Physics

Unit 1 (Modern Physics, Quantum mechanics)

1. The product of uncertainties between position and momentum is given by _____

   Ans: $\Delta x \, \Delta p \geq \frac{h}{4\pi}$

2. If free electron can exist in a nucleus, it must have a minimum energy of about_____

   Ans: 9 MeV

3. Rayleigh Jeans Law is applicable only in the

   A) shorter wavelength B) higher wavelength C) no change D) all wavelengths.

Ans: Higher wavelength

4. According to Max Born approximation $|\psi|^2$ represents _____

   Ans: Probability Density

5. The _____ Law successfully accounted for explaining the black body radiation spectrum.

Ans: Planck's Law

Unit 2 (LASERS, Optical fibers)

1. Emission of photons without being added by any external agency is called _____

   Ans: Spontaneous Emission

2. The life time of an atom in a metastable state is of the order _____

   Ans: Few milli seconds

3. What is meant by LASER?

4. Define Induced absorption.

5. Mention any one industrial applications of LASER.

6. Optical fibers works on the principle of _____

   Ans: Total Internal Reflection

7. Numerical aperture of an optical fiber depends on

a. diameter of the fiber b. acceptance angle c. critical angle d. η_{core} of material

8. Step index fiber can be a

a. mono mode fiber only b. multimode fiber only c. mono mode as well as multi mode

d. either mono mode or multimode (cannot be both)

Unit 3 (Mechanics and Oscillations & waves)

1. What is elasticity?
2. Define stress.
3. Define strain.
4. State Hook's law.
5. Define Young's modulus.
6. Define Bulk modulus.
7. Define Poisson's ratio.
8. What is meant by bending moment of a beam?
9. Write the relation between Y and K.
10. Write the relation between Y, K and n.
11. Define rigidity modulus.
12. Explain the term lateral strain.
13. Define angular frequency or angular velocity 'ω'.
14. Define Simple Harmonic Motion (SHM).
15. Write the equation of motion for free oscillations.

Unit 4 (Electromagnetic Theory)

1. Give the wavelength range for visible region in EM spectrum.
2. Define linear charge density.

3. Define surface charge density.

4. Define volume charge density.

5. When del operator operates on scalar function, it provides the resultant as a _____

   Ans: Vector.

6. The curl of vector field $\vec{A}$ is represented by _____

   Ans: $\vec{\nabla} \times \vec{A}$

7. The divergence of vector $\vec{A}$ is represented by _____

   Ans: $\vec{\nabla} \bullet \vec{A}$

8. Name the theorem which converts the surface integral in to line integral.

   Ans : Stoke's Theorem

9. Write any one differential form of Maxwell's equation.

   Ans:

1. $\vec{\nabla} \bullet \vec{D} = \rho$ OR $\vec{\nabla} \bullet \vec{E} = \frac{\rho}{\varepsilon_0}$
2. $\vec{\nabla} \bullet \vec{B} = 0$
3. $\vec{\nabla} \times \vec{E} = -\frac{\partial B}{\partial t}$
4. $\vec{\nabla} \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$

Unit 5

1. Rotary pump can attain a maximum vacuum of

   (a) 10^{-1} Torr (b) 10^{-3} Torr (c) 10^{-5} Torr (d) 10^{-6} Torr

2. Diffusion pump is used to attain a maximum vacuum of

   (a) 10^{-1} Torr (b) 10^{-2} Torr (c) 10^{-3} Torr (d) 10^{-6} Torr

3. Pirani gauge is used to measure a maximum vacuum of

   (a) 10^{-3} Torr (b) 10^{-5} Torr (c) 10^{-6} Torr (d) 10^{-9} Torr

4. Penning gauge is used to measure a maximum vacuum of

   (a) 10^{-1} Torr (b) 10^{-3} Torr (c) 10^{-6} Torr (d) 10^{-9} Torr

5. A quantum wire is an example of _____ structure.

   a) 2D b) 1D c) 0D d) bulk

6. Define density of states.

7. Bulk material reduced in three directions is known as_____.

8. 100 nm thickness is _____Å.

