KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

2020-21 CBCS

B.Sc – I semester question Bank

DSC-PHY-101

UNIT I: Frames of Reference

Two Marks Questions

1. What is an inertial frame of reference? Give one example.
2. Write the Galilean transformation equations.
3. What are limitations of Newton's laws of motion?
4. State hypothesis of Galilean invariance.
5. What are pseudo forces? Give an example.
6. What is Coriolis force? Give one example.
7. What are non inertial frames? Give one Example.
8. What are fictitious forces? Give one example.
9. Comment on the statement that the sun is a better frame of reference than earth for describing the motion of stars.
10. Strictly speaking earth is not an inertial frame. Explain.
11. What are elastic and inelastic collisions?
12. State principle of conservation of linear momentum?
13. What are the factors affecting velocity of the rocket?
14. Velocity of exhaust gas of the rocket is optimized at the starting. Justify?
15. What is double stage rocket?
16. Where does centre of mass of triangular plate and a thin uniform rod lie?
17. Where does centre of mass of semicircular lamina lie?
18. What is center of mass?

19. What do you mean by collision precisely?
20. Name the liquid fuels and oxidation used in liquid type rocket.

Five Marks Questions

1. Derive Galilean transformation equations
2. Find the transformation equations connecting two frames S and S^1 that their origins and Z-axis are coincident and the frames S^1 rotates about the common Z-axis with uniform angular velocity
3. Obtain the Galilean transformations equations, when two frames S and S' are moving with uniform relative velocity.
4. Show that Newton's laws of motion are invariant under Galilean transformation.
5. State and explain hypothesis of Galilean invariance.
6. Explain Galilean principle of invariance of space and time.
7. Describe the Foucault's pendulum.
8. Show that linear momentum is conserved under Galilean transformations.
9. Show that energy is conserved under Galilean transformations.
10. Show that velocity is not invariant under Galilean transformations.
11. Distinguish between inertial and non-inertial frames of reference.
12. State and explain the law of conservation of linear momentum for a system of particles.
13. What is the centre of mass? Show that in the absence of external forces, the velocity of the centre of mass remains constant.
14. Discuss the inelastic collision between two particles in laboratory. Show that K.E. after collision is less than before collision.
15. What is double stage rocket? What are its advantages over single stage rocket?
16. The total electrical energy generated in a country in a particular year was 7.5 $x10^{11}$ kWh. How much mass was converted in to energy?

17. If 4 kg of a substance is fully converted into energy, how much energy is produced?
18. A particle of mass 10^{-24} kg is moving with a speed of 1.8×10^{8} ms^{-1}. Calculate its mass when it is in motion.

Ten Marks Questions

1. Derive Galilean transformation equations. Prove that length is invariant in Galilean transformation.
2. State and explain hypothesis of Galilean invariance. Show that Newton's laws of motion are invariant under Galilean transformation.
3. Obtain the Galilean transformations equations, when two frames S and S' are moving with uniform angular velocity.
4. Explain the concept of center of mass. Find out the expression for Poisson vector and velocity of center of mass.
5. Discuss the inelastic collision between two particles in laboratory and in centre of mass frames of reference.
6. Discuss the elastic collision between two particles in laboratory and in centre of mass frame of reference.
7. What is multi stage rocket? What are its advantages over single stage rocket? Derive the expression for velocity of single stage rocket at any instant of time by considering the weight of the rocket.

UNIT II: Momentum and Energy

Two Marks Questions

1. Define moment of inertia. Mention its SI unit.
2. On what factors M.I. of body depends
3. What happens to the moment inertia when a gymnast sitting on a rotation stool with his arms stretched suddenly lowers his arms.
4. Define radius of gyration. Mention its SI unit.
5. Write the expression for MI of a hollow cylinder about an axis passing through its center.

6. State the theorem of parallel axes.
7. State the theorem of perpendicular axes.
8. What is gyroscope?
9. Without weighing how will you distinguish between the two identical balls of the material, one being solid and the other being hollow?
10. What is the K.E. of a rotating body of moment of inertia I and angular velocity ω ?
11. On what factors the M.I. of a body does not depend upon?
12. Write the expression for M.I. of a rectangle lamina of mass M, length L and breadth B about an axis through its center of gravity and perpendicular to its length?
13. What is bifilar suspension?
14. State the law of conservation of angular momentum.
15. What is the expression of time period of Bifilar suspension for parallel threads
16. Mention the expression for time period of compound pendulum.
17. What is escape velocity?
18. What is stationary satellite?
19. Define Spin and orbital angular momentum.

Five Marks Questions

1. Derive expression of M.I. of solid cylinder about its own axis.
2. State and prove the theorem of perpendicular for M.I.
3. State and prove the theorem of parallel axes for M.I.
4. Obtain an expression for M.I. of a rectangle lamina about an axis passing through its center and perpendicular to the plane of the lamina.
5. Derive an expression for K.E. of a rotating body.
6. Write a note on gyroscope and its applications.
7. Obtain the expression for 'g' in the case of bifilar suspension with parallel

threads.

8. Derive an expression for period of a compound Pendulum.
9. State and explain the Kepler's second law.
10. Obtain an expression for the escape velocity of a satellite.
11. State the law of conservation of angular momentum with illustrations.
12. Obtain the expression for time period of bifilar suspension with parallel threads.
13. State the law of conservation of angular momentum. show that the sum of all internal torques is zero.
14. A solid sphere of mass 1 kg and radius 0.25 m rolls without slipping with a uniform velocity of 0.1 ms^{-1} along a straight line on a horizontal table. Calculate its kinetic energy.
15. A thin hollow cylinder open at both ends and weighing 10 kg (a) slides with a speed of 10 ms^{-1} without rotating (b) rolls with a speed of 10 ms^{-1} without slipping. Calculate the kinetic energy of the cylinder in each case.
16. A thin uniform bar of 1.2m is made to oscillate about an axis through its end. Find the period of oscillation and other points about which it can oscillate with the same period.
17. A thin uniform bar of length 1.2m is made to oscillate about an axis through its end. Find the period of oscillation and length of equivalent simple pendulum.
18. Calculate the distance between center of suspension and center of oscillation of a thin uniform cylindrical bar used as second's pendulum (T=2sec)
19. A uniform rod 1 m in length oscillates about horizontal axis perpendicular to its length. Find the position of points about which the time period is minimum. If g = 9.8 ms^{-2}. Find the minimum period of oscillations.
20. A straight uniform stick is oscillating about an axis perpendicular to its length and passing through one of its ends. If its time period is 2.168 sec. Calculate its length assuming the value of g to be 9.8 ms^{-2}

21. A thin meter stick is used as compound pendulum with one of its ends as center of suspension. Find its time period.
22. A uniform bar of 2 meter oscillates about a knife edge 0.5m from one end. Calculate the period of oscillation.
23. A body of mass 0.2 kg oscillates about an axis at a distance of 0.2 m from its center of gravity. If the length of equivalent simple pendulum be 0.35 m. Find its moment of inertia about the axis of suspension.

Ten Marks Questions

1. Derive an expression of M.I. of a uniform circular disc about its axis.
2. Explain M.I. and radius of gyration. State and prove theorem on perpendicular axis.
3. Derive expression for M.I. of a solid cylinder about a standard axis.
4. Obtain an expression for M.I. of a rectangle lamina about an axis passing through its center and parallel to one of its sides.
5. State and prove the theorems of moment inertia.
6. Derive an expression for the M.I. of a solid cylinder about its own axis. Obtain an expression for Period in the case of bifilar suspension with parallel threads.
7. (a) What is bifilar suspension?

   (b) Derive the expression for time period of bifilar suspension for parallel threads

UNIT III: Rotational motion

Two marks questions

1. Define gravitational field.
2. Define gravitational potential field.
3. What is the intensity of the gravitational field.
4. Write the expression for the gravitational potential at a point outside the spherical shell.

5. Write the expression for the gravitational attraction at a point on the spherical shell.
6. Mention the expression for the gravitational field at a point inside the solid sphere.
7. Define gravitational self energy.
8. Mention the expression for the gravitational self energy of a uniform solid sphere and explain the terms.

Five marks questions

1. Derive the expression for the gravitational potential at a point outside the spherical shell.
2. Derive the expression for the gravitational attraction due to a spherical shell at a point inside the shell.
3. Explain the Boy's method to determine the gravitational constant.
4. Define gravitational self energy and derive the expression for it for uniform solid sphere.
5. Calculate the gravitational self energy of earth. How many calories of heat must been produced during the gravitational condensation of earth from dust particle?
6. The system consists of three particles of masses 2 kg, 4 kg, and 6 kg are placed at the vertices of an equilateral triangle of sides 1m. Find the gravitational self energy of this system(Given: $G = 6.67 \times 10^{-11}$ SI units).
7. What is the self energy of mass 2 kg on the surface of the earth and at a distance of 10^5km from the centre, referred to zero potential energy at infinite distance.(Given: $G = 6.67 \times 10^{-11}$ Nm^2kg^{-2}, mass of the earth = 6×10^{24} kg and the radius of earth $R = 6.4 \times 10^6$ m).
8. Calculate the mass of the Sun, given that the distance between the Sun and the earth is 1.5×10^{11}m and $G = 6.67 \times 10^{-11}$ Nm^2kg^{-2}.

Ten marks questions

1. Derive Newton’s law of gravitation from Kepler’s laws of motion.
2. Derive the expressions for gravitational potential for spherical shell at a point
   Outside
   On the surface
   Inside
3. Derive the expression for the gravitational potential for spherical shell at a point
   (a) Outside (external)
   (b) On the surface
   (c) Internal
4. Define the gravitational constant and explain the Boy’s method to determine the gravitational constant with theory.

UNIT IV: Rigid bodies

Two Mark Questions

1. State Hooke's law. What is elastic limit?
2. What are the dimensions of modulus of elasticity?
3. Define Poisson's ratio. What are its limiting values?
4. Define Young's modulus and modulus of rigidity.
5. Write the relation between Young's modulus, bulk modulus and modulus of rigidity
6. What is cantilever?
7. Define the terms, plane of bending and neutral axis.
8. State any two assumptions made in obtaining the expression for depression of cantilever.
9. What are the limits of Poisson's ratio?
10. Define rigidify modulus and Poisson’s ratio.
11. Write the relation between young’s modulus, rigidity and bulk modulus.
12. What is Double cantilever?

13. Define bending moment
14. What is Maxwell's needle?
15. What is the value of the Poisson's ratio for a body which is easily compressible.
16. What type of modulus is involved when a body is under torsion?
17. What is the unit of Poisson's ratio?
18. What is the period of a torsional pendulum?
19. Define surface tension and angle of contact.
20. Explain the terms "Molecular range" and "sphere of influence".
21. On what factors "angle of contact" depends.
22. If T is the surface tension and 'R' is the radius, what is the excess pressure inside an air bubble in a liquid.
23. Explain "Surface tension" and " Surface energy"
24. What is the angle of contact of pure water with glass?
25. What The angle of contact of mercury with glass?
26. Calculate the excess pressure in a soap bubble of radius l0mm, if the surface tension of soap solution is 3.2×10^{-2} N/m.
27. Find the excess pressure inside the spherical drop of water of diameter 4mm.Given that surface tension of water is 73×10^{-3} N/m.
28. Explain movement of Camphor particle on surface of water.
29. Find the excess of pressure inside a spherical drop water of diameter 4 mm, given that surface tension of water is 73×10^{-3} N/m.
30. Why Small drops of mercury are practically spherical?
31. Calculate the pressure difference between inside and outside of a soap bubble of radius 0.01m given that S.T. of soap solution = 0.032 N/m.
32. Write the Dimensional formula of co-efficient of viscosity.
    On which factors the viscosity of liquid drop depends.
33. What is terminal velocity?

34. State the Newton's law of Viscous flow in stream line motion
35. Mention any two assumptions made in the derivation of the expression for flow rate.
36. Explain the terms" Streamline flow" and "Turbulent flow".
37. Define coefficient of viscosity and mention the SI unit of it.

Five Mark Questions

1. Write a note on behavior of a wire under gradually increasing load.
2. Write the expressions for Young's modulus, bulk modulus & modulus of rigidity.
3. Mention different types of elastic modulii and explain them.
4. Obtain an expression for the twisting couple on a cylinder fixed at one end and twisted at the free end.
5. Using a torsion pendulum how the modules of rigidity of the material of a wire can be determined?
6. Explain Maxwell's needle method to determine the modulus of rigidity 'η'
7. A wire of length 2m is fixed at one end and a force of 10N is applied at the other end the area of cross-section of the wire is $2 \times 10^{-6} m^2$ and the young's modulus of elasticity of its material is $2 \times 10^{"}$ $N/m+2$. Calculate the stress and strain.
8. A steel wire of 0.5 mm radius is bent to form a circle of 0.1m radius. What is the bending moment and the maximum stress if $Y = 2 \times 10^{10}$ Newton's/m^2
9. Calculate the young's modulus for a material for which $K = 14 \times 10^{10}$ N/m^2 and $\eta = 4.2 \times 10^{10}$ N/m+2·
10. A wire 4m long 0.3 mm in diameter is stretched by a force of 0.8 kg-wt. If the extension
    amount to 1.5 mm, calculate the energy stored in the wire.
11. A wire of length 1 meter and diameter 1mm is fixed at one end and couple is applied at the other end so that the wire is twisted by II/2 radian .Calculate the moment of the couple required if the rigidity of the modulus is 2.8×10^{10} N/m^2
12. Calculate the value of Poisson's ratio if Young's modulus and rigidity modulus are 12.25×10^{10} Nm^{-2} and 4.5×10^{10} Nm^{-2} respectively.

13. Calculate the work done in twisting a steel wire of radius 1mm and length 0.25m through an angle of 45°. Its modulus of rigidity is 8×10^{10} Nm^{-2}.
14. Find the work done in stretching a wire of cross section 1sq. mm and length 2m through 0.lmm. Given Y = 2×10^{11} Nm^{-2}
15. Obtain the expression for excess pressure inside a liquid drop.
16. Describe an experiment to determine surface tension of water by capillary-rise method.
17. Calculate the height to which water will rise in a capillary tube of 1mm diameter. The angle of contact for water is zero and surface tension of water is 0.072 Nm^{-l}. The density of water is 103 Kgm^{-3}.
18. Find the pressure inside a small air bubble of diameter 0.2mm situated just below the surface of water. Surfaced tension of water is 70 x 10-3 N/m. Atmospheric pressure is 1.013 x 105 Nm^{-2}.
19. In a capillary tube water rises to a height of 0.1m. In the same capillary tube mercury is depressed by 3.42 x 10^{-2} m. Angle of contact for water =0^0. Angle of contact for mercury = 135^0 . Calculate the S.T of mercury, given that S.T of water as 72 x 10^{-3} N/m. Density of mercury = 13.6 x 10^3 kg/m^3
20. Calculate the, S.T of paraffin liquid if it rises to a height of 0.75 x 10^{-2} m in a capillary tube of radius 0.75 mm. Density of paraffin p = 800 kg/m^3 and angle of contact is 28^0.
21. What would be the pressure inside a small air bubble of 0.1 mm radius, situated just below the surface of water? Surface tension of water = 72x 10^{-3} N/m and atmospheric pressure = 1.013 x 10^5 Nm^{-2}.
22. In Jaeger's experiment, a capillary tube of internal diameter 5 x 10^{-4} m dips 3 x 10^{-2} m inside the water contained in a breaker. The difference in level of a water manometer when the bubble is released is 0.09 m. Calculate the S.T. of water.
23. Derive an expression for the excess of pressure on a curved surface of a membrane.
24. Explain Stoke's method of determining the viscosity of a liquid.

25. Obtain an expression for the volume of the liquid flowing per second through a uniform tube.
26. An air bubble of radius 0.01 m is allowed to rise through a long cylindrical column of viscous liquid and travels at steady rate of 0.021ms^{-1} of the density of the liquid is 1470 kg m^{-3}. Find its viscosity, g=9.8 ms^{-2} neglecting the density of air.
27. A spherical ball of radius 2mm and mass 1.4 X 10^{-4} kg takes 6.4 second to fall steady through a height of 0.32m.inside a large volume of oil of density 900kg m^{-3}. Calculate the co-efficient of viscosity of the oil (g=9.8 ms^{-2})

Ten Mark Questions

1. Derive the relation connecting Young's modulus, bulk modulus and modulus of rigidity
2. Derive an expression for torsional rigidity of a wire.
3. Obtain an expression for the depression at the loaded end of the cantilever, when the other end is fixed (Neglect the weight of the cantilever)
4. Explain with theory Maxwell's needle method to determine the modulus of rigidity.
5. Define young's modulus and Rigidity modulus. Derive an expression for the depression at the end of loaded single cantilever.
6. Explains with theory torsional pendulum to determine modulus of rigidity.
7. Obtain an expression for depression at the midpoint of cantilever.
8. With necessary theory, describe an experiment to determine the surface tension of a liquid by Jaeger's method.
9. Describe with relevant theory, Quincke's method of determining the surface tension of mercury.
10. Describe Quincke's method of measuring the surface tension and the angle of contact for mercury in the form of a large flat drop.

UNIT V: Gravitation

Two Marks Questions

1. Define S.H.M
2. What is the velocity of a particle executing SHM and mention when it is maximum and minimum?
3. Give the graphical representation between displacement and time of a particle starting with mean position performing SHM.
4. Give the graphical representation between displacement and time of a particle that starts from mean position performing SHM.
5. Define reverberation time.
6. State Fourier theorem.
7. Write Sabine's formula and explain the usual terms?
8. Define the terms phase and phase difference in connection with a particle performing SHM.
9. Draw the nature of P.E. and K.E. curves w.r.t. displacement.
10. What are Lissajous figures?
11. Write the expression for average K.E. and P.E. of a particle performing SHM.
12. Write the expression for total energy of a particle performing SHM.

