a refractive index of $1\cdot33$. (4) {Dec 2013 [PTU]}
26. Find the numerical aperture of an optical fiber, whose core and clad have refractive index respectively $1\cdot46$ & $1\cdot45$. (2) {Dec 2013 [GNE]}
27. Define acceptance angle and derive mathematical relation for it. (4) {Dec 2013 [GNE]}
28. Find the core radius necessary for SMF for propagation wavelength of 850nm and core and clad refractive index respectively as $1\cdot50$ & $1\cdot49$. (4) $1\cdot46$ & $1\cdot45$
29. What do you mean by fiber optic cable splicing? (2) {Jun 2013 [PTU]}
30. A step index fiber with core diameter of 30μm and $n_1 = 1\cdot530$ and $n_2 = 1\cdot515$ show absorption of $0\cdot00002\%$ of the incident power at each reflection at the core boundary. Find the attenuation in dB/km for such a fiber for a ray entering just below the acceptance angle. Assume that there are no other losses. (4) {Jun 2013 [PTU]}
31. Elaborate the concept of material dispersion. (4) {Jun 2013 [PTU]}
32. Specify an application where Laser and optical fiber are used together. (2) {Jun 2013 [GNE]}
33. What do you mean by acceptance cone for an optical fiber? (2) {Jun 2013 [GNE]}
34. A step index fiber with refractive index of $1\cdot458$ and numerical aperture of $0\cdot3$ is to be used at 820nm. Find the core radius if the normalized frequency is 75. (3) {Jun 2013 [GNE]}
35. What do you mean by intramodal and intermodal dispersion in optical fiber? What are its effects in signal transmission through optical fiber? (5) {Jun 2013 [GNE]}
36. What are splicers and couplers? (2) {Dec 2012 [GNE]}
37. What is the principle of optical fibre? Discuss various applications of optical fibres. (4) {Dec 2012 [GNE]}
38. Calculate the numerical aperture and acceptance of an optical fibre with $n_1 = 1\cdot50$ & $n_2 = 1\cdot45$. (4) {Dec 2012 [GNE]}
39. Give the main advantages of fibre communication. (2) {Dec 2012}
40. The core of a glass fibre has a refractive index of $1\cdot6$ while its clad is doped to give a fractional change in refractive index of $0\cdot008$ find the refractive index of the cladding and the critical internal refracting angle. (4) {Dec 2012}
41. Elaborate important characteristics of step index fibres. (4) {Dec 2012}
42. Find the core radius necessary for the single mode operation at 800nm in step index fibre with $n_1 = 1\cdot48$ & $n_2 = 1\cdot47$. Also find the numerical aperture and maximum acceptance angle. (5) {June 2012}
43. What do you understand by Material Dispersion? (3) {June 2012}
44. Give important applications of optical fibres. (2) {Dec 2011}
45. A 20km long fibre cable has a loss of 2dBkm^{-1} and a connector loss of 0.06dBkm^{-1}. Find the total loss. (3) {Dec 2011}

46. Derive an expression for pulse broadening due to intermodal dispersion in multimode step index fibre. (5) {Dec 2011}
47. Explain the term mode related to optical fibre. (2) {June 2011}
48. A fibre is made with core of refractive index $1{\cdot}5$ and the cladding is dopped to give a refractive index difference of $0{\cdot}0005$. Find (i) the cladding refractive index (ii) the critical angle (iii) acceptance angle and (iv) numerical aperture. (4) {June 2011}
49. Describe the role of fibre connectors, splicers and couplers in communication through fibres. (4) {June 2011}
50. What do you understand by single mode and Multimode fibre? (2) {Dec 2010}
51. Explain the difference between a step index and a graded index fibre. (3) {Dec 2010}
52. What is mean by acceptance angle for an optical fibre? Show how it is related to numerical aperture. (5) {Dec 2010}
53. What do you understand by "$10{\cdot}5dB/km@850nm$? (2) {June 2010}
54. Describe the construction of an optical fibre with the help of suitable diagram. Further describe different factors responsible for loss of signal propagating through a fibre. (4) {June 2010}
55. Calculate the numerical aperture, acceptance angle and critical angle of a fibre having core refractive index $1{\cdot}5$ and cladding refractive index $1{\cdot}45$. (4) {June 2010}
56. What is the significance of V-number in OFC's? (2) {Dec 2009}
57. Differentiate between Step index and Graded index optical fibre. (4) {Dec 2009}
58. Calculate the numerical aperture, acceptance angle and critical angle of a fibre having core refractive index $1{\cdot}5$ and cladding refractive index $1{\cdot}45$. (4) {Dec 2009}
59. Define NA (Numerical Aperture) and Acceptance Angle. (2) {June 2009}
60. Calculate the expression for NA for OFCs (Optical Fibre Cables). (4) {June 2009}
61. A step index fibre has a normalized frequency $= 26{\cdot}6$ at 1300nm wavelength. If the core is $50\mu m$ thick, calculate the acceptance angle of the fibre. (4) {June 2009}
62. Define bending losses in OFCs. (2) {Dec 2008}
63. What are the advantages of the optical fibres in communication systems? (2) {May 2008}
64. What are various kinds of optical fibres? Explain different mechanisms of dispersion in fibres. (5) {May 2008}
65. Light gathering capacity of an optical fibre is $0{\cdot}479$. If relative core cladding index difference is $0{\cdot}005$, calculate the refractive index of cladding if the outside medium is air. (4) {Dec 2008}
66. What is splicing? Define its types. Explain optical couplers. (4) {Dec 2008}
67. An optical fibre has NA of $0{\cdot}15$ and cladding refractive index is equal to $1{\cdot}5$. Find the numerical aperture of the fibre in a liquid of refractive index $1{\cdot}3$. Also find the refractive index of the core. (3) {May 2008}
68. Define acceptance angle and numerical aperture in optical fibre. (2) {Dec 2007}
69. Differentiate between step index and graded index fibre. (4) {Dec 2007}