UNIT III – MECHANICS, OSCILLATIONS AND WAVES

1. The restoring force per unit area set up inside the body is called

a) Work done **b) Stress** c)Strain d) Noe of these

2. Strain is the change produced in the body due to change in ---------- of a body

a) length b) volume c) stress **d) both (a) and (b)**

3. Unit of strain is ----------

a) cm b) cm^3 c) gram **d) no unit**

4. Modulus of elasticity is ratio of ----------

a) stress and strain b) strain and stress c) 1/stress d) 1/strain

5. The ratio of linear stress to linear strain is

a) infinity b) zero **c) constant** d) none of the above

6. Within the elastic limit, the ratio of the lateral strain to the longitudinal strain is called

a) Bulk modulus b) Young's Modulus c) Rigidity modulus **d) Poisson's ratio**

7. A homogeneous body of uniform cross section whose length is quite large compared to its other

dimensions is called ----------

a) ray **b) beam** c) elasticity d) rigidity

8. Which of the following can affect modulus of elasticity?

a) Heavy stress b)Temperature c) Heat treatment **d) all the above**

9. Modulus of elasticity is is completely independent of its ----------

a) shape b) dimensions c) temperature **d) both a) and b)**

10. Young's modulus of a beam of rectangular cross-section in single cantilever is ----------

to depression of a beam

a) directly proportional **b) inversely proportional** **c) equal** d) none of the above

11. Young's modulus of a beam circular cross-section in single cantilever varies as

a) 1/r b) $1/r^3$ c)r **d) $1/r^4$**

where 'r' is the radius of circular cross-section of a beam

12. The maximum distance covered by the body on either side of its mean or equilibrium position

during the oscillation is called as

a) amplitude b) time period c) elasticity d) frequency

13. If the motion of vibrating body is symmetric on either side of the equilibrium position then it is

said to be ---------- motion

a) equilibrium motion **b) simple harmonic** c) angular motion d) all the above

14. Angular frequency id inversely proportional to ----------

a) amplitude b) frequency **c) time period** d) both b) and c)

15. When a body is oscillating (or vibrating), its velocity

(a) decreases when moving away from the equilibrium position

(b) increases while approaching the equilibrium position

(c) becomes maximum when crossing the equilibrium position and

(d) all the above

16. When a body is oscillating (or vibrating), its velocity becomes ---------- at the maximum

displacement position where the body will be reversing its direction of motion

a) zero b) infinite c) highest d) lowest

17. ---------- force responsible for the oscillation of the body

a) electric b) magnetic **c)restoring** d) all the above

18. The SI unit of angular frequency is

a) degree **b) radian per second** c) minutes d) centigrade

19. One Hz is one ---------- per second

a) oscillation b) degree c) centimeter d) none of the above

20. If a body takes 'T' time period to complete one oscillation then its angular frequency ' ω' is given by

a) 2πT **b) 2πf** c) 1/T d) T

Descriptive Questions

1. Define following terms

(i) stress (ii) strain (iii) Elasticity

2. Explain Hook's law in brief

3. Describe three types of modulus of elasticity

4. Derive the relation between **y, n and σ**.

5. Derive the relation between **y, K and σ.**

6. Obtain expression for bending moment of a beam of rectangular cross-section.

7. Derive an expression for Young's modulus of a beam of rectangular cross-section in single cantilever

set up.

8. Explain simple harmonic motion

9. Discuss briefly about free vibrations

10. Elaborate neatly analytical treatment of free vibrations.

Problems:

1. A steel wire 4 m in length and 2.4 X 10^{-7} m^2 in cross sectional area is stretched by a force of 36 N. Calculate (a) stress (b) strain. Give Y for steel = 18 X 10^{10} N/m^2.

Solution:

(a) Stress = Force/area = $\frac{force}{area} = \frac{36}{2.4X10^{-7}} = 1.5\ x\ 10^8 N/\ m^2$

(b) Strain = stress/ Y = $\frac{1.5\ X\ 10^8}{18\ X\ 10^{10}} = 8.33\ X\ 10^{-4}$

2. A uniform wire 3 meter long weighing 21 X 10^{-3} elongates 2.4 X 10^{-3} m, when stretched by a force of 5 kg.wt. The density of the metal is 8.8 X 10^3 kg/m^3. Determine the value of Young's modulus for the metal.