Five Marks Questions

1. What is SHM? Obtain expression for velocity and a acceleration of particle performing SHM.
2. Define displacement, amplitude, acceleration, phase and period of a particle performing SHM.
3. Explain Fourier theorem.
4. Give the theory of forced vibrations.
5. Give the theory of Helmholtz resonator.
6. Give the theory of undamped free vibrations.
7. Explain the Fourier theorem for square wave.
8. Explain the Fourier theorem for saw tooth wave.

9. Explain Sabine's formula?
10. Explain Lissajous figures with five special cases.
11. Obtain an expression for average K.E. of a particle performing SHM.
12. Obtain an expression for average P.E. of a particle performing SHM.
13. A body executes SHM such that its velocity at the mean position is 1 m/s and the acceleration at one of the extremities is 1.57 m/s^2 Calculate the period.
14. A particle executes SHM of period 20 s and amplitude 0.02 m. Find the distance that it travels in 5s starting from zero displacement.
15. A body in SHM executes 100 vib/min and its speed at its mean position is 15 cms/s. What is the length of its path? What is its velocity when it is half way between its mean position and an extremity of its path?
16. A particle executes SHM of period 16 s. Two seconds after it posses the center of oscillation its velocity is found to be 4 cm/s. Find the amplitude.
17. A particle executing SHM has velocities of 0.8 m/s when displacements at 0.03 and 0.04 respectively. Calculate the amplitude of vibration and its velocity at distance 0.05 from the mean position.
18. The volume of a room is 600 m^3 and its surface area is 460 m^2. If the average sound absorption co-efficient is 0.24. Calculate the time of reverberation.
19. A Helmholtz resonator has volume of 0.001 m^3. The radius of the neck is 0.01m. and the length of neck is 0.05m. Calculate the natural frequency of resonator. If the velocity of sound at room temperature is 350 m/sec.
20. A Helmholtz resonator has volume of 0.001 m^3. The radius of the neck is 0.01m. and the length of neck is 0.02m. Calculate the frequency at resonance. Velocity of sound at room temperature is 340 m/sec.
21. A Helmholtz resonator has volume of 0.2 m^3. The radius of the neck is 0.005m. and the length of neck is 0.01m. Calculate the frequency at resonance. Velocity of sound at room temperature is 340 m/sec.
22. A cinema hall has a volume of 7500 m^3. It is required to have the reverberation time of 1.5 sec. What should be the total absorption in the hall?

23. A lecture hall has a volume of 120,000 m^3. It has reverberation time of 1.5 sec. What is average absorbing power total surface area is 25,000 m^2?
24. In an auditorium a volume of 1.275 m^3 is found to have reverberation time 1.5 sec. What is the total absorbing power of all the surface in the auditorium. If the area of surface absorbing the sound is 745 m^2. Calculate the adsorption co-efficient.
25. A Helmholtz resonator has a volume of $8X10^{-4}$ m^3. The radius of the neck is $1X10^{-2}$ m and the length of the neck is $3X10^{-3}$ m. calculate the natural frequency of the resonator. Given velocity of sound at room temperature is 350 m/sec.

Ten Marks Questions

1. Derive an expression for the total energy performing SHM.
2. Find the resultant of two mutually perpendicular SHM's having same period but different phases and amplitudes.
3. Define SHM. Derive an expression for the energy of particle executing SHM.
4. Define SHM. Show that if two SHM's are at right angles to each other the resultant motion is ellipse when the phase difference between them is $\pi/4$.
5. (a) Set up a differential equation for a particle executing SHM.
   (b) Obtain an expression for K.E. of a particle executing SHM.
6. Derive expression for displacement, velocity and acceleration of a particle in SHM assuming that it starts from its mean position.
7. Discuss the composition of two SHM's at right angles to each other.
8. Give the theory of Helmholtz resonator.
9. Write a note on Fourier theorem with square wave.
10. (a) What are Lissajous figure?
    (b) Explain Lissajous figure with five special cases.
11. Discuss the construction and theory of Helmholtz resonator.
12. What is reverberation? Derive Sabine's formula for period of reverberation.
13. Give the theory of damped vibrations and discuss its result.

14. Give the theory of Helmholtz resonator. Mention the applications of Helmholtz resonator.

UNIT VI Oscillations

13. Define S.H.M
14. What is the velocity of a particle executing SHM and mention when it is maximum and minimum?
15. Give the graphical representation between displacement and time of a particle starting with mean position performing SHM.
16. Give the graphical representation between displacement and time of a particle that starts from mean position performing SHM.
17. Define reverberation time.
18. State Fourier theorem.
19. Write Sabine's formula and explain the usual terms?
20. Define the terms phase and phase difference in connection with a particle performing SHM.
21. Draw the nature of P.E. and K.E. curves w.r.t. displacement.
22. What are Lissajousfigures ?
23. Write the expression for average K.E. and P.E. of a particle performing SHM.
24. Write the expression for total energy of a particle performing SHM.

Five Marks Questions

26. What is SHM? Obtain expression for velocity and a acceleration of particle performing SHM.
27. Define displacement, amplitude, acceleration, phase and period of a particle performing SHM.
28. Explain Fourier theorem.
29. Give the theory of forced vibrations.
30. Give the theory of Helmholtz resonator.

31. Give the theory of undamped free vibrations.
32. Explain the Fourier theorem for square wave.
33. Explain the Fourier theorem for saw tooth wave.
34. Explain Sabine's formula?
35. Explain Lissajous figures with five special cases.
36. Obtain an expression for average K.E. of a particle performing SHM.
37. Obtain an expression for average P.E. of a particle performing SHM.
38. A body executes SHM such that its velocity at the mean position is 1 m/s and the acceleration at one of the extremities is 1.57 m/s^2 Calculate the period.
39. A particle executes SHM of period 20 s and amplitude 0.02 m. Find the distance that it travels in 5s starting from zero displacement.
40. A body in SHM executes 100 vib/min and its speed at its mean position is 15 cms/s. What is the length of its path? What is its velocity when it is half way between its mean position and an extremity of its path?
41. A particle executes SHM of period 16 s. Two seconds after it posses the center of oscillation its velocity is found to be 4 cm/s. Find the amplitude.
42. A particle executing SHM has velocities of 0.8 m/s when displacements at 0.03 and 0.04 respectively. Calculate the amplitude of vibration and its velocity at distance 0.05 from the mean position.
43. The volume of a room is 600 m^3 and its surface area is 460 m^2. If the average sound absorption co-efficient is 0.24. Calculate the time of reverberation.
44. A Helmholtz resonator has volume of 0.001 m^3. The radius of the neck is 0.01m. and the length of neck is 0.05m. Calculate the natural frequency of resonator. If the velocity of sound at room temperature is 350 m/sec.
45. A Helmholtz resonator has volume of 0.001 m^3. The radius of the neck is 0.01m. and the length of neck is 0.02m. Calculate the frequency at resonance. Velocity of sound at room temperature is 340 m/sec.
46. A Helmholtz resonator has volume of 0.2 m^3. The radius of the neck is 0.005m. and the length of neck is 0.01m. Calculate the frequency at resonance. Velocity of sound at room temperature is 340 m/sec.

47. A cinema hall has a volume of 7500 m^3. It is required to have the reverberation time of 1.5 sec. What should be the total absorption in the hall?
48. A lecture hall has a volume of 120,000 m^3. It has reverberation time of 1.5 sec. What is average absorbing power total surface area is 25,000 m^2?
49. In an auditorium a volume of 1.275 m^3 is found to have reverberation time 1.5 sec. What is the total absorbing power of all the surface in the auditorium. If the area of surface absorbing the sound is 745 m^2. Calculate the adsorption co-efficient.
50. A Helmholtz resonator has a volume of $8X10^{-4}$ m^3. The radius of the neck is $1X10^{-2}$ m and the length of the neck is $3X10^{-3}$ m. Calculate the natural frequency of the resonator. Given velocity of sound at room temperature is 350 m/sec.

Ten Marks Questions

15. Derive an expression for the total energy performing SHM.
16. Find the resultant of two mutually perpendicular SHM's having same period but different phases and amplitudes.
17. Define SHM. Derive an expression for the energy of particle executing SHM.
18. Define SHM. Show that if two SHM's are at right angles to each other the resultant motion is ellipse when the phase difference between them is $\pi/4$.
19. (a) Set up a differential equation for a particle executing SHM.
    (b) Obtain an expression for K.E. of a particle executing SHM.
20. Derive expression for displacement, velocity and acceleration of a particle in SHM assuming that it starts from its mean position.
21. Discuss the composition of two SHM's at right angles to each other.
22. Give the theory of Helmholtz resonator.
23. Write a note on Fourier theorem with square wave.
24. (a) What are Lissajous figure?
    (b) Explain Lissajous figure with five special cases.

25. Discuss the construction and theory of Helmholtz resonator.
26. What is reverberation? Derive Sabine's formula for period of reverberation.
27. Give the theory of damped vibrations and discuss its result.
28. Give the theory of Helmholtz resonator. Mention the applications of Helmholtz resonator.

UNIT VII Elasticity

38. State Hooke's law. What is elastic limit?
39. What are the dimensions of modulus of elasticity?
40. Define Poisson's ratio. What are its limiting values?
41. Define Young's modulus and modulus of rigidity.
42. Write the relation between Young's modulus, bulk modulus and modulus of rigidity
43. What is cantilever?
44. Define the terms, plane of bending and neutral axis.
45. State any two assumptions made in obtaining the expression for depression of cantilever.
46. What are the limits of Poisson's ratio?
47. Define rigidify modulus and Poisson’s ratio.
48. Write the relation between young’s modulus, rigidity and bulk modulus.
49. What is Double cantilever?
50. Define bending moment
51. What is Maxwell’s needle?
52. What is the value of the Poisson’s ratio for a body which is easily compressible.
53. What type of modulus is involved when a body is under torsion?
54. What is the unit of Poisson's ratio?
55. What is the period of a torsional pendulum?
56. Define surface tension and angle of contact.
57. Explain the terms "Molecular range" and "sphere of influence".

58. On what factors "angle of contact" depends.
59. If T is the surface tension and 'R' is the radius, what is the excess pressure inside an air bubble in a liquid.
60. Explain "Surface tension" and " Surface energy"
61. What is the angle of contact of pure water with glass?
62. What The angle of contact of mercury with glass?
63. Calculate the excess pressure in a soap bubble of radius l0mm, if the surface tension of soap solution is 3.2×10^{-2} N/m.
64. Find the excess pressure inside the spherical drop of water of diameter 4mm.Given that surface tension of water is 73×10^{-3} N/m.
65. Explain movement of Camphor particle on surface of water.
66. Find the excess of pressure inside a spherical drop water of diameter 4 mm, given that surface tension of water is 73×10^{-3} N/m.
67. Why Small drops of mercury are practically spherical?
68. Calculate the pressure difference between inside and outside of a soap bubble of radius 0.01m given that S.T. of soap solution = 0.032 N/m.
69. Write the Dimensional formula of co-efficient of viscosity.
    On which factors the viscosity of liquid drop depends.
70. What is terminal velocity?
71. State the Newton's law of Viscous flow in stream line motion
72. Mention any two assumptions made in the derivation of the expression for flow rate.
73. Explain the terms" Streamline flow" and "Turbulent flow".
74. Define coefficient of viscosity and mention the SI unit of it.

Five Mark Questions

28. Write a note on behavior of a wire under gradually increasing load.

29. Write the expressions for Young's modulus, bulk modulus & modulus of rigidity.

30. Mention different types of elastic modulii and explain them.

31. Obtain an expression for the twisting couple on a cylinder fixed at one end and twisted at the free end.

32. Using a torsion pendulum how the modules of rigidity of the material of a wire can be determined?

33. Explain Maxwell's needle method to determine the modulus of rigidity 'η'

34. A wire of length 2m is fixed at one end and a force of 10N is applied at the other end the area of cross-section of the wire is $2 \times 10^{-6} m^2$ and the young's modulus of elasticity of its material is $2 \times 10^{"}$ N/m+2 . Calculate the stress and strain.

35. A steel wire of 0.5 mm radius is bent to form a circle of 0.1m radius. What is the bending moment and the maximum stress if Y =2×10^{10} Newton's/m^2

36. Calculate the young's modulus for a material for which K= 14×10^{10} N/m^2 and η = 4.2×10^{10} N/m+2·

37. A wire 4m long 0.3 mm in diameter is stretched by a force of 0.8 kg-wt. If the extension

amount to 1.5 mm, calculate the energy stored in the wire.

38. A wire of length 1 meter and diameter 1mm is fixed at one end and couple is applied at the other end so that the wire is twisted by II/2 radian .Calculate the moment of the couple required if the rigidity of the modulus is 2.8×10^{10} N/m^2

39. Calculate the value of Poisson's ratio if Young's modulus and rigidity modulus are 12.25×10^{10} Nm^{-2} and 4.5×10^{10} Nm^{-2} respectively.

40. Calculate the work done in twisting a steel wire of radius 1mm and length 0.25m through an angle of 45°. Its modulus of rigidity is 8×10^{10} Nm^{-2}.

41. Find the work done in stretching a wire of cross section 1sq. mm and length 2m through 0.lmm. Given Y = 2×10^{11} Nm^{-2}

42. Obtain the expression for excess pressure inside a liquid drop.

43. Describe an experiment to determine surface tension of water by capillary-rise method.
44. Calculate the height to which water will rise in a capillary tube of 1mm diameter. The angle of contact for water is zero and surface tension of water is 0.072 Nm^{-l}. The density of water is 103 Kgm^{-3}.
45. Find the pressure inside a small air bubble of diameter 0.2mm situated just below the surface of water. Surfaced tension of water is 70 x 10-3 N/m. Atmospheric pressure is 1.013 x 105 Nm^{-2}.
46. In a capillary tube water rises to a height of 0.1m. In the same capillary tube mercury is depressed by 3.42 x 10^{-2} m. Angle of contact for water =0^0. Angle of contact for mercury = 135^0 . Calculate the S.T of mercury, given that S.T of water as 72 x 10^{-3} N/m. Density of mercury = 13.6 x 10^3 kg/m^3
47. Calculate the, S.T of paraffin liquid if it rises to a height of 0.75 x 10^{-2} m in a capillary tube of radius 0.75 mm. Density of paraffin p = 800 kg/m^3 and angle of contact is 28^0.
48. What would be the pressure inside a small air bubble of 0.1 mm radius, situated just below the surface of water? Surface tension of water = 72x 10^{-3} N/m and atmospheric pressure = 1.013 x 10^5 Nm^{-2}.
49. In Jaeger's experiment, a capillary tube of internal diameter 5 x 10^{-4} m dips 3 x 10^{-2} m inside the water contained in a breaker. The difference in level of a water manometer when the bubble is released is 0.09 m. Calculate the S.T. of water.
50. Derive an expression for the excess of pressure on a curved surface of a membrane.
51. Explain Stoke's method of determining the viscosity of a liquid.
52. Obtain an expression for the volume of the liquid flowing per second through a uniform tube.
53. An air bubble of radius 0.01 m is allowed to rise through a long cylindrical column of viscous liquid and travels at steady rate of 0.021ms^{-1} of the density of the liquid is 1470 kg m^{-3}. Find its viscosity, g=9.8 ms^{-2} neglecting the density of air.

54. A spherical ball of radius 2mm and mass 1.4 X 10^{-4} kg takes 6.4 second to fall steady through a height of 0.32m.inside a large volume of oil of density 900kg m^{-3}. Calculate the co-efficient of viscosity of the oil (g=9.8 ms^{-2}).

Ten Mark Questions

11. Derive the relation connecting Young's modulus, bulk modulus and modulus of rigidity
12. Derive an expression for torsional rigidity of a wire.
13. Obtain an expression for the depression at the loaded end of the cantilever, When the other end is fixed (Neglect the weight of the cantilever)
14. Explain with theory Maxwell's needle method to determine the modulus of Rigidity.
15. Define young's modulus and Rigidity modulus. Derive an expression for the depression at the end of loaded single cantilever.
16. Explains with theory torsional pendulum to determine modulus of rigidity.
17. Obtain an expression for depression at the midpoint of cantilever.
18. With necessary theory, describe an experiment to determine the surface tension of a liquid by Jaeger's method.
19. Describe with relevant theory, Quince's method of determining the surface tension of mercury.
20. Describe Quince's method of measuring the surface tension and the angle of contact for mercury in the form of a large flat drop.

UNIT VIII Special theory of relativity

Two Marks Questions

. State postulates of special theory of relativity.

2. What is Lorentz – Fitzerald contraction?

3. What is ether medium?

4. What is time dilation?

5. Mention Lorentz Transformations equations & explain the terms.

6. Define proper and dilated time.

7. What was the motivation behind the Michelson Morley experiment?

9. How spheres moving with a relativistic speed with respect to an observer appear?

10. What is proper and contracted length?

11. A body of rest mass m_0 is moving with a velocity of (√5 c/3), where c is the velocity of light. Calculate its mass.

Five Marks Questions

Deduce Lorentz transformations by using postulates of special theory of relativity.

Obtain an expression for length contraction.