70. What will be the critical angle and acceptance angle for a ray in a step index fibre for which $n_1 = 1 \cdot 53$ and which has cladding whose refractive index is $2 \cdot 5\%$ less than that of core. (4) {Dec 2007}
71. Distinguish between step index and graded index fibre. (2) {May 2007}
72. What is optical fibre cable? Explain the basic theory of propagation of light in the optical fibre. (4) {May 2007}
73. An optical fibre has numerical aperture of $0 \cdot 20$ and cladding of refractive index $1 \cdot 59$. Determine the acceptance angle for the fibre in water which has refractive index $1 \cdot 33$. (4) {May 2007}
74. What are the factors, which affect the propagation of light through an optical fibre? (2) {Dec 2006}
75. What do you mean by Pulse dispersion in step index fibre? How is graded index fibre useful in reducing the pulse dispersion? (5) {Dec 2006}
76. Calculate the numerical aperture and acceptance angle of an optical fibre. Given that the refractive index of the core and cladding are $1 \cdot 45 \& 1.40$ respectively. (3) {Dec 2006}
77. Why the information carrying capacity of optical fibre is very much greater than the conventional radiowaves and microwaves? (2) {May 2006}
78. What is numerical aperture? Explain material dispersion and pulse dispersion and pulse dispersion in optical fiber. (6) {May 2006}
79. What are splicers and couplers? (2) {May 2006}
80. Define acceptance angle and numerical aperture. (2) {Dec2005}
81. What is the difference between single mode and multimode transmission in optical fibres? (4) {Dec2005}
82. Calculate the maximum value of angle of incidence that a ray can make with the axis of the fibre such that it is guided through the fibre for the following fibre parameters: (i) $n_1 = 1 \cdot 6, n_2 = 1 \cdot 5$ (ii) $n_1 = 2 \cdot 1, n_2 = 1 \cdot 5$. (4) {Dec2005}
83. What is total internal reflection? (2) {May 2005}
84. What is numerical aperture? Calculate the numerical aperture and hence the acceptance angle for optical fibre, given that the refractive indices of the core and cladding are $1 \cdot 45 \& 1 \cdot 40$ respectively. (2,6) {May 2005}
85. What is numerical aperture? (2) {Dec 2004}
86. What is total internal reflection? Calculate the numerical aperture and hence the acceptance angle for an optical fibre. Given that refractive indices of the core and the cladding are $1 \cdot 45 \& 1 \cdot 40$ respectively. (3,5) {Dec 2004}
87. Distinguish between step index and graded index optical fibre. (2) {May 2004}
88. Discuss the propagation of light through a step index multimode fibre. Explain the meaning of acceptance angle and numerical aperture. Also derive expressions for these. (6) {May 2004}
89. The core of a glass fibre has refractive index $1 \cdot 5$, while its cladding is doped to give a fractional change in refractive index of $0 \cdot 005$. Find (i) refractive index of cladding (ii) critical internal reflecting angle (iii) acceptance angle (iv) numerical aperture (2)
90. What do you understand by the term acceptance cone for an optical fibre? (2) {Dec2003}