Solution:

Given: F = 5 kg.wt\

L = 3 mtr

Volume of wire = mass/density

$= \frac{21\ x\ 10^{-3}}{8.8\ X\ 10^3}$

Cross-section= a = $\frac{21\ x\ 10^{-3}}{8.8\ X\ 10^3}\ X\ \frac{1}{3}$

Young's Modulus = Y = $\frac{F}{a}\ X\ \frac{L}{l} = 77\ X\ 10^9$ N/m^2

3. A spring is hung vertically and loaded with a mass of 2 kg. A force of 10 Kgm stretches 0.2 mtr. Find its period of oscillation and its frequency.

Solution:

$T = 2\ \pi\sqrt{\frac{M}{F}}$ ---------- (1)

Where M: mass of spring

F = force

$$\therefore T = 0.4015\ seconds$$

Frequency = n = $\frac{1}{T}$ = 2.49 cycle/second

UNIT 4

Electromagnetic Theory

Objective Type Questions:

1) The direction of $\vec{\nabla}\phi$ is always

a) parallel to the surface b) perpendicular to the surface

c) depends upon the shape of surface d) none of these

2) The vector field $\vec{A}$ is solenoidal if

a) $\vec{\nabla}\times\vec{A}=0$ b) $\vec{A}=0$

c) $\vec{\nabla}\cdot\vec{A}=0$ d) none of these

3) A vector field $\vec{A}$ is conservative if

a) $\vec{\nabla}\times\vec{A}\neq 0$ b) $\vec{\nabla}\cdot\vec{A}=0$

c) $\vec{A}=\vec{\nabla}\phi$ d) none of these

4) The vector function $\vec{\nabla}\cdot\vec{A}$ represents

a) the total flux over any arbitrary closed surface

b) the inward flux density at the point (x,y,z)

c) the outward flux density at the point (x,y,z)

d) none of these

5) The vector field is irrotational if

a) $\vec{\nabla}\times\vec{A}=0$ b) $\vec{\nabla}\cdot\vec{A}=1$

c) $\vec{\nabla}\cdot\vec{A}=0$ d) $\vec{\nabla}\times\vec{A}=1$

6) If $\vec{a}$ is a constant vector then $\vec{\nabla}\times\left(\vec{a}\times\vec{r}\right)$ is equal to

a) zero b) $2\vec{a}$

c) $\vec{a}/2$ d) $\vec{a}$

7) For a conservative field $\vec{E}$

a) $\oint\vec{E}\cdot\vec{dl}=0$ b) $\oint\vec{E}\cdot\vec{ds}=0$

c) $\vec{\nabla}\cdot\vec{E}\neq 0$ d) $\vec{\nabla}\times\vec{E}\neq 0$

8) The divergence of curl of a vector is always

a) 1 b) π/2 c) ½ d) zero

9) The unit of ε_0 in SI units is

a) Nm^2/C^2 b) C/S c) C^2/Nm^2 d) N/C

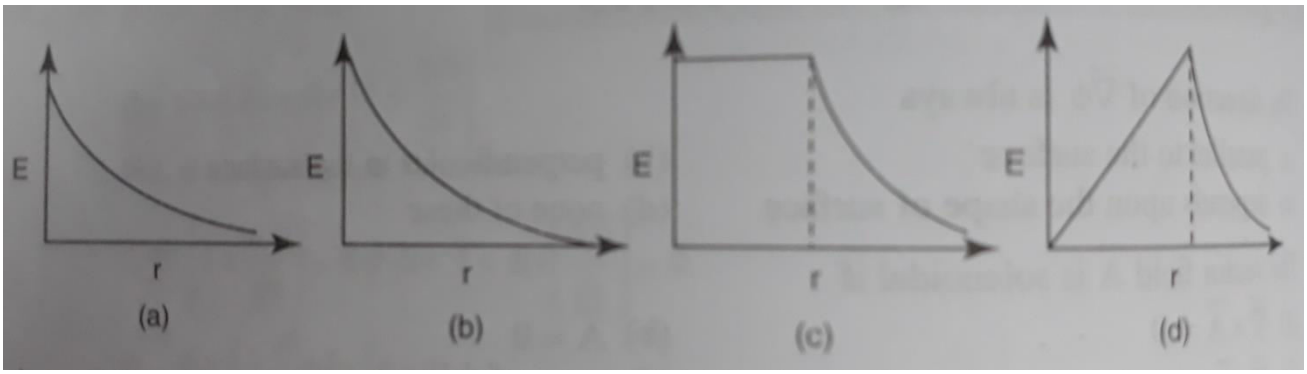
10) The unit of electric flux in SI system of units is