2. Derive an expression for the relativistic length using Lorentz transformation equation.

3. Obtain an expression for length contraction.

4. Obtain the relativistic law of addition of velocities.

5. Derive an expression for the relativistic time using Lorentz transformation equation.

6. Obtain an expression for time dilation.

7. If the mass of a particle in motion is exactly thrice its rest mass, calculate the velocity of a particle.($c=3x10^8 m/s$).

8. Two spaceships X and Y are moving in opposite directions each with a speed of $2.4x10^8 ms^{-1}$. Find the relative speed of Y with respect to X, given the velocity of light=$3x10^8$ ms^{-1}.

9. An observer on earth measures the length of a moving spaceship to be exactly $1/4^{th}$ of its rest length. Calculate the speed of spaceship and time dilation corresponding to 2 second on spaceship.

10. An aero plane is moving with a uniform velocity 600 $ms^{-1}$to rearch, By what fraction of its rest length will appear to be shortened to an observer on earth?

11. An observer an earth measures length of a moving spaceship to be exactly half its rest length. Calculate the speed of spaceship and time dilation corresponding to 1S on spaceship.

12. If the total energy of a particle is exactly thrice its rest energy, what is the velocity of a particle?

13. What is the length of a meter rod moving parallel to its length, when it's mass is 3/2 of its rest mass?

14. How the negative result of Michelson's Morley experiment is explained by means of Lorentz- Fitzgerald contraction hypothesis?

15. The paper mean life of pion is $2\text{-}5x10^{-8}$. What would be the mean life of a beam of a these ions travelling with a speed of a 0.73 c? Calculate the distance travelled during one mean life time.

Ten Marks Questions

1. Explain Michelson Morley experiment with relevant theory and mention the negative results.
2. Deduce an expression for the relativistic mass & show that rest mass is least.
3. Obtain an equation for the orbit of a particle under the action of a central force & Explain different types of orbits.
4. State & Prove Einstein's mass-energy equivalence. Give examples

5. Obtain the relativistic law of addition of velocities. Show that no object can travel with a velocity greater than that of light.

6. Derive Einstein's mass-energy relation. What is its physical significance?

NOTE: Further questions may be added.

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

2020-21 CBCS

B.Sc – II semester question Bank

DSC-PHY-202

UNIT I-Vector analysis

Two Marks Questions

1. Define gradient of a scalar filed.
2. Define divergence of a vector field.
3. The divergence of a vector function is scalar. Explain.
4. Explain curl of vectors.
5. State Poynting theorem
6. What does the curl of a vector field represent?
7. Write the differential form of Maxwell's third equation.
8. Write the integral form of Maxwell's fourth equation.
9. Write the differential form of Maxwell's fourth equation.
10. Write the differential form of Ampere's law.

Five Marks Questions

1. State and prove Gauss divergence theorem.
2. Derive $\nabla \cdot E = \frac{\rho}{\epsilon_0}$.
3. Derive $\nabla \cdot B = 0$.
4. Derive $\nabla \times E = -\left(\frac{\partial B}{\partial t}\right)$.
5. Derive $\nabla \cdot B = \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$.
6. State and prove poynting theorem.
7. Write a note on the electromagnetic wave satisfied by E and B.
8. State and explain the energy density and intensity of electromagnetic wave.
9. Define the gradient of the scalar field. Explain it with an example to give its physical significance.
10. Define the divergence of a vector field. Give its physical significance

Ten Marks Questions

UNIT II- Maxwell's equations and Electromagnetic wave propagation

Two Marks Questions

11. State Gauss divergence theorem.
12. State stoke's theorem.
13. What is meant by vector field?
14. State Green's theorem.
15. Define gradient of a scalar filed.
16. Define divergence of a vector field.
17. The divergence of a vector function is scalar. Explain.
18. Explain curl of vectors.
19. State Poynting theorem
20. What does the curl of a vector field represent?
21. Write the differential form of Ampere's law.
22. Write the integral form of Maxwell's first equation.
23. Write the differential form of Maxwell's first equation.
24. Write the integral form of Maxwell's second equation.
25. Write the differential from of Maxwell's second equation.
26. Write the integral form of Maxwell's third equation.
27. Write the differential form of Maxwell's third equation.
28. Write the integral form of Maxwell's fourth equation.
29. Write the differential form of Maxwell's fourth equation.

Five Marks Questions

11. State Maxwell's equations of electromagnetic field explaining the symbols.
12. State and explain Amper's circuital law .
13. State and prove Gauss divergence theorem.
14. Derive $\nabla \cdot E = \frac{\rho}{\epsilon_0}$.
15. Derive $\nabla \cdot B = 0$.
16. Derive $\nabla \times E = -\left(\frac{\partial B}{\partial t}\right)$.
17. Derive $\nabla \cdot B = \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$.
18. State and prove poynting theorem.

19. Write a note on the electromagnetic wave satisfied by E and B.
20. State and explain the energy density and intensity of electromagnetic wave.
21. Define the gradient of the scalar field. Explain it with an example to give its physical significance.
22. Define the divergence of a vector field. Give its physical significance.
23. Define the curl of a vector field. Give its physical significance.

1. **Ten** State and prove poynting theorem.
2. Write a note on maxwell's equations.
3. Derive Maxwell's equation for electromagnetic waves in space.
4. Give Maxwell's equation for electromagnetic field and deduce an expression for the velocity of propagation of plane electromagnetic wave moving in a free face.
5. Write a note on the electromagnetic wave satisfied by E and B.
6. Derive the following
   a. $\nabla \times E = -\left(\frac{\partial B}{\partial t}\right)$
   b. $\nabla \times H = \frac{1}{C^2}\frac{\partial E}{\partial t}$

Marks Questions

1. Explain the terms electric displacement and electric polarization. Write the relation connecting them.
2. Mention the expression for electrostatic pressure on the surface of charged conductor. Obtain the expression for excess pressure inside the soap bubble due to electrification.
3. Find the polarisation in a dielectric material with relative permittivity of 2.8 if the electric displacement is given by as D= $3x10^{-7}C/m^2$
4. Four grams of gold is beaten into a thin leaf of 1sq m. A small is cut of from this and placed upon the conductor. Calculate the charge density required by the conductor so that the piece of the gold is just lifted up.
5. Obtain an expression for the mechanical force on the surface of a charged conductor. Hence derive an expression for the energy density of the electrostatic field.

UNIT III- Electrostatics

Two Marks Questions

1. Define dielectric polarization.
2. Write the relation connecting P, E and D for a dielectric medium.
3. If a soap bubble is given a negative charge then what happens to its radius?
4. Mention the factors on which electric displacement depends.
5. What is the value of the electric field at a point inside a charged conducting sphere?
6. Define dielectric constant
7. Write the unit for electric displacement D .
8. What are the conditions that are to be satisfied to find an electrical image?
9. Write the unit for polarization $\vec{P}$.
10. What are dielectrics? In what respects do they differ from conductors?
11. Explain electric displacement (D).
12. Explain susceptibility (χ).
13. Mention the boundary condition to be satisfied by D and E at the interface of two dielectric media?
14. Give the expression for force between charges in a dielectric medium.
15. Explain the significance of electrical images.
16. Point out the limitations of Clausius -Mossotti equation
17. Give the relation between polarization and induced surface charge density
18. What is an electrical image?
19. What are the conditions that must be satisfied in finding an electrical image?
20. Calculate the dielectric constant of the material when inserted in parallel plate capacitor of size 10mm X10mm and distance between plates is 2 mm gives capacitance of 10^{-9} F.
21. The permittivity of a diamond is 1.46×10^{-10} C^2/Nm^2. Deterine the dielectric constant and electrical susceptibility.
22. A charge of 2μC is placed at a distance of 0.3m from the centre of the sphere of radius 0.1m. Calculate the magnitude of the electrical image.
23. The dielectric constant of a medium is 2. Electric field in the dielectric is 10^{6} Vm^{-1}. Calculate electric displacement.

Five Marks Questions

6. Give the Cavendish`s proof of inverse square law in electrostatics.
7. What are polar molecules and non-polar molecules? Explain the behavior of a dielectric in an electric Field.
8. Explain Gauss law in dielectrics and obtain the relation between induced charge and dielectric constant.
9. Derive the relationship between electric displacement D, polarization P and electric field E.
10. What are polar molecules and non-polar molecules? Obtain the relation between dielectric susceptibility and dielectric constant.
11. Obtain an expression for the mechanical force on the surface of a charged conductor.
12. Explain the terms electric displacement and electric polarization. Write the relation connecting them.
13. Mention the expression for electrostatic pressure on the surface of charged conductor. Obtain the expression for excess pressure inside the soap bubble due to electrification.
14. Find the polarisation in a dielectric material with relative permittivity of 2.8 if the electric displacement is given by as $D= 3x10^{-7}C/m^2$
15. Four grams of gold is beaten into a thin leaf of 1sq m. A small is cut of from this and placed upon the conductor. Calculate the charge density required by the conductor so that the piece of the gold is just lifted up.
16. What charge must there be upon soap bubble of radius 1.5 cm, if air pressure is same inside and outside bubble? The surface tension of soap bubble is 27.
17. A sphere of diameter 0.05 m is charged to a potential of 1000 volts. Calculate the outward pull per unit area.

Ten Marks Questions

1. Obtain an expression for the mechanical force on the surface of a charged conductor. Hence derive an expression for the energy density of the electrostatic field.

2. Define an electrical image. Derive the expression for the electric intensity at a point on an infinite plane conducting surface which is earthed. Find the force of attraction between the conducting plane and the charge.
3. Derive expression for electric intensity and surface density of charge at a point on the surface of an earthed conducting sphere using electrical image.
4. Derive Clausius-Mossotti equation for molecular field in a dielectric.
5. Derive the boundary conditions for electric displacement (D) and electric field (E) at a surface separating the two dielectric media.
6. Obtain an expression for the charge on the soap bubble if the pressure inside the bubble is same as that of outside.

UNIT IV- Capacitors and Dielectrics

Two Marks Questions

1. What is capacitor?
2. Write the formula of the capacitor.
3. Mention the S.I unit of capacitor.
4. What is the function of dielectric in capacitor?
5. What is dielectric?
6. What is the function of dielectric in capacitor?
7. Write the relation between capacitor and dielectric.
8. Mention the types of capacitors.
9. Write the relation of series and parallel combination of capacitors.
10. Mention the applications of capacitors.

Five Marks Questions

1. What is capacitor and explain
2. Write the function of dielectric in capacitors.
3. Explain parallel plate capacitor.
4. Explain spherical capacitor.

5. Explain cylindrical capacitor.
6. Explain Gauss's theorem of electrostatics.
7. Explain electric polarization
8. Explain electric polarization and susceptibility.
9. Explain electric displacement.
10. Define dielectric constant.
11. Explain displacement vector.
12. Explain dielectric.
13. Explain potential due to a point charge.
14. Explain uniformly charged solid sphere.
15. Explain energy per unit volume in electrostatics.

Ten Marks Questions

16. What is electrostatic field and electric flux? Explain Gauss's theorem of electrostatics.
17. Explain Gauss's theorem for electric field due to point charge.
18. Explain Gauss's theorem for uniformly charged spherical sphere.
19. Explain Gauss's theorem for electric field due to point charge.
20. Explain Gauss's theorem for plane charged sheet and charged conductor.
21. Explain Gauss's theorem in dielectrics.
22. Explain energy per unit volume in electrostatics field.
23. Explain dielectric medium, displacement vector and polarization.
24. Explain parallel plate capacitor filled with dielectrics.
25. Explain spherical capacitor and cylindrical capacitor

UNIT V- Current electricity

Two Marks Questions

1. What is Lorentz force?
2. State Ampere circuital law.
3. Give the statement of Biot-Savart law.
4. Define magnetic induction and magnetic flux.

5. What is damping.
6. What is figure of merit?
7. What is dead beat in galvanometer?
8. Define current reduction factor.
9. Define charge sensitivity.
10. Give the relation between charge sensitivity and current sensitivity.

Five Marks Questions

1. State and prove Ampere's circuital law.
2. Derive the expression for magnetic field on a axis of a circular coil carrying current.
3. Explain Helmholtz-galvanometer.
4. Explain logarithmic decrement.
5. Give the correction for damping in Ballistic galvanometer.
6. Calculate the value of torque on a current loop placed in a uniform magnetic field.
7. Explain the theory of Ballistic galvanometer.
8. Explain the correction of damping in Ballistic galvanometer.
9. The current sensitivity of the Ballistic galvanometer is 2.2×10^{-9} A for a deflection of 1 mm scale kept at a distance of 1m . If the charge sensitivity of the galvanometer is 2.17 $\times 10^{-9}$ coulomb mm. Calculate the time period of the coil.
10. The successive deflections to the right and left of the mean positions in case of a Ballistic galvanometer are found to be20,19.9,19.8cm calculate deflection without damping

Ten Marks Questions

1. State Biot-Savart law..Deduce an expression for the magnetic field due to current flowing in a straight conductor of infinite length.
2. Give the principle, working and theory of Helmholtz-galvanometer.

3. State and prove Ampere's circuital law.
4. Obtain an expression for magnetic field due to toroid using Ampere's circuital law.
5. Give the construction of Ballistic galvanometer and deduce the formula for the quantity of charge flowing through it.

UNIT VI –Galvanometer

Two Marks Questions

1. What is figure of merit?
2. What is dead beat in galvanometer?
3. Define current reduction factor.
4. Define charge sensitivity.
5. Define current sensitivity.
6. Give the relation between charge sensitivity and current sensitivity.
7. What is damping?
8. What is logarithmic decrement?
9. Which law is used to explain the Ballistic galvanometer
10. Write the difference between Ballistic galvanometer and Helmholtz-galvanometer

Five Marks Questions

1. Explain the working principle of galvanometers.
2. Explain the theory of Ballistic galvanometer.
3. Explain the theory of Helmholtz- galvanometer.
4. Define charge sensitivity, current sensitivity, and give the relation between charge sensitivity and current sensitivity.
5. State and prove Ampere's circuital law.

6. The successive deflections to the right and left of the mean positions in case of a Ballistic galvanometer are found to be20,19.9,19.8cm calculate deflection without damping
7. Explain the applications of galvanometers.
8. Explain the different types of galvanometers.
9. Explain the applications of galvanometers.
10. Explain the experimental determination of charge sensitivity using Ballistic galvanometer

Ten Marks Questions

1. Explain the working principle of galvanometers.
2. Explain the theory of Ballistic galvanometer.
3. Explain the theory of Helmholtz- galvanometer.
4. Define charge sensitivity, current sensitivity, and give the relation between charge sensitivity and current sensitivity.
5. Explain the determination of charge sensitivity using Ballistic galvanometer.
6. Explain the damping and logarithmic decrement in Ballistic galvanometer

UNIT VIII –AC and Transient circuits

Two Marks Questions

1. Through what angle does complex vector rotates when it is multiplied with operator j?
2. Mention the expression for instantaneous value of a.c. current.
3. Give the condition under which electric resonance occurs.
4. What is electrical resonance?
5. What is power factor of an ac circuit?
6. Define quality factor (Q).
7. Why series resonance circuit is called an acceptor circuit?
8. Why parallel resonance circuit is called as rejecter circuit?
9. Explain voltage magnification in series LCR circuit.
10. Mention the expression for quality factor (Q) in terms of band width.
11. What is meant by time constant in RL circuit?
12. What is time constant of the RC circuit?
13. Give the nature of Curves for growth & decay of charge in a condenser through a resistance .

14. Give the nature of Curves for growth and decay of current in RL circuit.
15. Calculate the time constant of RL circuit with R=10MΩ and L=5mH.
16. A condenser of 1 μF is first charged and then discharged through a resistance of 1MΩ. Calculate the time constant in which the charge of the condenser will fall to 63.2 % of initial value.
17. If the charge on a capacitor of capacitance 2μF is leaking through a high resistance of 100 MΩ is reduced to half of its maximum value, calculate the time of leakage.

Five Marks Questions

1. Write the expression for the impedance of a series LCR circuit with the meaning of each symbol used. Why is it called an acceptor circuit?
2. Distinguish between series and parallel resonance circuits.
3. Give the theory of growth of current in RL circuit.
4. Give the theory of decay of charge in a condenser through a resistance.
5. Describe with full theory the method of measuring high resistance by method of leakage.
6. An AC circuit containing an impedance of 10mH and a capacitor of lμf and a resistance of 100Ω in series a rms voltage 100V is applied. Calculate the frequency at which the circuit will be in resonance and find the value of current.
7. A series circuit has an inductance of 2mH a capacitance of 2mf and resistance of 100Ω. Find the resonant frequency of circuit.
8. An rms voltage 100V is applied to a AC circuit containing an impedance of 10mH and a capacitor of 1μf and a resistance of 100Ω in series. Calculate the frequency at which the circuit will be in resonance and find the value of current.
9. A capacitor is charged to a certain potential by a battery through a resistance of 3MΩ.If it reaches 2/3 of its final potential in 0.6 second, calculate its capacitance.
10. A series combination of a capacitor & a resistor is connected to a steady source of 200 v. The P. d. across the resistor rises from 0 to 80 v is 5 sec. calculate the time constant of the circuit.
11. An e.m.f 10 volts is applied to a circuit having a resistance of 10 ohms and an inductance of 0.5 Henry. Find the time required by the current to attain 63.2 % of its final value. What is the time constant of the circuit?
12. An inductance of 500 mH and a resistance of 5 ohms are connected in series with an e.m.f of 10 volts,find the final current. If the cell is removed and the two terminals are connected together, find the current after (i) 0.05 sec and (ii) 0.2 sec
13. A capacitor is charged by DC supply through a resistance of 2 MΩ if it takes 0.5 seconds for the charge to reach three quarters of its final value, what is the capacitance of the capacitor?