SPECIAL THEROY OF RELATIVITY

1. What are the conditions for existence of massless particle? (2) {JUN 15 [GNE]}
2. Derive expression for Lorentz transformation equations. Under what conditions, these equations become identical with Galilean transformation. (4) {JUN 15 [GNE]}
3. A rocket is going away from earth with speed $0 \cdot 8c$. It fires a missile, which is moving with speed $0 \cdot 6c$ w.r.t. earth. Find the velocity of missile for the following cases (i) missile is going away from earth (ii) missile is going toward earth. (4) {JUN 15 [GNE]}
4. What are space like and time like intervals in relativity? (2) {JUN 15 [PTU]}
5. Discuss Michelson-Moreley experiment and and give its conclusions. (6) {JUN 15 [PTU]}
6. What is the length of a meter stick moving parallel to its length when its mass is 1.5 times its rest mass? (2) {JUN 15 [PTU]}
7. State postulates of special theory of relativity. (2) {DEC 14 [GNE]}
8. Derive expression for variation of mass of body with speed. (4) {DEC 14 [GNE]}
9. A rocket is going away from earth with speed 0.6c. It fires missile, which is moving with speed 0.8c w.r.t. earth and making an angle of 60° with the direction of motion of rocket. Find the velocity of missile w.r.t. Rocket. (4) {DEC 14 [GNE]}
10. What are the conclusions of Michelson-Moreley experiment? (2) {DEC 14 [PTU]}
11. Justify why a photon cannot be brought to rest in any frame of reference? (2) {DEC 14 [PTU]}
12. Derive expression for length contraction. (5) {DEC 14 [PTU]}
13. The mean lifetime of a muon at rest is $2 \cdot 2 \mu s$. Calculate the average distance that it will travel in vacuum before decay, if it starts moving with velocity 0.9c. (3) {DEC 14 [PTU]}
14. What are postulates of Einstein's special theory of relativity? Using these, derive Lorentz transformation equations. (4) {JUN 14 [GNE]}
15. A rocket is moving away from earth with a velocity $0 \cdot 7c$. It fires a missile with velocity $0 \cdot 6c$ w.r.t. earth in its own direction. What is the velocity of the missile w.r.t. rocket? (4) {JUN 14 [GNE]}
16. Write the significance of negative result obtained in Michelson Moreley experiment. (2) {JUN 14 [GNE]}
17. Show that the speed of light in vacuum is invariant in Lorentz transformation. (2) {JUN 14 [GNE]}
18. What do you mean by relativity of simultaneity? Explain it with the help of an example. (4) {JUN 14 [PTU]}
19. A spaceship moving away from earth with speed 0.9c fires a missile in the same direction as its motion with speed 0.7c relative to the spaceship. What is the speed of missile relative to earth? (3) {JUN 14 [PTU]}
20. Derive Lorentz transformations equations. (5) {JUN 14 [PTU]}
21. What is the difference between inertial and non inertial frames of reference? (2) {JUN 14 [PTU]}
22. Give an account of Galilean transformation. (2) {Dec 2013 [PTU]}

23. The mass of a moving electron is 10 times its rest mass. Find its kinetic energy and momentum. (4) {Dec 2013 [PTU]}
24. Show that no signal can travel faster than light. (4) {Dec 2013 [PTU]}
25. If the total energy of a particle is twice its rest energy, then what is the velocity of the particle? (2) {Dec 2013 [PTU]}
26. A scientist observes that a certain atom 'A' moving relative to him with a velocity of $2\times10^{8} ms^{-1}$ emits a particle 'B', which moves with a velocity of $2\cdot8\times10^{8} ms^{-1}$ with respect to the atom 'A'. Calculate the velocity of 'B' with respect to the scientist.
27. Calculate the percentage contraction in the length of a rod moving with a velocity of $0\cdot8c$ in a direction inclined at 60° to its own length. (4) {Dec 2013 [PTU]}
28. Write the postulates of special theory of relativity. (2) {Dec 2013 [GNE]}
29. Two observers are moving relativistically wrt each other with uniform velocity v along X axis. How are space and time coordinates of both the observers related to each other? (4) {Dec 2013 [GNE]}
30. Two electrons are approaching each other with a aped of $0\cdot8c$. Find their relative speed. (4) {Dec 2013 [GNE]}
31. Does Ether exist? Comment. (2) {Jun 2013 [PTU]}
32. Define time dilation (2) {Jun 2013 [PTU]}
33. A flashing bulb is located at 40km from an observer. The bulb is fired and the observer sees the flash at $5:00pm$. What is the actual time when the bulb is fired? (4) {Jun 2013 [PTU]}
34. Develop a relation between relativistic momentum and energy. (4) {Jun 2013 [PTU]}
35. Define proper time interval and proper length interval. (2) {Jun 2013 [GNE]}
36. Using postulates of special theory of relativity deduce the formula governing the variation of mass of an object with its velocity. (4) {Jun 2013 [GNE]}
37. A spaceship moving away from the earth with a speed of $0\cdot9c$ fires a missile in the same direction as its motion with a speed of $0\cdot7c$ relative to the spaceship. What is the velocity of missile relative to earth? (4) {Jun 2013 [GNE]}
38. Rocket A travels to the right and rocket B travels to the left with velocities $0\cdot8c$ & $0\cdot6c$ respectively, relative to earth. What is the velocity of rocket A with respect to rocket B? (2) {Dec 2012 [GNE]}
39. Describe the Michelson-Moreley experiment and show how the negative results obtained in the experiment were interpreted. (4) {Dec 2012 [GNE]}
40. Derive an expression for Einstein's mass energy relation. (4) {Dec 2012 [GNE]}
41. What is free space? Does it exist? (2)
42. Define proper length and proper time. 92) {Dec 2012}
43. A block of metal of specific heat capacity $450Jkg^{-1}K^{-1}$ is heated from $0^{\circ}C$ to $90^{\circ}C$. Find the percentage increase in its mass. (4) {Dec 2012}
44. "No signal can travel with a velocity faster than light." Comment and justify your answer. (4) {Dec 2012}
45. What do you mean by time dilation? (2) {June 2012}
46. Does ether exist? Comment. (2) {June 2012}
47. Elaborate the concept and utility of Lorentz transformation. (5) {June 2012}