a) Weber b) Gauss c) Nm^2/C d) N/C

11) A charge of 15μC is placed at one corner of a cube. The electric flux will be
a) zero through each face b) same through each face
c) zero through three faces meeting at the location d) none of these.

12) The variation of electric field intensity E with distance r from centre of hollow spherical shell of radius R is

13) The electric field intensity E inside a uniformly charged spere varies with distance r of the observation point as



a) E ∝ r b) E ∝ 1/r c) E ∝ r^2 d) E ∝ 1/r^2

14) The electric field between two oppositely charged plates having equal charge density σ is given
by
a) σ/ε_0 b) $\sigma/2\varepsilon_0$ c) zero d) $2\sigma/\varepsilon_0$

15) Which of the following is zero
a) grad div b) div grad c) curl grad d) curl curl

16) The relation between electric field and potential is
a) $\vec{\nabla}\cdot\vec{E}=V$ b) $E=-\nabla^2 V$ c) $\vec{E}=-\vec{\nabla}V$ d) $E=\nabla^2 V$

17) The work done in displacing a charge 2C through 0.5m on an equipotential surface is
a) zero b) 4j c) 1j d) none of these

18) A point charge q is located at the origin. The amount of work done in bringing a unit positive charge from infinity to the origin is
a) zero b) finite c) infinite d) none of these

19) Which of the following equations tells us about the existence of the magnetic monopole?
a) curl $\vec{E}=-\frac{\partial\vec{B}}{\partial t}$ b) div $\vec{B}=0$ c) div $\vec{D}=\rho$ d) curl $\vec{H}=\vec{J}+\frac{\partial\vec{B}}{\partial t}$

20) Displacement current appears because of

a) time varying electric field b) time varying magnetic field
c) negative charge only d) positive charge only

General Questions

1) Describe gradient of a scalar field in Cartesian co-ordinates. Explain its physical significance.
2) The gradient of a scalar field is a vector. Hence explain how can you produce a vector from a scalar field.
3) Give the physical interpretation of grad V.
4) Define divergence of a vector field. What is its physical meaning? Give two examples.
5) Divergence of a vector field is a scalar quantity. Hence explain how you can produce a scalar field from a vector field.
6) Derive an expression for divergence of a vector field in Cartesian co-ordinates from first principle.
7) What do you mean by a solenoidal vector field? Give one example. What is the meaning of $\vec{\nabla} \cdot \vec{E} \neq 0$?
8) State and prove Gauss's divergence theorem.
9) Prove that the volume integral of the divergence of a vector field $\vec{A}$ taken over any volume is equal to the surface integral of $\vec{A}$ over the closed surface surrounding the volume.
10) Define curl of a vector field and give its physical significance. Show that curl of a vector field is
a vector quantity.
11) Calculate the value of the curl of a vector in terms of Cartesian co-ordinates.
12) What is an irrotational field? Give one example.
13) Prove that the curl of linear velocity of the particles of a rigid body rotating about an axis passing
through it is twice the angular velocity.
14) If $\vec{\omega} \times \vec{r} = \vec{V}$, prove that $\vec{\omega} = 1/2$ curl $\vec{V}$, where $\vec{\omega}$ is a constant vector.
15) Show by actual computation that curl gradient of a scalar function is always zero or curl grad
$\phi = 0$.
16) Show that the curl of a uniform electric field is zero.
17) Show that a vector field whose curl is everywhere zero can be expressed as athe gradient of another suitable scalar field. What is this type of field called?
18) Prove that div curl $\vec{A}$ =0.
19) IF a vector $\vec{B}$ is curl of another vector $\vec{A}$, then prove that the divergence of such vector is zero.
20) Show that a vector field whose divergence is everywhere zero can be expressed as curl of some

other suitable vector field.