14. A capacitor of capacitance of 2μF is first charged and then discharged through a resistance of 2 MΩ. calculate the time in which the potential difference across the capacitor falls to half of its original value.

Ten Marks Questions

1. Obtain the expressions for the current, impedance and phase angle in LCR Series and parallel Circuit. Under what condition will electric resonance occur?
2. Derive expressions for resonant frequency for
   i) A series resonant circuit. ii) A parallel resonant circuit.
3. Derive equation for the growth & decay of current in a circuit containing inductance resistance & a constant emf.
4. Obtain an expression for the growth & decay of charge in a condenser through a resistance.
5. Derive Helmholtz equations for the growth and decay of current in a circuit having inductance and resistance.
6. Describe, with full theory, the method of measuring a high resistance by the leakage method.

UNIT VIII- Thermoelectricity

Two Marks Questions

1. What is Seeback effect?
2. What is thermo electric series?
3. State the law of intermediate temperature.
4. State the law of intermediate metals.
5. What is thermoelectric curve & what it gives?
6. Define thermoelectric power and mention its expression.
7. Define temperature of inversion and mention its dependent factor.
8. What is peltier effect?
9. Define peltier co efficient.
10. What is Thomson effect? Define Thomson Co efficient.
11. What is Tait diagram?
12. What are the uses of Tait diagrams?

Five Marks Questions

1. State and explain Seeback effect.

2. State and explain laws of thermoelectricity.
3. Write a note on thermoelectric series.
4. Deduce, $T_N = \frac{t_1+t_2}{2} = \frac{-a}{2b}$.
5. Show that, $T_i = 2T_N - t_1$.
6. Explain thermoelectric curve.
7. What is Peltier effect? Explain.
8. Explain thermodynamics of Peltier effect.
9. What is Thomson effect? Explain.
10. Establish the relation between Seeback, Peltier and Thomson emfs.
11. Distinguish between Peltier and Joule's effects.
12. Show that, $e_{t_1}^{t_2} = (t_2 - t_1)\{a + b(t_2 + t_1)\}$.
13. Thermoelectric Potential of a thermocouple is 6μV at 100^0 C and is 15μV at 0^0 C. Find the emf between 50^0 C and 150^0 C.
14. Thermoelectric Potential of a thermocouple is 6μV at 100^0 C and is 15μV at 0^0 C. Find the emf between 0^0 C and 100^0 C.
15. Thermoelectric Potential of a thermocouple is 15μV at 0^0 C and is 6μV at 100^0 C. Find the emf between 100^0 C and 200^0 C. Also find neutral temperature and temperature of inversion when the temperature of cold junction is 20^0C.
16. Thermoelectric Potential of Fe is 17.5μV/^{0}C at 0^0C and 5μV/^{0}C at 250^0C and TEP of Cd is 3μV/^{0}C at 0^0C and 15μV/^{0}C at 300^0C. Calculate the neutral temperature and emf of Fe-Cd couple between 0^0C and 100^0c.
17. Thermoelectric Potential of Fe is 17.34μV/^{0}C at 0^0C and 12.47μV/^{0}C at 100^0C and TEP of Cu is 1.36μV/^{0}C at 0^0C and 2.31μV/^{0}C at 100^0C. Calculate the emf of Fe-Cu couple between 0^0C and 100^0c.
18. The emf of a thermocouple between 0^0C and t^0C is $e=1.36X10^{-5}\ t - 1.8X10^{-8}\ t^2$. Determine emf between 0 and 100^0C, emf between 100 and 200^0C, neutral temperature, peltier co efficient at 100^0C and Thomson Co efficient and temperature at 50^0C.

Ten Marks Questions

1. Deduce , $\pi = T\frac{de}{dt}$ and $\sigma = T\frac{de^2}{dt^2}$.
2. Explain Tait diagram of a thermocouple and its uses to determine Peltier and Thomson co-efficients and emfs.
3. Explain Tait diagram of an element and its uses to determine Peltier and Thomson co-efficients and emfs.

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

UNIT – 1 : KINETIC THEORY OF GASES

2 *Marks Questions*

Kinetic model of a gas:

1. At what temperature, pressure remaining constant will the R.M.S. velocity of hydrogen be double?
2. Write an expression for R.M.S. velocity of a gas and explain the terms.
3. At what temperature, pressure, remaining unchanged will the R.M.S. velocity of the gas be half its value at 0^oC.

Transport phenomena:

4. What are transport phenomena in a gas?
5. Mention how coefficient of viscosity of gas varies with temperature & pressure.
6. What is the relation between viscosity (n) and thermal conductivity (k)?
7. Define the term free path.

   or

   What is 'mean free path'?

Brownian motion:

8. What is Brownian motion?
9. Write expression for mean square displacement of Brownian particles from Einstein's theory.

5 *Marks Questions*

Kinetic model of a gas:

1. Write assumptions of Kinetic theory of gases.
2. Explain kinetic concept of temperature.
3. Write a note on kinetic model of a gas.
4. Calculate the RMS velocity of molecules of oxygen at 30°C, if R= 8.314 $Jmole^{-l}K^{-1}$ and molecular weight of oxygen =32.
5. Calculate the K.E. of 10-3 kg of the molecules of helium at 300K. R= 8.314 $Jmole^{-1}K^{-1}$. Molecular weight of helium = 4. Given that R= 8.314 Jmole-lK-1 & atomic weight of chlorine is 35.5, find the R.M.S. velocity of chlorine molecule at $O^{\circ}C$

Transport phenomena:

6. Define mean free path. Derive the expression $\lambda = 1/\pi\sigma^2 n$
7. Write a note on viscosity of gas.
8. Derive the expression for coefficient of diffusion of gas.
9. Derive an expression for the coefficient of thermal conductivity of gas.
10. Derive Poisson's equation for perfect gas.
11. If the coefficient of viscosity of a gas is 1.66 x 10-5 N.sec.m-2 , density = 1.25 kgm^{-3}

and average velocity = 4.5 x $10^2 ms^{-1}$ find **a)** mean free path **b)** collision frequency **c)**molecular diameter.

12. Calculate the mean free path for benzene, if the no. of molecules per cubic meter is 2.79 x 10^{25} and diameter of benzene molecule is 7.2AU.
13. Calculate the diameter of a gas molecule, if the no. of molecules per cubic meter is 2.79 x 10^{25} and the mean free path of the gas is 2.2 x 10^{-6}cm.
14. If the coefficient of viscosity of nitrogen is 1.66 x 10^{-5} SI units and coefficient of conductivity is 14.88 x 10^{-3} SI units, find the specific heat of nitrogen at constant volume.
15. The collision frequency of a gas molecule is 10^6 collision/ sec. If the velocity of the molecule is 2 x $10^5 ms^{-1}$, find out the mean free path.
16. Creation gas has a density of 1.2.kg m^3 at a pressure 10^5 N m^2 and at temperature O^0C Find R.M.S. velocity.
17. If the molecular velocity of a gas at NTP is 4.659 x 10^2 m^{-1} calculate the density of the gas.
18. Calculate the diameter of a gas molecule, if the number of molecules per cm^3 is 2.8 x 10^{19} and the mean free path of the gas is 2.2 x 10^{-6}cm.

10 *Marks Questions*

1. **Kinetic model of a gas:** Derive the expression for pressure exerted by gas molecules in an enclosed vessel.

Transport phenomena:

2. What is mean free path? Write the approximate expression for mean free path. Derive Clausius expression for it.
3. Obtain the expression for coefficient of viscosity form Kinetic theory of gases.
4. Obtain the expression for coefficient of thermal conductivity from Kinetic theory of gases.
5. What are transport phenomena? Derive an expression for the coefficient of thermal conductivity.
6. Derive an expression for the diffusion of gas.

Brownian motion:

7. Give Einstein's theory of Brownian motion.
8. Explain Brownian motion. Discuss Langevin's theory of Brownian motion.
9. Explain Brownian motion. Discuss Einstein's theory of Brownian motion.

UNIT -2 : STATISTICAL PHYSICS

2 *Marks Questions*

1. Define probability.
2. State postulate of equal a priori probability.
3. Define thermodynamic probability.
4. Give the additive law of probability.
5. What is joint probability rule?
6. Explain the conditional probability rule.

7. What do you meant by macrostate and microstates?
8. Define accessible and inaccessible states.
9. What do you mean by most probable distribution?
10. Mention any two limitations of Maxwell-Boltzmann method.
11. What are three kinds of particles in statistical physics?
12. What do you mean by distinguishable and indistinguishable particles?
13. What is difference between classical statistics and Quantum statistics?
14. What are Bosons? Which statistics is used to study them?
15. What are Fermions? Which statistics is used to study them?
16. A card is drawn from a well shuffled pack of 52 cards. Calculate the probability for this card to be a king.
17. We throw a dice and obtain two numbers. What is the probability that these numbers are 6 and 4 precisely in that order?

5 *Marks Questions*

1. Explain the concept of probability with examples.
2. State and explain the concept of equal a priori probability with example.
3. Define and explain the terms macrostate and microstate with the help of an example.
4. What do you mean by thermodynamic probability of macrostate? How is related to probability of occurrence of that state.
5. Define thermodynamic probability. For n distinguishable particles to be distributed in two compartments, prove that the thermodynamic probability is,

$$W_{(n1,n2)} = n! / n_1!\, n_2! \text{ , where } n_1+n_2=n$$

6. Distinguish between probability and frequency.
7. A card is drawn from a well shuffled pack of 52 cards. Calculate the probability for this card to be either a king or a queen.
8. What is the probability of drawing two queens in succession form a pack of 52 cards?
9. If a pair of 6 faced dice with faces marked 1 to 6 are thrown. What is the probability that the sum of the numbers which shows up is 8?
10. Two six faced dice, each marked 1 to 6 are thrown. Calculate the probability that one of the dice shows 6 and the other shows 5.
11. We throw a dice and obtain three numbers. What is the probability that these numbers are 6, 5 and 4 precisely in that order?
12. Calculate the probability that in tossing a coin 8 times, we get 5 heads and 3 tails.
13. Ten distinguishable particles are distributed among three, equal size partitions. Find the probability of the macrostates (i) (4,4,2) (ii) (5,3,2)
14. Distinguish between three kinds of particles.
15. From Maxwell-Boltzmann distribution law show that

$$n(E)dE = 2\pi N/(nkT)^{3/2}.E^{1/2}.\exp(-E/kT)dE$$

13. Treating ideal gas as a system governed by classical statistics, derive the Maxwell's distribution law for molecular speeds.

14. Define root mean square speed of the gas molecules. Using Maxwell's law for distribution of molecular speeds, derive expression for root-mean square speed.
15. What is most probable speed of the gas molecules? Using Maxwell's law for distribution of speeds of molecules, derive expression for most probable speed.
16. Using Maxwell's law for distribution of speeds of molecules, derive expression for the average speed of gas molecules.

10 *Marks Questions*

1. Find the expression for the probability of a macrostate corresponding to the distribution of n particles in k compartments of unequal sizes.
2. Treating ideal gas as a system governed by classical statistics, derive the Maxwell's distribution law for molecular speeds. Discuss special cases.
3. Using Maxwell's law for distribution of speeds of molecules in a gas, obtain expression for average speed and root-mean square speed.
4. Using Maxwell's law for distribution of speeds of molecules in a gas, obtain expression for most probable speed and average speed.
5. Using Maxwell's law for distribution of speeds of molecules in a gas, obtain expression for most probable speed and root-mean square speed.
6. Treating ideal gas as a system governed by classical statistics, derive the Maxwell's distribution law for molecular velocities. Discuss special cases.
7. Derive the Maxwell's distribution law for molecular velocities. Discuss special cases
8. Describe experimental verification of the Maxwell-Boltzmann distribution law for molecular speeds.
9. Distinguish between (or compare) Maxwell-Boltzmann statistics, Fermi-Dirac statistics and Bose –Einstein statistics.

UNIT -3: HEAT

2 *Marks Questions*

Thermometry:

1. Mention the thermometric properties of i)Magnetic thermometers ii) Gas thermometers iii) Resistance thermometers
2. What is Seebeck effect?
3. Give the principle of platinum resistance thermometer
4. Give the principle of thermoelectric thermometer.
5. Define the neutral temperature of thermocouple.
6. Define the terms (a) thermo emf (b) thermocouple.
7. What is meant by a scale of temperature? On what does the definition of any particular scale depend?
8. The temperature of the surface of the sun is about 6500^0C. What is the temperature (i) on Kelvin scale and(ii) on the
9. At what temperatures do the Celsius and Fahrenheit scales coincide?
10. At what temperature on the Fahrenheit scale will the reading be (i) the same as the reading on the Celsius scale (ii) double of the reading on the Celsius scale?

Specific heats:

11. What are the principles of calorimeter?

12. Distinguish between the specific heat of a gas at constant pressure and constant volume.
13. Define specific heat.
14. Give the reason why $C_p > C_v$.
15. Define Dulong and Petit's law.
16. Mention two uses of platinum coil (wire) in Nernst vacuum calorimeter.

Thermal conductivity:

17. Define the terms (a) water equivalent (b) thermal capacity.
18. Define coefficient of thermal conductivity. What are its dimensions?
19. Define temperature gradient and thermal conductivity.
20. Mention the CGS units of - Thermal conductivity, thermal diffusivity.
21. Define the terms - Thermal diffusivity, Thermal steady state.
22. Mention the SI units of –Thermal conductivity, Thermal diffusivity.
23. Give an expression for thermal conductivity and mention its dimensions.
24. The opposite faces of a metal plate of o.2 cm thickness are at a difference of 100 c and the area of the plate is 200 Sq cm. find the quantity of heat that will flow through the plate in one minute if k=0.2 CGS units.

25. Calculate the masses of silver lead and aluminium which have the same thermal capacity as a liter of water. Their specific heats are 0.056, 0.031 and 0.22 respectively.

5 *Marks Questions*

Thermometry:

26. Give an account of the thermo electric thermometry and discuss the range, sensitivity and usefulness of some important thermocouples.
27. What do you understand by neutral temperature of a thermocouple? Explain.
28. Describe Seebeck effect and explain the terms neutral temperature and temperature of inversion.
29. Describe Callendar and Griffith's bridge for measuring the resistance of a platinum resistance thermometer at various temperatures.
30. When the temperature on the gas scale is 80^0C, the corresponding temperature on the platinum scale is 80.2^0C .What will be the temperature on the platinum scale corresponding to 120^0Con the gas scale?
31. The resistance of the platinum wire of platinum resistance thermometer at the ice point is 5 ohms and at the steam point 5.93 ohms. The pressure exerted by the gas in a constant volume gas thermometer is (i) 100 cm of Hg at ice point (ii) 136.6 cm of Hg at the steam point. When both the thermometers are inserted in the hot bath the resistance of the platinum wire is 5.795 ohms and the pressure of the gas is 131.11cm of Hg. Calculate Celsius temperature of the bath (i) on the platinum scale and (ii) on the gas scale.
32. If the platinum temperature, corresponding to 50^0C on the gas scale is 50.25^0C, what will be the temperature on the platinum scale corresponding to 150^0C on the gas scale?
33. The resistance of the platinum wire at 0^0C,100^0C and 444.6^0C is found to be 5.5.7.5 and 14.5 ohms respectively. The resistance of the wire at temperature t^0C is given by the equation $R_t=R_0(1+\alpha t+\beta t^2)$. Find the values of α and β.

34. The emf of the thermocouple, one junction of which is kept at 0^0C is given by $E=at+bt^2$ Determine the neutral temperature and temperature of inversion.

Specific heats:

35. Describe and explain Joly's steam calorimeter method for finding specific heat of gas at constant volume
36. Describe Nernst vacuum calorimeter and indicate briefly how it may be used to determine the specific heat at low temperature
37. Discuss Dulong and Petit's law and explain the variation of atomic heat of substance with temperature
38. Describe how the specific heat of a gas at constant pressure is determined accurately.
39. Describe the Regnault's method to find the specific heat of a gas at constant pressure.

Thermal conductivity:

40. A metal bar is heated at one end , Derive Fourier's differential equation for rectilinear flow
41. Of heat. Obtain an expression for the temperature distribution when the rod is open.
42. Describe Lee's method for determination of the thermal conductivity of a bad conducting material in the form of a disc.
43. Discuss rectilinear flow of heat along a bar of uniform cross section and show that in the steady state of a metal bar heated at one end $\frac{d^2\theta}{dx^2} = \mu^2\theta$.
44. Establish the standard Fourier differential equation for one dimensional flow heat when one end of a rod is heated.
45. Define thermal conductivity of substance .Derive an expression for it.
46. Define coefficient of thermal conductivity. What do you understand by a thermal steady state?

10 ***Marks Questions***

Thermometry:

1. Give the principle, construction and working of a platinum resistance thermometer. Discuss its advantages over a thermoelectric thermometer.

Specific heats:

2. Describe and explain Joly's steam calorimeter method for finding specific heat of gas at constant volume
3. Describe Nernst vacuum calorimeter and indicate briefly how it may be used to determine the specific heat at low temperature
4. Discuss Dulong and Petit's law and explain the variation of atomic heat of substance with temperature

Thermal conductivity:

5. Define coefficient of thermal conductivity. Describe Forbes "method for determining the thermal conductivity of a metal rod.