48. What do you mean by simultaneity in relativity? (3) {June 2012}
49. Give Einstein's postulates of special theory of relativity. (2) {Dec 2011}
50. Does ether exist? Comment. (2) {Dec 2011}
51. A particle of rest mass m_0 moves with speed $\frac{c}{2}$. Calculate its mass, momentum, total energy and kinetic energy. (3) {Dec 2011}
52. Explain the Einstein's concept of time dilation. Deduce the necessary relation. (5) {Dec 2011}
53. Does photon have mass? If no, then how photons have momentum? (2) {June 2011}
54. Calculate the mass and velocity of an electron having a total energy of 2MeV. (3) {June 2011}
55. State the fundamental postulates of special theory of relativity and hence deduce the Lorentz transformation. (5) {June 2011}
56. A stationary body explodes into two fragments, each of rest mass 1kg, that move apart at speeds of $0 \cdot 6c$ relative to the original body. Find the mass of original body. (2) {Dec 2010}
57. What is the objective of conducting Michelson-Moreley experiment? Describe the experiment. How is the negative result of the interpreted? (5) {Dec 2010}
58. Show that the rest mass of a particle is given by $m_0 = \frac{p^2c^2 - T^2}{2Tc^2}$; where p and T denote the momentum and kinetic energy of the particle respectively. (3) {Dec 2010}
59. Two photons approach each other. What is their relative velocity? (2) {Dec 2010}
60. How do you define proper length and proper time as per special theory of relativity? (2) {June 2010}
61. State and explain the postulates of special theory of relativity with the help of an example. (2) {June 2010}
62. Define time dilation and derive expression relating time interval as observed in two different inertial frames of reference. (3) {June 2010}
63. Find the total energy of an electron and a proton, both having momentum equal to $2MeV/c$. (3) {June 2010}
64. Explain the term time dilation. (2) {Dec 2009}
65. Explain the concept of ether. (2) {Dec 2009}
66. Explain Michelson Moreley's experiment and discuss its significance. (5) {Dec 2009}
67. Explain various postulates of special theory of relativity. (3) {Dec 2009}
68. Explain the term Length contraction. (2) {June 2009}
69. Differentiate between inertial and non inertial frames of reference. (2) {June 2009}
70. Derive expression for Lorentz Transformation equations. (5) {June 2009}
71. Prove that the velocity of light is independent of the velocity of the frame of reference. (3) {June 2009}
72. What are the outcomes of Michelson Moreley's experiment? (2) {Dec 2008}
73. Derive Lorentz transformation equations and apply them to explain (i) Length contraction (ii) time dilation. (4+2+2) {Dec 2008}
74. Explain why a particle cannot move faster than speed of light? (2) {May 2008}

75. Explain Michelson Moreley experiment in detail and give the significance of negative results. (8) {May 2008}
76. Write postulates of Einstein's special theory relativity. (2) {Dec 2007}
77. Prove that the relation $F = ma$ is covariant under relativistic transformation. (4) {Dec 2007}
78. Show that the relativistic form of Newton's second law, when F is parallel to v is $F = m_0 \frac{dv}{dt}\left(1-\frac{v^2}{c^2}\right)^{\frac{-3}{2}}$. (4) {Dec 2007}
79. Explain simultaneity in relativity. (2) {May 2007}
80. Write Lorentz transformations. (2) {May 2007}
81. If T is the relativistic kinetic energy of a particle of mass m_0, then show that $T^2 + 2m_0c^2T = p^2c^2$. (4) {May 2007}
82. A particle of mass M disintegrates while at rest into two parts having masses $\frac{M}{2}$ & $\frac{M}{4}$. Show that the relativistic kinetic energies of the parts are $\frac{3Mc^2}{32}$ & $\frac{5Mc^2}{32}$ respectively. (4) {May 2007}
83. An event occurs in the frame S at $t = 1ms$ at $x = 5km$. The position of the point of occurrence of event in frame S' appears to be $x' = 35km$. Find the time of occurrence of the event (t') in the frame S'. (2) {Dec 2006}
84. Show that the law of addition of velocity predicts the constant value of the velocity of light in all the inertial frames. (2) {Dec 2006}
85. Explain the postulates of special theory of relativity and derive the Lorentz transformation equations. (5) {Dec 2006}
86. Two particles come towards each other with speed $0{\cdot}8c$ with respect to the laboratory. What is their relative speed? (3) {Dec 2006}
87. Discuss in detail Michelson-Moreley experiment. (5)
88. Calculate the expected fringe shift in Michelson-Moreley experiment, if the distance of each mirror is 2m and the wavelength of light is $6000\,\text{Å}$. Given that the speed of earth is $3\times10^4 ms^{-1}$. (3) {May 2006}
89. Show that relativistic law of addition of velocities predicts constant value of velocity of light in all inertial frames. (2) {Dec2005}
90. Explain the postulates of theory of relativity and derive Lorentz transformation equation. (5) {Dec2005}
91. A certain process requires $10^{-6}s$ to occur in an atom at rest in the laboratory. How much time will this process require to an observer in the laboratory, when the atom is moving with a speed of $5\times10^7 ms^{-1}$? (3) {Dec2005}
92. State Einstein's postulates of special theory of relativity. (2) {May 2005}
93. On the basis of Lorentz transformation, discuss the following kinematic effects: (i) length contraction (ii) time dilation (4) {May 2005}
94. A scientist observes that a certain atom A moving with respect to him with a velocity of $2\times10^{10} cms^{-1}$ emits a particle B, which is moving with