21) State and proved Stokes' theorem. Give its importance.

22) What is a conservative field? Show that a conservative field is the gradient of a scalar field and curl of such a field is zero.

23) Show that electric field is conservative and curl $\vec{E}$ =0.

24) What is the difference between a conservative and non-conservative field? Give one example of each.

25) What do you understand by the term charge density?

26) What is line charge density? Derive an expression for the electric field due to an infinitely long uniformly charged straight wire using Coulomb's law.

27) A thin non-conducting rod of length *l* carries a positive charge distributed uniformly over its length. If the linear charge density is λ, find the intensity of the electric field at a point at a distance a from the near end of the rod and on its axis.

28) Two parallel infinite wires have uniform line charge densities λ1 and λ2 separted by a distance x. Calculate the electric force per unit length on one wire as a result of the other.

29) Derive an expression for electric field at a point situated on the axis of a uniformly charged ring.

30) Define surface charge density and volume charge density. State the relation between electric intensity and charge density.

31) Is volume charge density invariant (under Lorentz transformations)?

32) Find the electric field due to a circular charged disc at a point on a line perpendicular to the disc and passing through its centre. Hence calculated electric field due to an infinitely large plane conducting sheet of charge.

33) Calculate the electric field strength due to a uniform charged circular sheet on the axis.

34) Explain the meaning of the term electric flux. What are its dimensions and S.I. units.

35) State and prove Gauss's theorem in electrostatics. Prove that total flux over a surface due to a charge lying outside is zero.

36) State Gauss's theorem. Derive the differential form of Gauss's theorem.

37) Write the law for a volume distribution of charge.

38) Apply Gauss's theorem to calculate the electric field due to a uniformly charged solid cylinder.

39) Prove that the electric field at a point inside a uniformly charged cylinder of infinite length is

proportional to the distance of the point from the axis.

40) Apply Gauss's theorem to find the electric field strength $\vec{E}$ near a plane non-conducting thin sheet of charge of infinite extant. Hence show that the field is independent of the distance of the observation point from the sheet.

41) Apply Gauss's law to calculate
   i) The electric field at any point due to two parallel sheets of charge.
   ii) Calculate the intensity of the electric field at a point between oppositely charged parallel plates.

42) Using Gauss's theorem calculate the electric field due to a uniform spherical shell of charge at a point (i) Outside the shell and (ii) inside the shell. Hence show that for points lying external to ti a uniformly charged spherical shell behaves as if the entire charge were concentrated at its centre and for point lying inside it the electric field is zero.

43) Using Gauss's theorem calculate the electric field due to a uniformly charged non-conducting solid sphere at a point
   i) Outside the sphere
   ii) On the surface of the sphere, and
   iii) Inside the spere

44) State and prove Gauss's law or Gauss's theorem. Express it in differential form and show that $\vec{\nabla}\cdot\vec{E} = \rho / \varepsilon_0$.

45) Show that Coulomb's law can be deduced from Gauss's law and considerations of symmetry.

46) Coulomb's law is a special case of Gauss's law. Explain.

47) Prove that the electric field on the surface of a conductor is ρ / ε_0 where ρ is the surface charge density.

48) State and prove Ampere's circuital law of magnetic field. Deduce Ampere's law in the form $\oint \vec{B}\cdot\vec{dl} = \mu_0 I$, where the symbols have their usual meaning.

49) Show that the line integral of the magnetic field over a closed path is independent of the shape of the path.

50) Using Ampere's law obtain an expression for the magnetic field due to a current carrying straight conductor of infinite length.

51) Using Ampere's law calculate the magnetic field at a point inside a long current carrying solenoid.

52) Explain the concept of Maxwell's displacement current and show how it led to the modification of Ampere's law.