   Or

6. Describe in detail Forbes method for finding the co efficient of thermal conductivity of a metal bar.

UNIT -4: THERMODYNAMICS

2 *Marks Questions*

Heat engines:

1. Distinguish between Otto engine & Diesel engine.
2. What is the heat engine? Mention the types of it.
3. Why the Diesel engines are not used in light vehicles.
4. What is the efficiency of Otto engine & Diesel engine?
5. State Carnot's theorem.
6. Draw the P-V diagrams that represent (i) Otto cycle and (ii) Diesel cycle.
7. Draw the entropy temperature diagram for Carnot's reversible engine.
8. State second law of thermodynamics?
9. What is temperature entropy (T-S) diagram? Write the expression for efficiency of a reversible Carnot's engine in terms of temperature.
10. Write the Clausius-Clapeyron's (Latent heat) equation and explain the terms.
11. State Clausius statement of second law of thermodynamics.
12. Explain the term entropy.
13. Is entropy scalar or vector? Write its S.I. unit.
14. What is T-S diagram?
15. What is the significance of T-S diagram?
16. What is the change in entropy in reversible and irreversible processes?
17. Write a short note on entropy as a measure of disorder.
18. What is effect of increase of pressure on the melting point of solid which contracts on melting?
19. What is effect of pressure on the boiling point of liquid?
20. Calculate the change in entropy when 1kg of water at 100^{o}C is converted into steam at the same temperature.(Given: Latent heat of steam = 540 cal/gram)
21. Calculate the change in entropy when 10gram of ice at 0^{o}C is converted into water at the same temperature.(Given: Latent heat of ice = 80 cal/gram)

Thermodynamic potentials:

22. Mention different types of thermodynamic potentials.
23. Write an expression for Enthalpy & Gibb's free energy.
24. Write an expression for internal energy & Helmoltz free energy.
25. Write the significance of thermodynamic potentials.

Low temperature:

26. Mention different methods of production of low temperature.
27. What is Refrigerator?
28. What is Joule-Thomson effect?
29. What do you mean by enthalpy?

5 *Marks Questions*

Heat engines:

1. Explain the working of Otto engine with neat labeled diagram.
2. Derive an expression for efficiency of Otto engine.
3. Explain the working of Diesel engine with neat labeled diagram.
4. Derive an expression for efficiency of Diesel engine.
5. Prove that efficiency of reversible engine is always greater than any other engine.
6. Prove that entropy always increases in irreversible processes.
7. Write a note on T-S diagram.
8. What do mean by entropy? Show that entropy remains constant in reversible process.
9. Calculate the change in entropy when 10gram of water at 60° C is mixed with 30gram of water at 20°C.
10. Calculate the change in entropy when 10grams of ice at 0°C is converted into steam at 100°C. (Given: Latent heat of steam = 540 cal/gram) .
11. Calculate the change in entropy when 0.1kg of water at 15°C is mixed with 0.16kg of water at 40°C. (Given: specific heat of water = 4200 J/Kg/K).
12. Find the efficiency of a Carnot's engine working between 400 K and 300 K. It absorbs 80 calories of heat. How much heat is rejected?
13. Calculate the change in entropy when 5 kg of water at 100 °C is converted into steam at the same temperature.(Given; Latent heat of steam=540calories/g)
14. Calculate the change in entropy, when 50 g of ice at 0°C is converted into water at the same temperature. (Given; Latent heat of steam=80calories/g)

Thermodynamic potentials:

15. Write a short note on thermodynamic potentials.
16. Using Maxwell's thermo dynamical relations deduce the Clausius-Clapeyron's equation. Hence explain the effect of pressure on boiling point of liquid.
17. Using Maxwell's thermo dynamical relations deduce the equation $\mathbf{C_P - C_V = T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P}$ where symbols have their usual meaning.
18. Using Maxwell's thermodynamical relation, show that for a Vander Waal's gas $Cp - Cv = R\left(1 + \frac{2a}{VRT}\right)$
19. Use Maxwell's relation to obtain Cp-Cv=R for an ideal gas. Where Cp and Cv are molar specific heat at constant pressure and constant volume respectively.
20. Write down Maxwell's four thermodynamical relations and explain the terms.
21. Calculate under what pressure ice freezes at272 K if the change in specific volume when 2kg of water freezes is 90x 10^{-6} m^3 given Latent heat of ice =3.36x10^5 j/kg.
22. Calculate the pressure required to made ice freezes at -1 ^{0}C L=79.6 Calories/g, Specific volume of water at 0 ^{0}C=1000cc, specific volume of ice at 0°C=1.091 cc and one atmosphere = 1.0313x10^6 dynes/cm^2.
23. Calculate the change in Boiling point of water when the pressure is increased. By 1 atmosphere, B.P.of water 100°C. specific volume of steam =1.671 m^3 and Latent heat of steam 2.268x10^6J/kg.

24. Calculate the change in the boiling point of water when the pressure of steam on its surface is increased from 1atmospheres to 1.10 atmospheres. Given: Latent heat of water at 100°C = 537 cal/gram; volume of 1gram of steam at 100°C = 1676 cm^3.

Low temperature:

1. What is refrigerator? Explain the working of vapour compression machine.
2. Give the theory of porous plug experiment. Obtain conditions for heating and cooling of gas.
3. Explain vapour-compression machine with neat diagram.
4. What is Joule-Thomson's effect? Describe the Joule –Thomson's porous plug experiment.

10 *Marks Questions*

Heat engines:

1. Explain the working of Otto engine hence derive an expression for its efficiency.
2. Explain the working of Diesel engine hence derive an expression for its efficiency

3. What do mean by entropy? Show that (i) entropy remains constant in reversible process and (ii) entropy increases in irreversible process.

4. Write a note (i) entropy (ii) T-S diagram

Thermodynamic potentials:

5. Derive Maxwell's thermo dynamical relations.
6. Using Maxwell's thermodynamical relation, derive the following equations

(i)Cp-Cv=R

(ii) $Cp - Cv = R\left(1 + \frac{2a}{VRT}\right)$ for a Vander Waal's gas

Low temperature:

7. Describe porous plug experiment. What conclusions have been drawn from it? What is inversion temperature?
8. a) What do you mean by Joule-Thomson effect? Explain.

b) What is refrigerator? Explain the working of vapour compression machine.

UNIT -5: RADIATION

2 *Marks Questions*

Radiation:

1. What is radiation pressure?
2. Write any two properties of thermal radiation.
3. State Stefan's law of radiation.
4. State Planck's law of radiation.
5. State Stefan's- Boltzmann's law of radiation.
6. State Wien's displacement law
7. State Rayleigh-Jean's law?
8. Write Planck's energy equation and explain the terms.
9. Explain emissive power and absorptive power.

10. List the advantages of Planck's law of radiation over the other laws.
11. Define solar constant.
12. What is total radiation pyrometer?
13. Distinguish b/w Stefan's law of Stefan's Boltzmann's law.
14. Who designed artificial black body?
15. What is pyrometer?
16. If Wein's constant K=0.3 cm K calculate the temperature of the Sun whose radiation has maximum energy of wavelength 5500 Å.
17. What is the wavelength of maximum intensity radiated from the surface of the temperature of 3000^0C and Wein's constant is $2.898x10^{-3}$ mK.
18. The surface temperature of the sun is 6000k and Wein's constant is 0.293mxk. Calculate the maximum emission of wavelength of sun at given temperature.
19. Compare the radiant emittance of the black body at 200 K and 2000 K given that $\sigma=5.6x10^{-8}$ $Wm^{-2}K^{-4}$.
20. The value of λ in a Black body radiation of a certain temperature in 65 30 $^{\bullet}$. Calculate λ When temperature of that body is doubled.
21. A black body radiates 1000J of energy per solid when its temperature is 300k? What is the amount of energy radiated when its temperature is 600K

ENERGY SOURCES

22. What do you mean by conventional energy sources?
23. What do you mean by non-conventional energy sources?
24. What are renewable energy sources?
25. What are non-renewable energy sources?

5 *Marks Questions:*

Radiation:

1. What is radiation pressure? State and explain Stefan's law of radiation.
2. What is black body? Explain the black body spectrum.
3. Deduce the Wein's displacement law.
4. Derive Stefan's law of radiation.
5. With neat diagram explain total radiation pyrometer
6. With neat diagram explain water flow pyreheliometer.
7. State Stefan's law explain the method to calculate the surface temperature of the sun using it.
8 Describe the experiment to determine the Solar constant.
9 Estimate the amount of heat radiated per second and the temperature of the sun given radius of the sun $=6.958x10^5$Km, mean distance between sun and earth $=148.48x10^7$km solar constant $=1.39x10^3$ Wxm^{-2} Stefan's constant $=5.672x10^{-8}$ W $m^{-2}K^{-4}$.
10 Estimate the temperature of the Sun.
11 State and explain Wien's law and Rayleigh-Jeans law.
12 Write a note on solar radiation.

Energy Sources:

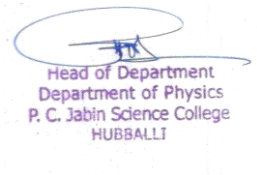
13 Explain conventional and nonconventional energy sources?
14 Explain renewable and nonrenewable energy sources?

10 *Marks Questions*

1. Describe with necessary theory the laboratory method to determine the Stefan's law.
2. Derive Planck's law of radiation.
3. Discuss the construction and working of Ferry's radiation pyrometer.
4. What is radiation pyrometer? Discuss the principal, construction and working of total radiation pyrometer
5. Give the laboratory method of determining Stefan's constant.
6. Discuss Wien's displacement law and Rayleigh- Jean's law. When Planck's law can be reduced to Wien's law and Rayleigh- Jean's law?
7. Estimate the Solar constant and the temperature of the Sun.

ENERGY SOURCES

8. a) What do you mean by energy source? b) Explain conventional and non-conventional energy sources. c) Explain renewable and non-renewable energy sources.



III SEMESTER 2020-21 DSC-PHY-303

UNIT I-Thermodynamics

UNIT II- Heat engines

UNIT III- Thermodynamic potentials

UNIT IV- Theory of radiation

UNIT V-Kinetic theory of gases

UNIT VI-Transport phenomena

UNIT VII-Stastitical mechanics

UNIT VIII-Stastitical distribution laws

IV SEMESTER 2020-21-DSC-PHY-404

UNIT I-Wave motion

UNIT II- Superposition two collinear harmonic oscillations

UNIT III- Vacuum Techniques

UNIT IV-Sound

UNIT V- Theories of light

UNIT VI- Interference

UNIT VII-Diffraction

UNIT VIII-Polarization

III SEMESTER SEC

IV SEMESTER SEC

V SEMESTER 2021-21 DSE-PHY-505A

UNIT I- Fundamentals of quantum mechanics

UNIT II- Wave mechanics

UNIT III-Atomic spectra

UNIT IV-Magnetic field effect on light

UNIT V-Molecular spectra

UNIT VI-Raman effect

UNIT VII-Nuclear models

UNIT VIII-Detectors

VI SEMESTER -2021-22 DSE-PHY-606B

UNIT I-Crystal structure

UNIT II-Lattice

UNIT III-Lattice dynamics

UNIT IV-Magnetic properties of materials

UNIT V- Domain

UNIT VI-Dielectric properties of materials

UNIT VIII-Elementary band theory

UNIT VIII-Superconductivity

I SEMESTER NEP 2021-22 115DSC1T

Mechanics and properties of matter

UNIT I

Chapter 1- Unit and measurments

Chapter 2-Momentum of relativity

Chapter 3-Special theory of relativity

UNIT II

Chapter 4-Laws of motion

Chapter 5- Dynamics of rigid bodies

Chapter 6-Gravitation

UNIT III

Chapter 7- Elasticity

Chapter 8- Bending of beam

UNIT IV

Chapter 9-Surface tension

Chapter 10-Viscosity

SEMESTER II 2021-22 NEP 115DSC02T

ELECTRICITY AND MAGNETISM

UNIT I

Chapter 1-Electrostatics

Chapter 2-Laws of electrostatics

Chapter 3- Electric potential

UNIT II

Chapter 4-Basics of dielectrics

Chapter 5-Theory of dielectrics

UNIT III

Chapter 6- Magnetism

Chapter 7- Electrical instruments and aMeasurments

Chapter 8- Alternating current circuits

UNIT IV

Chapter 9- Electromagnetic waves

Chapter 10- Magnetic materials

2021-22

III SEMESTER III SEC

IV SEMESTER SEC

V SEMESTER SEC

VI SEMESTER SEC

I SEMESTER OEC

II SEMESTER OEC

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

Department of Physics- CBCS -2020-21

B.Sc III Sem.DSC-PHY-303

Thermal physics and Stastical physics

Model questions

UNIT-I Thermodynamics

2 Marks

1. What do you meant by thermodynamics?
2. Define thermodynamic system in closed system,open system and isolated system.
3. State first law of thermodynamics.
4. State second law of thermodynamics.
5. State third law of thermodynamics.
6. Give the Clausisus statement of second law of thermodynamics.
7. Give the Kelvin's- Plank's statement of second law of thermodynamics.
8. What is the internal energy of thermodynamic system?
9. Define the term isothermal, isobaric, isochoric cycle process.
10. What is an inductor diagram?
11. What is PV diagram?
12. Define efficiency of heat engine?
13. Explain reversible and irreversible process
14. What are the types of heat engines?
15. Define entropy.

5 Marks

1. Prove C_P-C_V = R
2. Deduce an expression for the work done during isothermal process.
3. Deduce an expression for the work done during adiabatic process.
4. What is an heat engine? Explain Carnot's heat engine.
5. State and prove Carnot's heat engine.
6. Explain four –cycle petrol engine.
7. Explain four stroke petrol engine.
8. Explain efficiency of petrol engine.
9. State and explain third law of thermodynamics.
10. Explain diesel engine.

10 Marks

1. Describe the theory and working of an Otto and petrol engine.
2. What is heat engine? Explain isothermal process.
3. State and prove Carnot's theorem.
4. Prove C_P-C_V = R using first law of thermodynamics.
5. Explain T-S diagram.
6.

UNIT-II Heat Engines

2 Marks

Heat engines:

1. Distinguish between Otto engine & Diesel engine.
2. What is the heat engine? Mention the types of it.
3. Why the Diesel engines are not used in light vehicles.
4. What is the efficiency of Otto engine & Diesel engine?
5. State Carnot's theorem.
6. Draw the P-V diagrams that represent (i) Otto cycle and (ii) Diesel cycle.
7. Draw the entropy temperature diagram for Carnot's reversible engine.
8. State second law of thermodynamics?
9. What is temperature entropy (T-S) diagram? Write the expression for efficiency of a reversible Carnot's engine in terms of temperature.
10. Write the Clausius-Clapeyron's (Latent heat) equation and explain the terms.
11. State Clausius statement of second law of thermodynamics.
12. Explain the term entropy.
13. Is entropy scalar or vector? Write its S.I. unit.
14. What is T-S diagram?
15. What is the significance of T-S diagram?
16. What is the change in entropy in reversible and irreversible processes?
17. Write a short note on entropy as a measure of disorder.
18. What is effect of increase of pressure on the melting point of solid which contracts on melting?
19. What is effect of pressure on the boiling point of liquid?
20. Calculate the change in entropy when 1kg of water at 100^{o}C is converted into steam at the same temperature.(Given: Latent heat of steam = 540 cal/gram)
21. Calculate the change in entropy when 10gram of ice at 0^{o}C is converted into water at the same temperature.(Given: Latent heat of ice = 80 cal/gram)

5 Marks

Heat engines:

1. Explain the working of Otto engine with neat labeled diagram.
2. Derive an expression for efficiency of Otto engine.
3. Explain the working of Diesel engine with neat labeled diagram.
4. Derive an expression for efficiency of Diesel engine.
5. Prove that efficiency of reversible engine is always greater than any other engine.
6. Prove that entropy always increases in irreversible processes.
7. Write a note on T-S diagram.
8. What do mean by entropy? Show that entropy remains constant in reversible process.
9. Calculate the change in entropy when 10gram of water at 60^o C is mixed with 30gram of water at 20^{o}C.

10. Calculate the change in entropy when 10grams of ice at 0°C is converted into steam at 100°C. (Given: Latent heat of steam = 540 cal/gram) .
11. Calculate the change in entropy when 0.1kg of water at 15°C is mixed with 0.16kg of water at 40°C. (Given: specific heat of water = 4200 J/Kg/K).
12. Find the efficiency of a Carnot's engine working between 400 K and 300 K. It absorbs 80 calories of heat. How much heat is rejected?
13. Calculate the change in entropy when 5 kg of water at 100 °C is converted into steam at the same temperature.(Given; Latent heat of steam=540calories/g)
14. Calculate the change in entropy, when 50 g of ice at 0°C is converted into water at the same temperature. (Given; Latent heat of steam=80calories/g)

Heat engines:

1. Explain the working of Otto engine hence derive an expression for its efficiency.
2. Explain the working of Diesel engine hence derive an expression for its efficiency

3. What do mean by entropy? Show that (i) entropy remains constant in reversible process and (ii) entropy increases in irreversible process.

4. Write a note (i) entropy (ii) T-S diagram

UNIT-III Thermodymic potential

2 Marks

Thermodynamic potentials:

1. Mention different types of thermodynamic potentials.
2. Write an expression for Enthalpy & Gibb's free energy.]
3. Write an expression for internal energy & Helmholtz free energy.
4. Write the significance of thermodynamic potentials.

Low temperature:

1. Mention different methods of production of low temperature.
2. What is Refrigerator?
3. What is Joule-Thomson effect?
4. What do you mean by enthalpy?