velocity $2{\cdot}8\times10^{10}\,cms^{-1}$ with respect to the atom. Calculate the relative velocity of the emitted particle with respect to the scientist. (4) {May 2005}

95. State Einstein's postulates of special theory of relativity. (2) {Dec 2004}
96. Show that the mass of a body in motion is given by: $m=\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$, where m_0 is the rest mass of the body and m is the mass when it is moving with speed v. (8)
97. Define inertial frame of reference. Does an inertial frame of reference exist? (2) {May 2004}
98. Derive expression for variation of mass of a body with speed. (5) {May 2004}
99. Define Proper length and Proper time. A space crew has a life support system that will last for 1000hours. Find the minimum speed for safe travel between two space stations at a proper distance of $8\times10^{11}\,km$ from each other. (3)
100. State postulates of special theory of relativity. (2) {Dec 2003}

QUANTUM MECHANICS

1. Define uncertainty principle and give its origin. (2) {JUN 15 [GNE]}
2. If the mass of a neutron is $1{\cdot}66\times10^{-27}\,kg$, then find the de-Broglie wavelength at 300K. (Given $k=1{\cdot}38\times10^{-38}\,JK^{-1}$) (2) {JUN 15 [GNE]}
3. wavefunction of particle in a one dimensional box of length L is given as $\Psi(x)=\sqrt{\frac{2}{L}}\sin\left(\frac{n\pi x}{L}\right)$; n = integer. Show that this wave function satisfies one dimensional time independent Schrodinger equation. Given that $E=\frac{n^2\pi^2\hbar^2}{2mL^2}$ and U = 0. (4) {JUN 15 [GNE]}
4. Define wavefunction. Give its significance and write conditions for a wavefunction to be well behaved. (4) {JUN 15 [GNE]}
5. Using energy-time uncertainty principle, show that no excited state in atom can be mono-energetic in nature. (2) {JUN 15 [PTU]}
6. Why a particle trapped in a box cannot be at rest? (2) {JUN 15 [PTU]}
7. What is the matter wave associated with a moving particle? Derive expression for phase and group velocities of such a wave packet. (4) {JUN 15 [PTU]}
8. Give a brief account of need and origin of quantum mechanics. (4) {JUN 15 [PTU]}
9. Explain briefly uncertainty principle. (2) {DEC 14 [GNE]}
10. Derive expression for time independent Schrodinger wave equation. (4) {DEC 14 [GNE]}
11. Derive relation between group velocity and phase velocity. Hence discuss the cases of normal and anomalous dispersion. Which dispersion is must for group velocity to be less than velocity of light? (4) {DEC 14 [GNE]}
12. What are essential conditions for a wave function to be well behaved? (2) {DEC 14 [PTU]}

13. Show that Heisenberg's Uncertainty principle is a natural consequence of wave nature associated with moving material particles. (4){DEC 14 [PTU]}
14. Obtain time independent Schrodinger equation. Argue qualitatively that energy quantization is embedded in this equation. (4) {DEC 14 [PTU]}
15. Discuss the formation of wave packet and hence prove that particle velocity is equal to the group velocity. (4) {JUN 14 [GNE]}
16. Calculate the energy eigen values and eigen functions for the motion of a particle in one dimensional box. (4) {JUN 14 [GNE]}
17. Can $\psi(x) = x^2$ be an acceptable wave function in quantum mechanics? (2) {JUN 14 [GNE]}
18. Calculate the de-Broglie wavelength associated with electrons, which are accelerated by a voltage of 50kV. (3) {JUN 14 [PTU]}
19. Solve Schrodinger equation for a particle confined to an infinite potential box of width L in order to derive the expression for energy eigen values. (5) {JUN 14 [PTU]}
20. What is the physical significance attached to the conditions of continuity and single valued nature of an acceptable wavefunction? (2) {JUN 14 [PTU]}
21. What is the concept of Larmor frequency? (2) {Dec 2013 [PTU]}
22. What do you understand by wave particle puzzle? (2) {Dec 2013 [PTU]}
23. Derive time dependent Schrodinger equation and discuss its significance in today's context. (4) {Dec 2013 [PTU]}
24. What is the significance of uncertainty principle for macroscopic bodies? (4) {Dec 2013 [PTU]}
25. What is de-Broglie hypothesis. (2) {Dec 2013 [PTU]}
26. An electron is bound in one dimensional box of size $4\times10^{-10}m$. What will be the minimum energy? (2) {Dec 2013 [PTU]}
27. State and explain Heisenberg's uncertainity principle. (4) {Dec 2013 [PTU]}
28. At time t = 0, a particle is represented by a wave function