53) What is equation of continuity? Explain. How could Maxwell correct and present Ampere's law in its generalized form?

54) What are Maxwell's equations? Derive Maxwell's equations (differential form). Discuss integral form of above equations. What are the significance of these equations to electricity and magnetism?

55) Obtain he electromagnetic wave equations, using Maxwell's equation, in an isotropic dielectric medium and show that the speed of wave is less than its speed in vacuum.

56) Obtain Maxwell's equations deduce an expression for the velocity of propagation of a plane electromagnetic wave in a medium of dielectric constant ε and relative permeability μ.

57) Define pointing Vector. Derive and expression for it and explain its physical significance for electromagnetic wave in free space.

58) Derive the electromagnetic wave equation from Maxwell field equations. Consider plane wave solutions of this equation and prove that the energy density associated with such a wave in a stationary homogeneous non-conducting medium propagates with the same speed with which the field vectors do.

59) A plane monochromatic electromagnetic wave propagates in conducting medium. Shwo that attenuation is equal to phase vector.

60) Discuss the propagation of plane monochromatic electromagnetic waves in conducting media. Derive the dispersion equation and thus obtain: (i) phase velocity (ii) refractive index (iii) skin depth.

61) Show that inside the conducting medium the wave is damped and obtain an expression for the
skin depth δ.

62) What is a wave guide? Describe the propagation electromagnetic wave along a hollow wave guide of uniform cross section.

63) Give a brief note on co-axial cables with special reference to characteristic impedance.

64) Write note on
(i) Displacement current
(ii) Pointing vector.

DAYANANDA SAGAR COLLEGE OF ENGINEERING

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Department of Physics

Question bank

Sub: Engineering Physics

Unit-I

1. State and explain Rayleigh-Jeans law. Show how its drawbacks can be overcome using Planck's law. (VTU July 04) 5 Marks

2. Show that Planck's law reduces to Wien's law and Rayleigh-Jeans law under certain conditions. 10 Marks

3. What is Compton effect? Explain its physical significance. (VTU Dec 2014) 5 Marks

4. What are matter waves? Mention their properties. (VTU Jan 10) 5 Marks

5. Explain Heisenberg's uncertainty principle. Give its physical significance. (Jan 2008, 2010, July 09, July 04) 5 Marks

6. Show that a free electron cannot exist within the nucleus of an atom. (June 10, June 08, Jan 07) 5 Marks

7. Compute the de Broglie wavelength for a neutron moving with one tenth part of the velocity of light. Mass of neutron is 1.6749×10^{-27} kg. 5 Marks

8. Write a short note on black body radiation spectrum with a neat diagram. 5 Marks

9. Calculate the momentum of an electron and the de Broglie wavelength associated with it if its kinetic energy is 1.5 keV. 5 Marks

10. What is wave function? Give its physical significance and properties. (July 09, Jan 09) 5 Marks

11. Set up time independent Schrodinger wave equation. (July 09, Jan 09) 10 Marks

12. Define the terms probability density, normalization, Eigen functions and Eigen values. (July 09, Jan 09) 10 Marks

13. Derive the Eigen values and Eigen functions for a particle in one dimensional potential well of infinite height and discuss the solutions. (July 06, July 04)

10 Marks

14. Discuss the wave functions, probability densities and energy levels for a particle in a box by considering the ground state and the first two excited states. 10 Marks

15. The position and momentum of an electron with energy 1 keV are simultaneously determined. If the inherent uncertainty in measurement of its position is 1 Å, What is the minimum uncertainty in its momentum? (July 04) 5 Marks

16. An electron is bound in a one dimensional potential well of width 1 Å, but of infinite height. Find its energy values in the ground state and also in the first two excited states.(Jan 2006, Jan 2003) 5 Marks

17. In a measurement that involved an uncertainty of 0.003 %, the speed of an electron was found to be 800 m/s. Calculate the corresponding uncertainty involved in determining its position. 5 Marks

18. In a simultaneous measurement of position and velocity of an electron moving with a speed of 6×10^5 m/s. Calculate the highest accuracy with which its position could be determined. Error in the velocity is 0.01 % for the speed stated. (Jan 07) 5 Marks