5 Marks

Thermodynamic potentials:

1. Write a short note on thermodynamic potentials.
2. Using Maxwell's thermo dynamical relations deduce the Clausius-Clapeyron's equation. Hence explain the effect of pressure on boiling point of liquid.

3.Using Maxwell's thermo dynamical relations deduce the equation $\mathbf{C_P - C_V = T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P}$ where symbols have their usual meaning.

3. Using Maxwell's thermo dynamical relation, show that for a Vander Waal's gas

$$Cp - Cv = R\left(1 + \frac{2a}{VRT}\right)$$

4. Use Maxwell's relation to obtain Cp-Cv=R for an ideal gas. Where Cp and Cv are molar specific heat at constant pressure and constant volume respectively.
5. Write down Maxwell's four thermo dynamical relations and explain the terms.

6. Calculate under what pressure ice freezes at272 K if the change in specific volume when 2kg of water freezes is 90x 10^{-6} m^3 given Latent heat of ice =3.36x10^5 j/kg.
7. Calculate the pressure required to made ice freezes at -1 ^{0}C L=79.6 Calories/g, Specific volume of water at 0 ^{0}C=1000cc, specific volume of ice at 0^{o}C=1.091 cc and one atmosphere = 1.0313x10^6 dynes/cm^2.
8. Calculate the change in Boiling point of water when the pressure is increased. By 1 atmosphere, B.P.of water 100^{o}C. Specific volume of steam =1.671 m^3 and Latent heat of steam 2.268x10^6J/kg.
9. Calculate the change in the boiling point of water when the pressure of steam on its surface is increased from 1atmospheres to 1.10 atmospheres. Given: Latent heat of water at 100^{o}C = 537 cal/gram; volume of 1gram of steam at 100^{o}C = 1676 cm^3.

Low temperature:

1.What is refrigerator? Explain the working of vapour compression machine.
2.Give the theory of porous plug experiment. Obtain conditions for heating and cooling of gas.
3.Explain vapour-compression machine with neat diagram.
What is Joule-Thomson's effect? Describe the Joule –Thomson's porous plug experiment

10Marks

Thermodynamic potentials:

5. Derive Maxwell's thermo dynamical relations.
6. Using Maxwell's thermo dynamical relation, derive the following equations
(i)Cp-Cv=R
(ii) $Cp - Cv = R\left(1 + \frac{2a}{VRT}\right)$ for a Vander Waal's gas

Low temperature:

7. Describe porous plug experiment. What conclusions have been drawn from it? What is inversion temperature?
8. a) What do you mean by Joule-Thomson effect? Explain.
b) What is refrigerator? Explain the working of vapour compression machine.

UNIT-IV Theory of radiation

2 Marks

1. What is a black body?
2. What is Stefan's –Boltzmann law
3. What is Wien's law?
4. What is Rayleigh's law?
5. What is Plank's law?

5 Marks

1. Calculate the elevation of the boiling point of water due to change of pressure of 1 cm of mercury. Assume L= 2.25 x10 ^{6} jkg^{-1}. Specific value of steam= 1.671m^3
2. Calculate the depression in the melting point of ice, when the pressure changes by one atmosphere. Specific value of ice at O^{o}C is $10^{-3}m^3$ kg^{-1} and L= = 3.36 x10 ^{5} $jkg^{-1.}$
3. Explain black body radiation.
4. Explain black body spectrum.
5. Explain the properties of blackbody radiations with examples.

10 Marks

1. Explain the dynamic system. What are thermodynamic variables? Define intensive and emissive variables.
2. Explain enthalpy, Helmholtz and Gibbs functions in thermodynamics. Derive Gibbs Helmholtz equations.
3. Derive Maxwell's thermo dynamical general equations connecting the thermodynamic quantities.
4. Explain Maxwell's four thermo dynamical equations and hence find two thermodynamic quantities.

NIT-V Kinetic theory of gases

2 Marks

Kinetic model of a gas:

1. At what temperature, pressure remaining constant will the R.M.S.Velocity of hydrogen be double?
2. Write an expression for R.M.S. velocity of a gas and explain the terms.
3. At what temperature, pressure, remaining unchanged will the R.M.S. velocity of the gas be half its value at 0^oC.

Brownian motion:

4. What is Brownian motion?
5. Write expression for mean square displacement of Brownian particles from Einstein's theory.

5 Marks

Kinetic model of a gas:

1. Write assumptions of Kinetic theory of gases.
2. Explain kinetic concept of temperature.
3. Write a note on kinetic model of a gas.
4. Calculate the RMS velocity of molecules of oxygen at 30°C, if R= 8.314 $Jmole^{-l}K^{-1}$ and molecular weight of oxygen =32.
5. Calculate the K.E. of 10-3 kg of the molecules of helium at 300K. R= 8.314 $Jmole^{-1}K^{-1}$. Molecular weight of helium = 4. Given that R= 8.314 Jmole-lK-1 & atomic weight of chlorine is 35.5, find the R.M.S. velocity of chlorine molecule at $O^{\circ}C$

10 Marks

1. **Kinetic model of a gas:** Derive the expression for pressure exerted by gas molecules in an enclosed vessel.

Brownian motion:

2. Give Einstein's theory of Brownian motion.

3. Explain Brownian motion. Discuss Langevin's theory of Brownian motion.
4. Explain Brownian motion. Discuss Einstein's theory of Brownian motion.

UNIT-VI Transport phenamena

2 Marks

Transport phenomena:

6. What are transport phenomena in a gas?
7. Mention how coefficient of viscosity of gas varies with temperature & pressure.
8. What is the relation between viscosity (n) and thermal conductivity (k)?
9. Define the term free path.

or

What is 'mean free path'?

5 Marks

Transport phenomena:

5. Define mean free path. Derive the expression $\lambda = 1/\pi\sigma^2 n$
6. Write a note on viscosity of gas.
7. Derive the expression for coefficient of diffusion of gas.
8. Derive an expression for the coefficient of thermal conductivity of gas.
9. Derive Poisson's equation for perfect gas.
10. If the coefficient of viscosity of a gas is 1.66 x 10-5 N.sec.m-2 , density = 1.25 kgm^{-3} and average velocity = 4.5 x $10^2 ms^{-1}$ find **a)** mean free path **b)** collision frequency **c)**molecular diameter.
11. Calculate the mean free path for benzene, if the no. of molecules per cubic meter is 2.79 x 10^{25} and diameter of benzene molecule is 7.2AU.
12. Calculate the diameter of a gas molecule, if the no. of molecules per cubic meter is 2.79 x 10^{25} and the mean free path of the gas is 2.2 x 10^{-6}cm.
13. If the coefficient of viscosity of nitrogen is 1.66 x 10^{-5} SI units and coefficient of conductivity is 14.88 x 10^{-3} SI units, find the specific heat of nitrogen at constant volume.
14. The collision frequency of a gas molecule is 10^6 collision/ sec. If the velocity of the molecule is 2 x 10^5 ms^{-1}, find out the mean free path.
15. Creation gas has a density of 1.2.kg m^3 at a pressure 10^5 N m^2 and at temperature O^0C Find R.M.S. velocity.
16. If the molecular velocity of a gas at NTP is 4.659 x 10^2 m^{-1} calculate the density of the gas.
17. Calculate the diameter of a gas molecule, if the number of molecules per cm^3 is 2.8 x 10^{19} and the mean free path of the gas is 2.2 x 10^{-6}cm.

10 Marks

Transport phenomena:

18. What is mean free path? Write the approximate expression for mean free path. Derive Clausius expression for it.
19. Obtain the expression for coefficient of viscosity form Kinetic theory of gases.
20. Obtain the expression for coefficient of thermal conductivity from Kinetic theory of

gases.

21. What are transport phenomena? Derive an expression for the coefficient of thermal conductivity.
22. Derive an expression for the diffusion of gas.

UNIT-VII Statistical mechanics

2 Marks

1. Define probability.
2. State postulate of equal a priori probability.
3. Define thermodynamic probability.
4. Give the additive law of probability.
5. What is joint probability rule?
6. Explain the conditional probability rule.
7. What do you meant by macro state and microstates?
8. Define accessible and inaccessible states.
9. What do you mean by most probable distribution?
10. Mention any two limitations of Maxwell-Boltzmann method.

5 Marks

1. Explain the concept of probability with examples.
2. State and explain the concept of equal a priori probability with example.
3. Define and explain the terms macro state and microstate with the help of an example.
4. What do you mean by thermodynamic probability of macro state? How is related to probability of occurrence of that state.
5. Define thermodynamic probability. For n distinguishable particles to be distributed in two compartments, prove that the thermodynamic probability is,

$$W_{(n1,n2)} = n! / n_1!\, n_2! \text{ , where } n_1+n_2=n$$

6. Distinguish between probability and frequency.
7. A card is drawn from a well shuffled pack of 52 cards. Calculate the probability for this card to be either a king or a queen.
8. What is the probability of drawing two queens in succession form a pack of 52 cards?
9. If a pair of 6 faced dice with faces marked 1 to 6 are thrown. What is the probability that the sum of the numbers which shows up is 8?
10. Two six faced dice, each marked 1 to 6 are thrown. Calculate the probability that one of the dice shows 6 and the other shows 5.

10 Marks

1. Find the expression for the probability of a macro state corresponding to the distribution of n particles in k compartments of unequal sizes.
2. Treating ideal gas as a system governed by classical statistics, derive the Maxwell's distribution law for molecular speeds. Discuss special cases.

3. Using Maxwell's law for distribution of speeds of molecules in a gas, obtain expression for average speed and root-mean square speed.
4. Using Maxwell's law for distribution of speeds of molecules in a gas, obtain expression for most probable speed and average speed.
5. Using Maxwell's law for distribution of speeds of molecules in a gas, obtain expression for most probable speed and root-mean square speed.

UNIT-VIII Statistical distribution law

2 Marks

1. What are three kinds of particles in statistical physics?
2. What do you mean by distinguishable and indistinguishable particles?
3. What is difference between classical statistics and Quantum statistics?
4. What are Bosons? Which statistics is used to study them?
5. What are Fermions? Which statistics is used to study them?
6. A card is drawn from a well shuffled pack of 52 cards. Calculate the probability for this card to be a king.
7. We throw a dice and obtain two numbers. What is the probability that these numbers are 6 and 4 precisely in that order?

5 Marks

1. We throw a dice and obtain three numbers. What is the probability that these numbers are 6, 5 and 4 precisely in that order?
2. Calculate the probability that in tossing a coin 8 times, we get 5 heads and 3 tails.
3. Ten distinguishable particles are distributed among three, equal size partitions. Find the probability of the macro states (i) (4,4,2) (ii) (5,3,2)
4. Distinguish between three kinds of particles.
5. From Maxwell-Boltzmann distribution law show that

$$n(E)dE = 2\pi N/(nkT)^{3/2}.E^{1/2}.\exp(-E/kT)dE$$

5. Treating ideal gas as a system governed by classical statistics, derive the Maxwell's distribution law for molecular speeds.
6. Define root mean square speed of the gas molecules. Using Maxwell's law for distribution of molecular speeds, derive expression for root-mean square speed.
7. What is most probable speed of the gas molecules? Using Maxwell's law for distribution of speeds of molecules, derive expression for most probable speed.
8. Using Maxwell's law for distribution of speeds of molecules, derive expression for the average speed of gas molecules.

10 Marks

1. Treating ideal gas as a system governed by classical statistics, derive the Maxwell's distribution law for molecular velocities. Discuss special cases.
2. Derive the Maxwell's distribution law for molecular velocities. Discuss special cases
3. Describe experimental verification of the Maxwell-Boltzmann distribution law for molecular speeds.
4. Distinguish between (or compare) Maxwell-Boltzmann statistics, Fermi-Dirac statistics and Bose –Einstein statistics.

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

PHYSICS QUESTION BANK CBCS-2020-21

B.Sc IV Sem.DSC-PHY-404

UNIT-I Wave motion

UNIT-II Superposition of two collinear harmonic oscillations

2 Marks

1. What is wave motion?
2. Write the difference between harmonic wave and longitudinal wave.
3. Define progressive wave and stationary wave.
4. Write the expression for progressive wave and explain the terms.
5. Define principle of superposition of wave.
6. Write two differences between standing wave and progressive wave.
7. What do you meant by node and antinodes?
8. What is wave intensity?
9. Write two properties of stationary wave.
10. What are Lissojous figures?

5 marks

1. Define beats.
2. Define group velocity and phase velocity.
3. Define plane waves, spherical waves, wave intensity with equal frequencies.
4. Define plane waves, spherical waves, wave intensity with unequal frequencies.
5. Explain the types of wave motion like transverse wave and standing wave.
6. Write two differences between standing wave and progressive wave.
7. Write two properties of stationary wave and progressive wave.
8. What are Lissojous figures? And write the applications of Lissojous
9. Calculate the velocity of sound in a gas in which the wave of wavelength 500cm
10. Explain the superposition of two perpendicular harmonic oscillations.

10 Marks

1. Explain the types of wave motion like transverse wave and standing wave.
2. Explain the normal modes of a string, group velocity, and phase velocity.
3. Explain the superposition of two harmonic oscillations.
4. Explain oscillations having equal frequency and oscillations.
5. Explain oscillations having different frequency and oscillations.
6. What are Lissojous figures with equal frequency and unequal frequencies?
7. Explain the properties of stationary wave and progressive wave.
8. What are the characteristics of wave motion? Define linearity and superposition principle.

UNIT-III Vacuum techniques

2 Marks

1. What is vacuum?
2. Write the ranges of vacuum.
3. Mention the vacuum measuring units.
4. What is pumping speed?
5. What is pump down time?
6. Mention the types of vacuum pumps.
7. Mention the different units to measure the vacuum.
8. Write the applications of vacuum pumps.

5 marks

1. Explain the production of vacuum.
2. Explain diffusion pump.
3. Explain molecular pump.
4. Explain penning and pirani of vacuum pumps.
5. Explain the leakages in vacuum pumps.

10 Marks

1. Explain the production of vacuum, measuring of vacuum, measuring units, vacuum ranges, pumping speed and pump down time?
2. Explain the types of vacuum pumps. a) Rotary pump b) Diffusion pump
3. Explain Knudsen absolute guage.
4. Explain Penning and Pirani in vacuum pumps
5. Explain the leakages in vacuum pumps with neat leveled diagram.

UNIT-IV Sound

2 Marks

1. Define SHM.
2. What are forced vibrations? Give examples.
3. What are free vibrations? Give examples.
4. What is resonance?
5. What is intensity of sound?
6. What is loudness of sound?
7. What is decibel?
8. What is intensity level?
9. What are musical notes ?
10. What is acoustics ?

5 marks

1. Calculate the intensity level when the intensity of sound increases 10^6 times its original intensity.

2. Calculate the change in intensity level when the intensity of sound increase 100 times its original intensity.
3. Explain amplitude, energy and displacement of SHM.
4. For a particle vibrating horizontally to a displacement of 8 cm at the and velocity is 8 cm/s instant velocity is 6cm calculate (i) amplitude (ii) frequency (iii) time period
5. Explain absorption coefficient.

10 Marks

1. Explain Fourier theorem.
2. Explain Fourier theorem for saw tooth wave.
3. Explain Fourier theorem for square wave.
6. Explain acoustics of building with reverberation time and absorption coefficient.
4. Derive Sabine's formula for measurement of reverberation time.

UNIT-V Theories of light

2 Marks

1. What were the merits of wave theory of light?
2. What were the contributions of Fresnel to Huygens wave theory?
3. What is nature of light?
4. What is interference of light?
5. What are coherent sources?
6. Define fringe width?
7. What are newton's rings?
8. What is minimum condition to get interference pattern

5 marks

1. Discuss the interference phenomena for wedge shaped film.
2. Derive the expression for fringe width for wedge shaped film.
3. How do you determine the wavelength of light using Fresnel's biprism.
4. Explain Stoke's theorem of phase change in reflection and refraction.
5. Explain Newtons rings using reflection.

10 Marks

1. Describe Fresnel's biprism experiment to determine the wave length of monochromatic light.
2. Derive the condition for constructive and destructive interference in case of a thin film for reflected light.
3. Derive the condition for constructive and destructive interference in case of a thin film for transmitted light.
4. Explain the formation of Newton's rings to obtain an expression for wave length of light.
5. Describe the construction and working of Michelson –Morley experiment.

UNIT-VI Interference

2 Marks

Interference:

1. In moving the mirror M_1 of Michleson's interferometer through a distance of 0.4220mm, 1500 fringes are counted calculate the wave length of the light.
2. The diameter of 4^{th} ring in Newton's ring experiment is 0.18mm, Calculate diameter of 16^{th} dark ring?

5 marks

1. Discuss the interferences phenomenon for wedge-shaped film.
2. Derive the expression for fringe width in the wedge shaped film.
3. How do you determine the wavelength of light using Fresnel's Biprism?
4. Explain stoke's treatment of phase change to reflection and refraction.
5. Explain Newton's ring's produced due to reflection.
6. Describe Michelson's interferometer with a neat diagram.
7. Determine the wavelength of light by Newton's rings.
8. In Newton's rings experiment, obtain the conditions for bright and dark rings.
9. Describe the construction of fabry perot interferometer with labeled diagram.
10. Describe the principle and working of fabry perot interferometer.
11. Describe the construction of Michelson's interferometer with neat labeled diagram.
12. Explain Michelson's interferometer is used for determination for wavelength of monochromatic source of light.
13. Explain how Michelson's interferometer is used to determine the difference in wavelength of two close lines.