$$\Psi(x) = \begin{cases} A\dfrac{x}{a} & \text{for } 0 \le x \le a \\ A\dfrac{(b-x)}{(b-a)} & \text{for } a \le x \le b \\ 0 & \text{elsewhere} \end{cases}$$; where A, a and b are constants.

    (i) Normalize $\Psi(x,0)$
    (ii) Sketch $\Psi(x,0)$ as a function of x.
    (iii) Where is the particle most likely to be at t = 0 ?
    (iv) What is the probability of finding the particle to the left of x = a at t = 0? (4) {Dec 2013 [PTU]}
29. Explain Uncertainity principle. (2) {Dec 2013 [GNE]}
30. Calculate the energy eigen values and eigen functions for the motion of a particle confined in a 1-D box. (4) {Dec 2013 [GNE]}

31. At a certain time, the normalized wave function of the particle moving along the X-axis is given by: $\Psi(x) = \begin{cases} x+\beta & \text{for } -\beta < x < 0 \\ -x+\beta & \text{for } 0 < x < \beta \\ 0 & \text{elsewhere} \end{cases}$. Find the value of β and the probability that the particle's position is between $x = \frac{\beta}{2}$ & $x = \beta$. (4) {Dec 2013 [GNE]}
32. Differentiate between phase velocity and group velocity. (2) {Jun 2013 [PTU]}
33. Obtain Bohr's condition of quantization of angular momentum using de Broglie's idea of matter waves. (3) {Jun 2013 [PTU]}
34. Develop energy time relation and discuss some relevant application. (5) {Jun 2013 [PTU]}
35. Write the expression of normalized wave function for a particle confined in a potential box. (2) {Jun 2013 [GNE]}
36. Find the probability of finding a particle in a region $0 \cdot 4L$ to $0 \cdot 6L$ trapped in an infinite potential well of width L. (4) {Jun 2013 [GNE]}
37. Derive an expression for energy of a particle of mass m confined to infinite potential well of width L. Why such a particle cannot have zero energy? (4) {Jun 2013 [GNE]}
38. What do you understand by wave-particle duality? (2) {Dec 2012 [GNE]}
39. A particle of mass m is confined to move inside an infinite potential well described by following function:

$$V(x) = \begin{cases} +\infty & \text{for } x < a \\ 0 & \text{for } 0 \le x \le a \\ +\infty & \text{for } x > a \end{cases}$$

Calculate the wave function and energy of the particle. (4) {Dec 2012 [GNE]}
40. What is uncertainty principle? Explain the nonexistence of the electron inside the nucleus using this principle. (4) {Dec 2012 [GNE]}
41. What do you understand by wave packet? (2) {Dec 2012}
42. What is the minimum uncertainty in the energy state of an atom if an electron remains in this state for $10^{-8} s$? (3) {Dec 2012}
43. Develop time independent Schrodinger equation and discuss its significance. (5) {Dec 2012}
44. What are matter waves? (2) {June 2012}
45. Compute the de-Broglie wavelength of a proton of wavelength whose kinetic energy is equal to the rest energy of an electron. Given that mass of proton is 1840 times the mass of electron. (4) {June 2012}
46. What do you mean by normalization of a wave function? (4) {June 2012}
47. Calculate the wave number of 10keV neutron. (3) {Dec 2011}
48. Explain Heisenberg's uncertainty principle. (5) {Dec 2011}
49. What is the significance of wave function? (2) {June 2011}
50. What is the importance of uncertainty principle? (2) {June 2011}
51. Derive an expression for time dependent Schrodinger wave equation. (6) {June 2011}