19. What requirements of wave function Ψ must satisfy in order to obtain important properties from the Schrödinger Equation? 5 Marks

20. Explain how a wave function can be normalized (State the normalization condition).

5 Marks

Unit-II

1. Derive an expression for energy density at thermal equilibrium in terms of Einstein co-efficients. (VTU June 08) 10 Marks

2. What are the requisites and conditions for Laser action? Explain briefly the applications of laser. (VTU Jan 2015, July 07) 10 Marks

3. Explain the basic principle of LASER with diagram. (VTU Aug 2000, Mar 99) . 5 Marks

4. Define the following: 1. Metastable state 2. Active medium 3. Pumping. 5 Marks

5. Explain the construction and working of Co_2 laser with energy level diagram. (VTU Jan 08, Jan 04, July 03) 10 Marks

6. Explain the process of spontaneous and stimulated emission. (June, 2013, Dec 2013) 5 Marks

7. Explain the construction and working principle of semiconductor laser. 10 Marks

8. The average output power of laser source emitting a laser beam of wavelength 633 nm is 5 mW. Find the number of photons emitted per second by the laser source.

5 Marks

9. The ratio of population of two energy level is 1.059×10^{-30}. Find the wave length of light emitted at 330 K. (V.T.U June 12) 5 Marks

10. Obtain an expression for numerical aperture of an optical fibre with a neat diagram. 5 Marks

11. Explain the types of optical fibers with suitable diagrams. (Jan15, June 08, July 07) 10 Marks

12. What is attenuation? Explain the mechanisms of attenuation in optical fibres. (Jan 15, Jan 06, Jan 07) 10 Marks

13. Obtain an expression for acceptance angle of an optical fibre. (Jan 15, June 10, July 07) 5 Marks

14. The angle of acceptance of an optical fibre is 30^{o} when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. (July 13, July 11, Jan 09, Jan 03) 5 Marks

15. Find the attenuation in an optical fibre of length 500 m, when a light signal of power 100 mW emerges out of the fibre with power 90 mW. (Jan 06) 5 Marks

16. Discuss point to point communication using optical fibre with neat block diagram. What are the advantages of optical fibre communication over other methods? (Jan 10, July 04, Feb 05) 10 Marks
17. Write a note on applications of LASER. 5 Marks

18. The refractive indices of core and cladding are 1.50 and 1.48 respectively in an optical fibre. Find the Numerical aperture and angle of acceptance. 5 Marks
19. A Laser operating at 632.8 nm emits 3.182 x 10^{16} photons per second. Calculate the output power of the laser if the input power is 100 W. Also find the % power converted into coherent light energy. 5 Marks
20. Write a note on angle of acceptance and numerical aperture. 5 Marks

Unit-III

1. Explain the terms stress and strain. State and explain Hooke's law and different moduli of elasticity. 5 Marks
2. Define Young's modulus, Bulk modulus and rigidity modulus. 5 Marks
3. With usual notations show that, Y = 2n (1 + σ). 10 Marks
4. Explain the nature of elasticity with the help of stress-strain diagram. 5 Marks
5. Derive the relation between Y, n and σ. 10 Marks
6. Derive the relation between K, Y and σ. 10 Marks
7. Derive the relation between K, n and Y. 5 Marks
8. Derive the relation between K, n and σ. 5 Marks
9. Write a note on limiting values of σ. 5 Marks
10. Write a note on neutral surface and neutral axis. 5 Marks
11. Explain the term bending moment of a beam. Show the bending moment of a thin uniform bar of rectangular cross section is $\frac{Y}{R}\frac{bd^3}{12}$. 10 marks
12. A rod of cross section of area 1 cm x 1cm is rigidly planted into the earth vertically. A string which can withstand a maximum tension of 2 kg is tied to the upper end of the rod and pulled horizontally. If the length of the rod from the ground level is 2 m, calculate the distance (δ) through which its upper end is displaced just before the string snaps. (Y for steel = 2 x 10^{11} N/m^2 and g = 9.8 m/s^2).**Ans:δ = 0.314 m** 5 Marks
13. Explain the terms angular frequency, period and simple harmonic motion. 5 Marks
14. Write the relation between frequency (ν) & time period (T) and also relation between angular frequency (ω) & time period (T). 5 Marks
15. Construct a simple harmonic wave equation and explain the terms restoring force and force constant. 10 Marks
16. Explain free vibrations and discuss about the analytical treatment of free vibrations. 10 Marks.
17. Calculate the displacement at the end of 10 seconds, and also the amplitude of oscillation for a free particle which is executing a simple harmonic motion in a straight line with a period of 25 seconds. 5 seconds after it has crossed the equilibrium point, the velocity is found to be 0.7m/s. 5 Marks