10 Marks

1. In a biprism experiments with sodium light of wave length 5893 Å. The micrometer reading is 2.32 mm. When the eyepiece is placed at a distance of 100 cm from the source. If the distance between two virtual sources is 2 cm. Find the new reading of the micrometer if the eye piece

is moved such that 20 fringes cross the field of view.

2. In a biprism experiment, a biprism of angle 10 and refractive index 1.5 is placed at a distance of 0.4 m from the slit and 0.6 m from the screen. Calculate the fringe width if light of 599.6 nm is used.

3. In a biprism experiment with sodium light bands of width 0.0195 cm are observed at 100 cm from the slit. On introducing a convex lens 30 cm away from the slit, two images of the slit are seen 0.7 cms. apart at 100 cms distance from slit. Calculate the wavelength of sodium light.

4. In Newton's ring experiment, find the radius of curvature of the lens in contact with the glass plate, for the light of wave length 6000 Å. The diameter of 5th dark ring in the reflected pattern is 5.2 mm.
5. In a Newton's rings experiments the diameters of 5^{th} &15^{th} rings are $0.336x10^{-2}$m and $0.590x10^{-2}$ resp find the radius of curvature of plano convex lens, if wave length of light used is 5890 Å. A transparent plate of thickness 10^{-3} cm is placed in the path of one of the interfering beams of a biprism experiment using light of wave length 5000 Å if the central fringe shifts by a distance equal to width of 10 fringes. Calculate R.I of the plate.
6. In an experiment with michelson's Interfereometer to distance traveled by movable mirror for two successive positions of maximum intensities was 0.2845mm if the mean wave length of two components of sodium D line is 5893 Å .Calculate to difference between wave length

UNIT-VII Diffraction

2 Marks

3. What is diffraction of light? And who discovered it?
4. What is Fresnel diffraction?
5. What is Fraunhoffer diffraction?
6. What do you understand by zone plate?
7. Compare zone plate with convex lens.
8. What are half period zones?
9. What is diffraction grating?
10. Define Resolving power of grating.
11. State Rayleigh's criterion for limit of resolution.
12. Define resolving power and limit of resolution of an optical instrument.
13. Distinguish between prism and grating spectra.

14. Distinguish between interference fringes and diffraction fringes.
15. Define R.P of prism & write the expression for it.

Problems:

16. Find the resolving power of a prism having base of 5 cm and $d\mu/d\lambda$. = 1200.
17. Calculate the resolving power of a diffraction grating in the second order having 10000 lines.
18. What is the radius of first zone in a zone plate of focal length 0.40m for the light of 400 nm?
19. Calculate the thickness of a half wave plate of quartz for which $\mu_0 = 1.544$ & $\mu_e = 1.553$, for a light of wave length 5893Å
20. In the first order diffraction with a light of wave length 6000Å the diffraction angle for a grating is 30^0 find the number of lines per cm of the grating
21. Calculate the thickness of the half wave plate. Given λ=5000 Å η_0=1.544 & η_e=1.553

5 Marks

7. Discuss Fresnel's theory of half period zone in relation to plane wave front.
8. Discuss Fraunhaffer diffraction due to double slit.
9. Show that the amplitude due to a complete wave front of a point is half the what would be caused by the first zone.
10. Distinguish between Fresnel and Fraunhoffer diffraction.
11. What is diffraction of light? How Fresnel did explained diffraction based on his assumption.
12. Give the comparison of a Zone plate & a convex lens.
13. Discuss analytically the distribution of intensity in the diffraction pattern due to a single slit.
14. What is dispersive power of a grating and deduce an expression for it?
15. Compare between prism spectra & grating spectra.
16. Derive an expression for the angular dispersion of a plane diffraction grating.

10 Marks

1. What is Zone plate? Explain the theory of zone plate (obtain the expression for focal length of zone plate).
2. Describe the construction of zone plate. Show that the zone plate has different foci for different wavelengths.
3. Give Fresnel's theory of half period zones. How it is used to explain rectilinear propagation of light?
4. What is plane transmission grating? Discuss its theory and derive the condition for secondary maxima & minima.
5. Define resolving power and dispersive power of plane diffraction grating. Obtain expression for these in case of plane diffraction grating.
6. a) Define resolving power of an optical instrument.
   b) Derive an expression for resolving power of a prism.
7. Discuss the Fraunhofer type of diffraction produced by a narrow single slit of width 'a' and illuminated by a monochromatic light of wavelength λ.

8. Discuss Fraunhoffer diffraction pattern due to a single slit. Find the exp for the width of the central maxima.
9. Give the complete account of the phenomenon & relevant theory of diffraction at 'n' parallel slits.
10. Mention the difference between Fresnel and Fraunhoffer diffraction. Explain the diffraction pattern at single slit.
11. Explain the terms half period zones in relation to plane wave font show that the amplitude due to a complete wave font at a pt is half of what would because by the first half period eliminate zone.

UNIT-VIII Polarisation

2 Marks

1. State and explain malu's law.
2. Discuss the difference between positive and negative crystal.
3. Describe Huygen's explanation of double refraction in uniaxial crystal.
4. Explain Huygen's theory of light in negative crystal when optic crystal is in the plane of incidence and inclined at an angle to the refracting surface.
5. Explain Huygen's wave theory of light when optic axis is in the plane of incidence and perpendicular to the refracting surface.
6. Describe Huygen's wave theory in negative crystal when optic axis is in the plane of incidence and parallel to the refracting surface.
7. What is quarter wave plate? Arrive at an expression for its thickness.
8. What is half wave plate? Arrive at an expression for its thickness.
9. What is circularly polarized light? How is it produced?

5 Marks

1. How can elliptically polarized light be produced? Explain.
2. Give the analytical treatment of circularly polarized light.
3. Give the analytical treatment of elliptically polarized light.
4. Explain Fresnel's theory of optical rotation.
5. Distinguish between circularly polarized light and unpolarized light.
6. What is double refraction? Describe how Huygen explained it.
7. Write a note on optical activity.
8. Write the assumption made by Fresnel to explain the phenomenon of optical rotation.

10 Marks

1. a. State and explain malu's law
   b. Distinguish between positive and negative crystal.

2. a. Give the Huygen's theory of double refrection

b. Distinguish between positive crystals & negative crystals .

3. Discuss the phenomenon of double refraction based on Huygen's principle of double refraction in (i). optic axis parallel (ii). Perpendicular to the refracting surface.

4. What is optical activity give Fresnels theory of rotational polarization ?

5. Explain the Fresnel's theory of rotatory polarization.

6. Distinguish between positive and negative crystals.

7. What are retarders? Obtain the expression for thickness of (i) half wave plate. (ii) Quarter wave plate.

8. Give the detail analysis of unpolarized, plane, circularly and elliptically polarized light

9. What are quarter wave plate & half wave plate? Write the expression for thickness of the quarter wave plate & half plate for negative & positive crystal.

10. Give the analytical treatment for production of Circularly and Elliptically polarized light.

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

Department of Physics-2020-21

B.Sc III Sem. SEC Model questions

Electrical and Network skills

2 Mmarks

1. What is Ohm's law?
2. Electricity Principles.
3. mention different types of signal generator?
4. What are vacuum measuring units?
5. Define Distortion factor meter.
6. Define pump down time.
7. Types of vacuum pumps.
8. Define Rotary pump.
9. Define Diffusion pump.
10. Define Molecular pump.
11. Penning and pirani gauge.
12. What do you mean by forced vibrations?
13. What do you mean by resonance?
14. Define intensity of sound.
15. Define loudness of sound.

5 Marks

1. What do you mean by Distortion factor meter, explain briefly.
2. State and explain about vacuum.
3. Explain about pumping speed and pump down time.
4. State and explain Rotary pump
5. State and explain Diffusion pump
6. State and explain Molecular pump
7. Explain briefly about detection leakage.
8. Derive equation for Simple harmonic motion
9. Discuss about Intensity and loudness of sound, Decibel, Intensity levels.
10. Discuss briefly about Acoustics of buildings

10 Marks

1. How Series, parallel, and series-parallel combinations. Explain with AC Electricity
2. Explain working principle of Relays. Fuses and disconnect switches

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

Department of Physics-2020-21

B.Sc IV Sem. SEC Model questions

Signal Generators and Analysis Instruments
Digital Instruments

2 Marks

1. What you mean by signal generator?
2. Define generators.
3. mention different types of signal generator?
4. What are vacuum measuring units?
5. Define Distortion factor meter.
6. Define pump down time.
7. Types of vacuum pumps.
8. Define Rotary pump.
9. Define Diffusion pump.
10. Define Molecular pump.
11. Penning and pirani gauge.
12. What do you mean by forced vibrations?
13. What do you mean by resonance?
14. Define intensity of sound.
15. Define loudness of sound.

5 Marks

1. What do you mean by Distortion factor meter, explain briefly.
2. State and explain about vacuum.
3. Explain about pumping speed and pump down time.
4. State and explain Rotary pump
5. State and explain Diffusion pump
6. State and explain Molecular pump
7. Explain briefly about detection leakage.
8. Derive equation for Simple harmonic motion
9. Discuss about Intensity and loudness of sound, Decibel, Intensity levels.
10. Discuss briefly about Acoustics of buildings

10 Marks

1. How production of signal has done? explain briefly about generators.
2. Explain working principle of digital multimeter with block diagram

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

2020-21

BSc V Semester

MODERN PHYSICS –DSC-PHY-505A

Classical mechanics, Relativity & Quantum mechanics

2 mark questions: Classical mechanics

1. A system of 5 particles moves in a plane. Then what will be the number of degrees of freedom?
2. Calculate the number of degrees of freedom of a system of five particles subjected to two constraints.
3. What are the numbers of degrees of freedom of a system of N particles subjected to K constraints?
4. Calculate the number of degrees of freedom for a system of 12 particles subjected to 3 constraints.
5. What is scleronomic constraint? Give an example.
6. Name the constraints which are independent of time.
7. Calculate the number of constraints, if the number of degrees of freedom for a system of 5 particles is 12.
8. What do you mean by configuration space?
9. Name the constraint which may be expressed in the form of an equation relating the co-ordinates of the system and the time.
10. What is kind of constraint of a particle restricted to move on the surface of sphere without slipping? Justify.
11. Name the constraint involved in the motion of a particle in a spherical container.
12. In which frame of reference Classical mechanics holds good.

13. Which are forms of the Lagrangian equations?.
14. What are generalised co-ordinates?
15. What are virtual displacements?
16. What are constraints?
17. State D Alembert's principle.
18. State the principle of virtual work
19. Write an expression for a generalised force.
20. What is an inertial frame of reference?
21. Find the Lagrangian function at an instant for which the kinetic energy and potential energy of the system are 80J and 20J respectively.
22. What kind of constraint is involved in the motion of a bob of simple pendulum?
23. What kind of constraint is involved in the motion of a bob of simple pendulum with a fixed length of pendulum?
24. What kind of constraint is involved in the motion of particle in an expanding air bubble?
25. What are the consequences of two body force problem?
26. Write Lagrangian equations of motion of a body under central force.

Relativity

1. State postulates of special theory of relativity.
2. What is Lorentz – Fitzerald contraction?.
3. What is an ether medium?.
4. What is time dilation?.
5. Mention Lorentz Transformations.
6. Calculate the energy due to the conversion of 1kg mass into energy.
7. Define amu and eV.
8. Compute the apparent length of a metre rod moving with a velocity of c/2 along its length.
9. How a sphere moving with a relativistic speed with respect to an observer appear?
10. What is an inertial frame of reference?
11. A body of rest mass m_0 is moving with a velocity of ($\sqrt{5}$ c/3), where c is the velocity of light. Calculate its mass.

Quantum mechanics

1. What is Compton effect?
2. What is the importance of Compton effect?
3. Why is Compton effect observed for X-rays and not observed for visible rays?
4. Calculate Compton shift for a photon scattered through an angle of 90˚.
5. Why the wave nature of matter is not apparent in our daily life?
6. Which experiment confirms the wave nature of electrons.
7. An electron and proton have same de Broglie wavelength. Which one will move faster? Why?
8. Why the concept of trajectory in phase space has no meaning in quantum mechanics?
9. The period of harmonic oscillator in its ground state is 2.2 ms. Find the zero point energy.
   (Given h = 6.625 x 10^{-34} JS)
10. Calculate change in wavelength when the recoil electron has maximum kinetic energy.
    (Given h = 6.625 x 10^{-34} JS, electron mass = 9.1 x 10^{-19}Kg)

11. A photon recoils back after striking an electron at rest. What is the change in the wavelength of the photon?
12. A microscope using photons is employed to locate an electron in an atom to within a distance of 0.1 Å. What is the uncertainty in the momentum of electron located in this way?
13. State Heisenberg's Uncertainty principle.
14. Write orthonormality condition of wave function.
15. State de Broglie hypothesis.
16. What are matter waves?
17. What is de Broglie wavelength of an electron of energy 100 eV?
18. What are the eigen values and eigen functions?
19. What is zero-point energy?
20. Why is it important for a wave function to be normalized?
21. Calculate the wavelength associated with 20 eV photon.

22. What is the de Broglie wavelength of an electron which has been accelerated from rest to a p.d of 100 volt?.

23. If the uncertainty in the position of an electron is $4X10^{-10}$ m, calculate uncertainty in its momentum. Given $h=6.625X10^{-34}$ J-s

24. Give any two properties of wave functions.

5 mark questions:

Classical mechanics

1. What are constraints? Explain the different types of constraints with one example in each case.
2. State and explain the principle of virtual work.
3. Set up an equation of motion for harmonic oscillator using Lagrangian equation.
4. State and explain D Alembert's principle.
5. Define generalised co-ordinates and obtain an expression for the generalised virtual displacement.
6. Obtain an expression for generalized velocity.
7. Obtain an expression for generalised Kinetic energy.
8. Obtain an expression for generalised force.
9. Set the Lagrangian & hence set an equation for the electrical circuit containing capacitor and inductor.
10. State and derive Kepler's second law of planetary motion.
11. State and prove Kepler's third law of planetary motion
12. Explain how a two body central force problem can be reduced to single body problem.
13. The period of earth is 365.25 days and that of venus is 224.7 days. Find the ratio of the major axes of their orbits.
14. Show that the generalized force need not always have the same dimension.
15. What are constraints? Explain holonomic and nonholonomic constraints with one example each.
16. Obtain an equation for the orbit of a particle under the action of a central force.

Relativity

1 .Deduce Lorentz transformations by using postulates of special theory of relativity.
Obtain an expression for length contraction.

2. Derive an expression for the relativistic length using Lorentz transformation equation.
3. Obtain an expression for length contraction.
4. Obtain the relativistic law of addition of velocities.
5. Derive an expression for the relativistic time using Lorentz transformation equation.
6. Obtain an expression for time dilation.
7. If the mass of a particle in motion is exactly thrice its rest mass, calculate the velocity of a particle.($c=3x10^8 m/s$).
8. Two spaceships X and Y are moving in opposite directions each with a speed of $2.4x10^8 ms^{-1}$. Find the relative speed of Y with respect to X, given the velocity of light=$3x10^8\ ms^{-1}$.
9. An observer on earth measures the length of a moving spaceship to be exactly $1/4^{th}$ of its rest length. Calculate the speed of spaceship and time dilation corresponding to 2 second on spaceship.
10. An aeroplane is moving with a uniform velocity 600 mst wrt earch, By what fraction of its rest length will appear to be shortened to an observer on earth?
11. An observer an earth measures length of a moving spaceship to be exactly half its rest length. Calculate the speed of spaceship and time dilation corresponding to 1S on spaceship.
12. If the total energy of a particle is exactly thrice its rest energy, What is the velocity of a particle?
13. What is the length of a metre rod moving parallel to its length, when its mass is 3/2 of its rest mass?
14. How the negative result of Michelson's Morley experiment is explained by means of Lorentz-Fitzgerald contraction hypothesis?
15. The paper mean life of pion is $2\text{-}5x10^{-8}$. What would be the mean life of a beam of a these pions travelling with a speed of a 0.73 c? Calculate the distance travelled during one mean life time.

Quantum mechanics

1. Illustrate Uncertainty principle using Gamma ray microscope.
2. Describe diffraction of electrons at a single slit.
3. Write the properties of wave function.
4. Give physical significance of wave function.
5. State de Broglie hypothesis and derive an expression for de Broglie wavelength.
6. Derive an expression for the energy of a particle in one dimensional box.

7. Describe Davisson and Germer experiment to study matter waves.
8. Derive an expression for the energy of a particle in one dimensional infinitely deep potential well.
9. Discuss Compton scattering qualitatively and write the expression for Compton shift.
10. Give the physical significance of wave function and zero point energy.
11. X-rays of wavelength 0.5Å incident on few stationary electrons are scattered at 90˚. Calculate the Compton shift and the direction of the recoil electron.
12. An electron in ground state is moving in an infinitely deep potential well of width 20Å. Find the probability of finding electron at the centre around 2Å distance.
13. The photon is confined to a nucleus of radius $5x10^{-15}$m. Calculate the minimum uncertainty in (i) momentum; (ii) K.E. of the photon.
14. A beam of mono-energic neutrons corresponding to 27˚C is allowed to fall on a crystal. A first order reflection is observed at a glancing angle 30˚. Calculate the inter planar spacing of the crystal. Given that h = 6.625 x 10^{-34} JS, mass of neutron m_n= $1.67x10^{-27}$Kg and Bolzmann constant k=$1.38x10^{-23}$ J/K.
15. An electron is bound by a potential which closely approaches in infinite squre well of width $2.5x10^{-10}$m. Calculate the lowest three permissible quantum energies the electron can have.
16. The energy of a linear harmonic oscillator in its third excited state is 0.1eV. Calculate its frequency.
17. In Davison and Germer experiment, electrons are accelerated to a pd of 55V and get reflected at 50° in the 1st order. Calculate the wavelength of these electrons. What would be the pd if electrons are reflected at 48° in the second order (Given d= 2.2Å)
18. X-rays of wavelength 0.5Å are incident on free stationary electrons and get scattered directly backwards. Calculate the wavelength of scattered X-rays.