52. What is the energy of Gamma ray having wavelength of 1Å ? (2) {June 2011}
53. What is de-Broglie's hypothesis? (2) {Dec 2010}
54. What is Compton Effect? (2) {Dec 2010}
55. What is Born's interpretation of wave function? (2) {Dec 2010}
56. What is the difference between phase velocity and group velocity? Show that the de-Broglie group velocity associated with the wave packet is equal to the velocity of the particle. (6) {Dec 2010}
57. Why $n = 0$ state is not allowed for a particle confined to an infinite potential box? (2) {June 2010}
58. What is the physical significance attached to the conditions of continuity and single valued nature of an acceptable wave function? (2) {June 2010}
59. Establish time dependent Schrodinger wave equation and further deduce tie independent equation from it. (4) {June 2010}
60. What are the characteristics of a well behaved wave function? (2) {June 2010}
61. Find the probability of a particle trapped in a box of length L to be found in the region $0 \cdot 45L \; to \; 0 \cdot 55L$ for the ground state. (2) {June 2010}
62. Differentiate between phase velocity and group velocity. (2) {Dec 2009}
63. Define wave function and obtain the expression for time dependent Schrodinger wave equation. (4) {Dec 2009}
64. Differentiate between Photoelectric effect and Compton Effect and derive expression for Compton shift. (8) {Dec 2009}
65. Define Eigen values and Eigen functions. (2) {June 2009}
66. Define wave function and calculate the expression for Time Independent Schrodinger wave equation. (4) {June 2009}
67. Explain Compton Effect and calculate the expression for the Compton Shift. (8) {June 2009}
68. Define photoelectric effect. (2) {Dec 2008}
69. Give the significance of Compton Effect. Find the expression for (i) Compton Shift (ii) Kinetic energy of recoiled electron. (1+4+3) {Dec 2008}
70. What is the importance of Compton shift? (2) {May 2008}
71. Derive Schrodinger equation for a linear harmonic oscillator. Determine the normalized wave function and energy levels of the oscillator. (8) {May 2008}
72. Distinguish between phase and group velocity. (2) {Dec 2007}
73. Prove Heisenberg's uncertainty principle $\Delta x.\Delta p_x \geq \frac{h}{2}$. (4) {Dec 2007}
74. If the energy of a particle is zero, then prove using quantum mechanics that it can not exist in a one dimensional box. (4) {Dec 2007}
75. An X-ray photon of energy $75keV$ is scattered at an angle 45°, then calculate the energy of the scattered X-ray photon. (4) {Dec 2007}
76. What do you mean by matter waves? (2) {May 2007}
77. Discuss Harmonic Oscillator in quantum mechanics. Define energy Eigen values for it. Does it explain the tunneling phenomenon for particle in a box? (8) {May 2007}
78. How do you explain the zero point energy of a harmonic oscillator? (2) {Jan 2007}
79. Can visible light be used to demonstrate Compton Effect? Explain. (2) {Dec 2006}

80. Show that the relation between the direction of the recoiled electron and the scattered photon in case of Compton Effect is given by $\cot\theta = (1+\alpha)\tan\left(\frac{\Phi}{2}\right)$, where $\alpha = \frac{h\nu}{m_0 c^2}$ and other symbols have their usual meanings. (5)
81. What is the de Broglie wavelength of an electron, which has been accelerated from rest through a potential difference of 150V? (3)
82. The energy of a linear harmonic oscillator in its third excited state is $0{\cdot}1eV$. Calculate the frequency of vibration. (3) {Dec 2006}
83. Explain de Broglie concept of matter waves. (2) {May 2006}
84. What are orthogonal wave functions? (2) {May 2006}
85. Write the Schrodinger equation for particle in a box and solve it to obtain energy Eigen values and Eigen functions. (6) {May 2006}
86. Explain briefly Uncertainty Principle. (2) {May 2006}
87. What voltage must be applied to an electron to produce electrons of wavelength $0{\cdot}5\,\text{Å}$? Given that $h = 6{\cdot}62\times10^{-34}Js$, $e = 1{\cdot}6\times10^{-19}C$ & $m = 9{\cdot}1\times10^{-31}kg$. (2) {Dec2005}
88. What is the physical significance of wave function? (2) {Dec2005}
89. Discuss Compton scattering and derive a relation for the change in wavelength of the scattered photon. (6) {Dec2005}
90. Explain briefly Uncertainty principle. (2)
91. What is Compton Effect? (2) {May 2005}
92. What do you understand by Eigenvalues and Eigen functions? (2) {May 2005}
93. What is the need for quantum mechanics? Discuss the Born's interpretation of wave function and normalization of the wave function. (2,2) {May 2005}
94. At a certain time, the normalized wave function of the particle moving along the X-axis is given by: $\Psi(x) = \begin{cases} x+\beta & \text{for } -\beta < x < 0 \\ -x+\beta & \text{for } 0 < x < \beta \\ 0 & \text{elsewhere} \end{cases}$. Find the value of β and the probability that the particle's position is between $x = \frac{\beta}{2}$ & $x = \beta$. (4) {May 2005}
95. What is uncertainty principle? (2) {Dec 2004}
96. Give the Born's interpretation of wave function. (2) {Dec 2004}
97. For a particle in a one dimensional box, show that the value of uncertainity product is: $\Delta x\Delta p = \hbar\sqrt{\frac{n^2\pi^2}{12} - \frac{1}{2}}$, where symbols have their usual meanings. (8) {Dec 2004}
98. Is it possible to observe Compton Scattering of visible light? Explain. (2) {May 2004}
99. Can every physical system be described by the time independent Schrodinger equation? Comment. (2) {May 2004}