18. Calculate the frequency of oscillation for a spring if it is set for vertical oscillations with a load of 200 gm, attached to its bottom. The spring undergoes an extension of 5 cm for a load of 50 gm. Ignore the mass of the spring. 5 Marks

Unit-IV

1. Write a note on Linear, Surface and Volume Charge density. 5 Marks
2. Describe the vector operator $\vec{\nabla}$ and explain the concepts of divergence, gradient and curl. 8 Marks
3. Describe the physical significance of divergence, gradient and curl with suitable diagrams. 5 Marks
4. Explain Gauss's divergence or Green's theorem. 5 Marks
5. Mention Stokes's theorem. 5 Marks
6. Explain Superposition principle. 5 Marks
7. Write about Poisson's and Laplace equations. 5 Marks
8. Explain differential form of Gauss's Theorem. 10 Marks
9. Explain briefly the Ampere's circuital law. 5 Marks
10. Discuss continuity equation. 10 Marks
11. List the four differential forms of Maxwell's equations. 5 Marks
12. Derive Maxwells first equation in differential form. 5 Marks
13. Derive Maxwells second equation in differential form. 5 Marks
14. Derive Maxwells third equation in differential form. 5 Marks
15. Derive Maxwells fourth equation in differential form. 5 Marks
16. Derive Maxwells first equation in integral form. 5 Marks
17. Derive Maxwells second equation in integral form. 5 Marks
18. Derive Maxwells third equation in integral form. 5 Marks
19. Derive Maxwells fourth equation in integral form. 5 Marks
20. Write a note on significances of Maxwell's equations. 5 Marks
21. Find the divergence of the vector field $\vec{A}$ given by, $\vec{A} = 6x^2 a_x + 3xy^2 a_y + xyz^3 a_z$ at a point P (1,3,4) 5 Marks
22. Derive the expression for Maxwell's equation in isotropic dielectric medium. 10 Marks
23. Derive an expression for hole concentration in an intrinsic semiconductor. 10 Marks
24. Derive an expression for electron concentration in an intrinsic semiconductor. 10 Marks

25. Show that $E_F = E_g/2$ in an intrinsic semiconductor at absolute zero. 10 Marks

26. Define Hall effect? Derive an expression for Hall coefficient. With a neat diagram explain the measurement of Hall voltage. 10 Marks

Unit-V

1. Give the graphical representation of density of states with equation for 0D, 1D, 2D and 3D structures. (VTU Jan 15) 10 Marks
2. Mention the applications of carbon nano tubes. 5 Marks
3. Explain thermal evaporation process for the deposition of thin films. 5 Marks
4. Write a note on carbon nano tubes and their physical properties.(Jan 15) 10 Marks
5. Explain various structures of CNT with diagrams. 5 Marks
6. Write a note on top down and bottom up approach with diagrams. 10 Marks
7. Describe Ball Milling and Sol-gel methods of nano materials. 10 Marks
8. Compare thin films and Thick films? Explain different ranges of vacuum. 5 Marks
9. Explain various stages of thin film growth with illustrations? 10 Marks
10. Write a brief note on importance of nanotechnology. 5 Marks
11. Describe briefly the process of thermal evaporation with a neat block diagram of thin film unit. 10 Marks
12. What are the advantages and disadvantages of Ball milling method? 5 Marks
13. Explain ball milling method of preparation of nanomaterials 5 Marks

*Note: All the above questions from all the units are given as sample questions.