100. Show that the energy lost by a photon of frequency v in Compton interaction with a stationary electron of rest mass m_0 is given by; $\frac{hv\alpha(1-\cos\theta)}{1+\alpha(1-\cos\theta)}$; where $\alpha = \frac{hv}{m_0c^2}$ and θ is angle of scattering of photon. Also obtain an expression for maximum kinetic energy of the recoil electron. (6) {May 2004}

101. Find the ground state energy of an electron confined to a one dimensional rigid box of length 1Å . (2)

102. What is the utility of normalization of wave function? (2) {Dec2003}

103. The uncertainty principle imposes no restriction on the measurements relasted to macroscopic objects. Comment. (2) {Dec2003}

NANOPHYSICS

1. Why storage of nanomaterials is a challenge? (2) {JUN 15 [GNE]}
2. Write short notes on (i) Quantum confinement (ii) Carbon nanotubes (CNTs). (2) {JUN 15 [GNE]}
3. Write major applications and disadvantages of nanotechnology. (2) {JUN 15 [GNE]}
4. Define nanoscience and nanotechnology. (2) {JUN 15 [PTU]}
5. Discuss various techniques for synthesis of nanomaterials. (5) {JUN 15 [PTU]}
6. Write short note on carbon nanotubes. (3) {JUN 15 [PTU]}
7. Write four disadvantages of nanotechnology. (2) {DEC 14 [GNE]}
8. How can we synthesize nanomaterials? Explain various steps involved in Sol-Gel technique. (4) {DEC 14 [GNE]}
9. Name and explain two important factors responsible for distinguished properties of nanomaterials. (4) {DEC 14 [GNE]}
10. Give a brief and broad outline of sol-gel synthesis of nanomaterials. (2) {DEC 14 [PTU]}
11. Discuss various techniques of synthesis of nanomaterials. (5) {DEC 14 [PTU]}
12. Write short note on carbon nanotubes. (3) {DEC 14 [PTU]}
13. Explain optical and magnetic properties of nano materials. (4) {JUN 14 [GNE]}
14. Discuss in detail sol-gel technique for synthesis of nano-materials. (4) {JUN 14 [GNE]}
15. Write any two properties of carbon nanotubes. (2) {JUN 14 [GNE]}
16. Discuss briefly different methods used to synthesize the nanoparticles. (4) {JUN 14 [PTU]}
17. Give two properties of carbon nanotubes. (2) {JUN 14 [PTU]}
18. Differentiate between nanowire and nanotune. (2) {Dec 2013 [PTU]}
19. Justify that surface area to volume ratio increases while we go from bulk to nano scale. (4) {Dec 2013 [PTU]}
20. Demonstrate the composition of fullerene C_{60} structure and discuss its real world application(s). (4) {Dec 2013 [PTU]}

21. Give examples of one, two and three dimensional nanomaterials. (2) {Dec 2013 [GNE]}
22. How can nanomaterials be synthesized? Explain any technique in detail by giving its advantages and disadvantages. (4) {Dec 2013 [GNE]}
23. Write applications and potential risks of nanomaterials. (4) {Dec 2013 [GNE]}
24. What is electron confinement? (2) {Jun 2013 [PTU]}
25. "Surface area to volume ratio gets enhanced at nano scale." Comment. (4) {Jun 2013 [PTU]}
26. Discuss some applications of carbon nanotubes. (4) {Jun 2013 [PTU]}
27. Write two peculiar features which distinguish nano materials from normal materials. (2) {Jun 2013 [GNE]}
28. Discuss briefly different methods for synthesis of nanomaterials. (4) {Jun 2013 [GNE]}
29. What do you understand carbon nanotubes? How are these synthesized? (4) {Jun 2013 [GNE]}
30. What are nanomaterials? Explain. (2) {Dec 2012 [GNE]}
31. How can we synthesis nanomaterials? Explain Sol-Gel technique in details. (4) {Dec 2012 [GNE]}
32. What are carbon nanotubes? Discuss various applications of nanomaterials. (4) {Dec 2012 [GNE]}
33. What is quantum dot? (2) {Dec 2012}
34. Elaborate the concept of particle confinement in context of nanophysics. (4) {Dec 2012}
35. Elaborate the advantages of using Sol-Gel process for synthesizing nanomaterials. (4) {Dec 2012}
36. What is Nanophysics? (2) {June 2012}
37. What are advantages of synthesizing nanomaterials? (4) {June 2012}
38. Synthesis of nanotubes is a challenge. Comment. (4) {June 2012}
39. What are nano materials? (2) {Dec 2011}
40. What is Quantum confinement? (2) {Dec 2011}
41. What are advantages of synthesizing nano materials using Sol-Gel method? (4) {Dec 2011}
42. Advocate the utility of fullerene structure in reference to the synthesis of nanotubes. (4) {Dec 2011}