10mark questions:

Classical mechanics

1. What are generalized coordinates? Obtain an expression for generalized potential.
2. State Kepler's laws of planetary motion. Deduce Kepler's third law of planetary motion.
3. Using D'Alembert's principle derive Lagrangian equation of motion.
4. State and explain the principle of virtual work. Hence arrive at D'Alembert's principle.
5. Set up the Lagrangian equation for a particle moving in central force field. Show that the total energy of a particle moving in a central force field remains constraint.

6. Reduce two-body central force problem to an equivalent one body problem and hence derive an expression for total energy of the system.
7. Obtain the expressions for a) Generalised Kinetic energy b) Generalised Potential energy.
8. State Kepler's laws of planetary motion. Deduce Kepler's first law using Lagrangian equation.
9. Setup Lagrangian equation for :
   a) Linear harmonic oscillator b) Electrical circuit consisting of an inductor and a capacitor.
10. State Kepler's laws of planetary motion. Derive Kepler's second law of planetary motion.
11. Obtain equations of motion of a body under the action of a central force.
12. Deduce an expression of the reduced mass of two body force problem & Hence explain the following a) Revolution of planets around sun b) Falling of a stone on earth.
13. Deduce an expression for the orbit of a particle under the action of a central force & hence explain different types of orbits.

Relativity

1. Explain with relevant theory, Michelson Morley experiment.
2. Deduce an expression for the relativistic mass & show that rest mass is least.
3. Obtain an equation for the orbit of a particle under the action of a central force & Explain different types of orbits.
4. State & Prove Einstein's mass-energy equivalence. Give examples
5. Obtain the relativistic law of addition of velocities. Show that no object can travel with a velocity greater than that of light.
6. Derive Einstein's mass-energy relation. What is its physical significance?.

Quantum mechanics

1. State and explain uncertainty principle. Illustrate the principle with Gamma ray microscope.
2. Derive an expression for energy of a particle in one dimensional box.
3. Deduce the time independent Schrödinger's wave equation
4. Write Schrödinger's time independent wave equation for a particle. Explain the physical significance of wave function, eigen function and eigen values. What is the concept of zero point energy?
5. Write Schrödinger's wave equation for a linear harmonic oscillator and hence show that its

energy is quantized. Explain the concept of zero point energy.

6. Write Schrödinger's wave equation for a linear harmonic oscillator. Write the expression for its energy levels. Show that its energy is quantized.
7. What is Compton effect ? Derive an expression for Compton Shift.

8 a. Write a note on eigen functions and eigen values.

b. Discuss the permitted energy levels of a linear harmonic oscillator.

9. Develop the time independent Schrödinger's wave equation. What are the conditions that must be satisfied by the solution of the above wave equation.

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

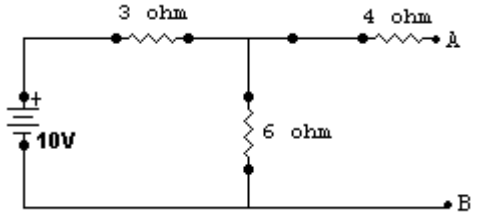
2020-21
Department of Physics

B.Sc V Semester Paper –II Question Bank

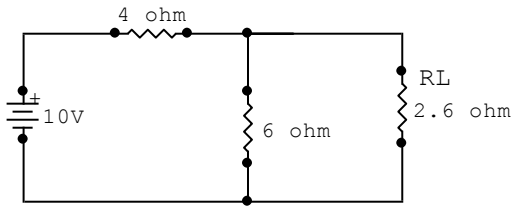
Unit I: Electronics and communication

Two Marks Questions

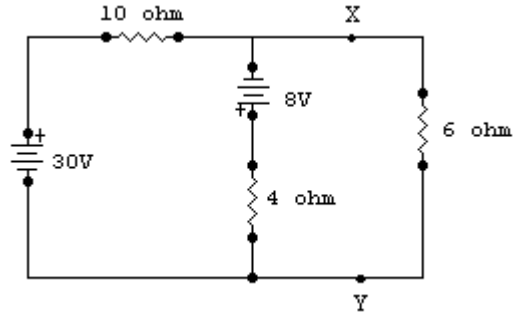
1. State superposition theorem.
2. State Thevenin's theorem.
3. State Norton's theorem.
4. State Maximum power transfer theorem..
5. When is the maximum power delivered? Write an Expression for maximum power.
6. What is meant by voltage source?
7. What is meant by current source?
8. Draw the symbol of ideal voltage ac source .
9. Draw the symbol of ideal current ac source .
10. Draw the symbol of ideal current dc source .
11. Name the devices whose characteristics are close to that of an ideal current and voltage source.
12. Draw the symbol of ideal voltage dc source.
13. Using Thevenin's theorem, find the voltage across AB in the circuit given below.



14. Find the Norton's current for the following circuit



15.Using *Milliman's* theorem, find the voltage across XY terminals in the circuit given below.



1. A constant source applied a current of 300 mA to aload of 1K ohm when the load is changed to 100 ohm , What will be the load current
2. Draw the Norton's equivalent circuit
3. Draw the Thevenin's equivalent circuit
4. What is power supply?
5. Mention the constituents of the power supply
6. Draw the circuit diagram IC based regulated power.
7. Define rectification.
8. What is rectifier?
9. Define efficiency of a rectifier.
10. Define ripple factor of a rectifier.

11. What do you mean by regulation?
12. What is PIV?
13. In bridge rectifier input is from 230V, 50Hz what is the D.C. output voltage & peak Voltage
14. Sketch the input & output waveforms in case of half wave rectifier.
15. Sketch the input & output waveforms in case of full wave rectifier.
16. Sketch the input & output waveforms in case of bridge rectifier.
17. Draw the circuit diagram of. half wave rectifier
18. Draw the circuit diagram of. full wave rectifier.
19. Draw the circuit diagram of. bridge rectifier
20. Give advantage of half wave rectifier
21. Give advantage of full wave rectifier.
22. Give advantage of bridge rectifier
23. Give demerits of half wave rectifier
24. Draw the circuit diagram IC based regulated power supply
25. what are the advantages of IC regulator over Zener as a voltage regulator
26. why Zener diode is called voltage reference source.
27. what is Zener diode draw the symbol?
28. Draw the equivalent circuit of Zener diode
29. what is voltage regulation?
30. write the expression for percentage voltage regulation
31. Which characteristic of a diode is responsible for the rectification?
32. Name the active component used for rectification
33. What is power supply? Mention the constituents of power supply
34. Define rectification
35. Show that maximum rectification efficiency of a half wave is 40.6%
36. Show that maximum rectification efficiency of a full wave is 81%
37. Explain why we need filters in power supply
38. when do we prefer inductor, filter?

39. Why is capacitor input filter preferred over choke input filter
40. How is the rippel reduced to using a capacitor filter
41. How is the rippel reduced to using a inductor filter
42. How is the rippel reduced to using a LC filter
43. what is transistor?
44. What is Transistor ? Mention the types with symbols representation.
45. Write the current equation and explain the terms.
46. Sketch the typical input & output characteristics of polar transistor. When connected in CE configuration.
47. Obtain the relation between α and β of a transistor.
48. Explain why CE configuration is most popular in amplifier circuit?.
49. What are the hybrid parameters
50. A transistor has β=150, Calculate the approximate collector & base current, if the emitter current Ie=12mA
51. If for the transistor α=0.95 & I_E=1mA. Find the values of I_C & I_β
52. Name the different configuration for the transistor.
53. In CE connected transistor has β=100, I_B =50µA. Compute the values α, IC & IE
54. Name the h-parameter for transistor IA CE mode.
55. Define input impedance of a transistor in CE mode.
56. Define output admittance of a transistor in CE mode
57. Define reverse Current gain of a transistor in CE mode
58. Define forward voltage gain of a transistor in CE mode
59. Define Draw the circuit diagram of emitter follower.
60. Why common collector configuration is called emitter follow?
61. What is field effect transistor?
62. Name the parameter of FET.
63. Write the expression for Drain resistance in case of FET.
64. Write the expression for Tran conductance in case of FET.

65. Write the expression for amplification factor in case of FET
66. Draw the symbol of NPN & PNP transistor & specify the leads
67. Name the 3 possible transistor configuration
68. Why is collector wider than emitter & base?
69. Why is collector is less than emitter current?
70. Why is base made thin?
71. What is faithful amplification?
72. What do you understand by transistor?
73. Find the value of β if 1. α=0.9 , 2. α=0.98
74. Calculate emitter current in a transistor for which β=50 & I_b=20μA
75. Sketch the small signal h-parameter equivalent circuit of a transistor amplifier in CE mode.
76. Explain the function of the coupling capacitor in common emitter amplifier circuit
77. Explain the function of bypass capacitor in common emitter amplifier circuit.
78. Why common collector amplifier is called as emitter follower?
79. Write the special features of CE amplifier.
80. Write the special features of CC amplifier.
81. Define current gain or current amplification Ai of an amplifier.
82. Define voltage gain of an amplifier.
83. Define power gain of an amplifier.
84. What is meant by an frequency response of an amplifier circuit'
85. Draw frequency response curve for CE amplifier transistor and mark upper and lower half power frequency.
86. The CE amplifier is supposed to be a best amplifier among the three configurations. Give reason
87. Define bandwidth.
88. What is FET?

89. Why FET is called a unipolar transistor?
90. Mention types of FETs.
91. Why is the input impedance of a FET higher than of an ordinary transistor?
92. Why does a FET have low noise level?
93. Why is the input impedence of a MOSFET higher than that of a FET?
94. Why is MOSFET useful in frequency applications?
95. In a FET a change in gate voltage of 0.1V causes a change of 0.3mA is drain current. What is the transconductance?
96. A FET has an amplification factor of 50. What does it mean?
97. A FET has an amplification factor is 10k ohm and transconductance of 3000μmhos. What is its amplification factor?
98. In FET a change in drain voltage of 2V produces a change in drain current of 0.02ma. What is the ac drain resistance?
99. When the gate to source voltage (VGS) of a FET changes from -3.1V to -3V the drain current (ID) changes from 1mA to 1.3mA. What is the value of transconductance.
100. What is a Feedback?
101. Mention the type of feedback.
102. Define negative feedback.
103. Define the positive feedback.
104. Mention the disadvantage of positive feedback in amplifier with a negative feedback
105. Write down the equation of voltage gain of amplifier with a negative feedback.
106. What will be the effect of negative feedback on the gain of an amplifier.
107. What will be the effect of negative feedback on input impedence amplifier.
108. What will be the effect of negative feedback on output impedence amplifier?
109. Which type of feedback is used in oscillator?

110. When does a transistor amplifier acts as an oscillator?
111. Write down the condition for sustained oscillation.
112. What is the Barkhausen criterion for sustained in oscillation.
113. What is function of feedback network in basic network.
114. What are the fundamental assumptions made for feedback amplifier.
115. Mention the general properties of negative feedback.
116. Give the advantages of negative feedback.
117. What type of feedback is used in emitter follower circuit?
118. Write the expression of frequency for sustained oscillation in case Hartely oscillator.
119. Write the expression of frequency for sustained oscillation in case Wien Bridge oscillator.
120. Mention advantages and disadvantages of Wein bridge oscillator.
121. The Hartley oscillator has frequency of 4000KHz the capacitance 100pF. Find the self-inductance of the coil neglecting the mutual inductance between the two portions of the coil.

Unit II Digital Electronics

122. What are logic gates?
123. Mention special features of Boolean algebra
124. What is truth table?
125. What do you mean by universal gates?
126. Why NAND and NOR gates are called universal gates?
127. Draw the logic symbol of basic gates.
128. Draw neat circuit diagram of a two input diode AND gate.
129. Draw neat circuit diagram of a two input diode OR gate.
130. Draw neat circuit diagram of a two input diode NOT gate.
131. Draw neat circuit diagram of transistor as an inverter.

132. Write the truth table for three input OR gate.
133. Write the truth table for three input AND gate.
134. Mention the importance algebraic properties of XOR gate.
135. Why XOR gate is called or odd number 1's detector?
136. Why XNOR gate is called or even number 1's detector?
137. Implement XOR gate using basic gates.
138. What is timing diagram?
139. What do you mean by positive logic?
140. What do you mean by negative logic?
141. Implement Y= A+B C using basic gate.
142. Prepare truth table for Y= A+B C
143. State De-Morgan's theorem.
144. What Boolean algebra?
145. Two electric signals represented by 101101001 and 111001101 are applied to OR gate. Draw the output timing diagram.
146. Implement Y=A B +C D by using NAND gates only
147. Find the decimal equivalent of a) $[4\ A]_{16}$ b) $[10110]_2$
148. Find binary equivalent of a) $[29]_{10}$ b) $[0.62]_{10}$
149. Find the hexa-decimal equivalent of a) $[93]_{10}$ b)$[110110.0110101]_2$
150. What is the decimal equivalent of $[25]_8$
151. What is the decimal equivalent of $[AB]_{16}$
152. What is the binary equivalent of $[DAD]_{16}$
153. Name the different number systems
154. What is binary number system?
155. W hat is octal number system?
156. What is Hexa number system?
157. How many basic digit are present in the hexa decimal number system?write them.
158. What is the most significant digit in a number system?

159. What is the least significant digit in a number system?

Unit –III Modulation

160. what is ionosphere ? Mention its different layers .
161. What is virtual height?
162. What is critical frequency?
163. What is maximum usable frequency?
164. What is skip distance?
165. State secant law.
166. What is modulation? Why is it needed?
167. What is Amplitude modulation?
168. What is frequency modulation?
169. What is Phase modulation?
170. For an amplitude modulated carrier waves, the maximum & minimum amplitudes are 600 mv & 200 mv respectively, calculate the modulation index.
171. The carrier power radiated from the transmitter is 50 KW & fully modulated. What is the power in the side band?
172. A 100 KHz carrier is amplitude modulated with 1500 Hz audio signal. What are the upper & lower side band frequencies?
173. A sinusoidal carrier voltage of frequency 10 MHz & amplitude 200 V is amplitude modulated by sinusoidal voltage of 10 KHz producing 40% modulation. Calculate the band width & amplitude of each side band.
174. What is modulation? What are the types of modulation?
175. What is side band? What are the types of sidebands?
176. What is Band width? Write the expression for band width.
177. What is modulation index in AM Wave?
178. What are the main functions of IF amplifier in super heterodyne receiver?

179. What is super heterodyne reciever?
180. Give the principle of super heterodyne receiver.
181. Name the different blocks of super heterodyne receiver.
182. Explain the working of mixer in super heterodyne reciever?
183. What are the draw backs of AM technique?
184. What is efficiency of transmission in AM Wave?
185. What is frequency modulation?
186. What is frequency deviation? When does the frequency deviation become Maximum?
187. What is modulation index in frequency modulation.
188. What are the advantages of FM over AM?
189. What is phase modulation?
190. What is Linear detecter?
191. What is Square law detecter?
192. What is Demodulation?
193. Explain the square law detection.
194. What is demodulation? Why is it required?
195. Draw the Circuit diagram of AM diode detector.
196. A 100 KHz carrier is amplitude modulated with 1000 Hz audio signal. What are the upper and lower side band frequencies?
197. Write the expression for a) The instantaneous voltage of AM Wave b) The relation between total power and carrier power of an AM Wave.
198. Draw the circuit diagram of AM diode detector
199. What is the importance of side bands in AM technique?
200. Draw the frequency response curve of balanced slope detector.
201. The maximum frequency deviation of an FM signal is 10 KHz. The maximum modulating frequency is 3.33KHz. Find deviation ratio.
202. The total AM signal power is 2800 W the carrier power is 2000W. Find the modulation index.

203. Give any two flow chart symbols.
204. What is computer?
205. Define programme in C- language.
206. What are flow charts? Give their symbols.
207. What is data?
208. Variable means what?
209. Name the types of variables.
210. Give the Essential features of program.
211. What is the importance of header files?
212. Name the basic input/output statement functions.
213. When void main () is used in C Programming ?
214. What is source file ?
215. Write any two features of C language
216. List the various compilers available in C
217. What is necessity of an Operating System for C program ?
218. What are special characters in C ? Give any two.
219. List out the four basic data types in C.
220. List the four basic types of constants in C.
221. Identifiers and keywords means what?
222. Give the structure of a simple C Program.
223. Give the syntax of increment and decrement operaters in C.
224. Give the syntax of IF – ELSE statement in C.
225. What is algorithm? Is it essential to write programme?

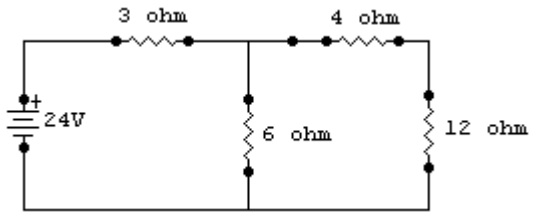
226. List the logical operators in C .Write their meanings.
227. How do you separate set of expressions of a C program ?Write an example.
228. Give the difference between while – do and do-while loop.
229. Write the declaration statements for the following

    Integer variables : X ,Y, Z

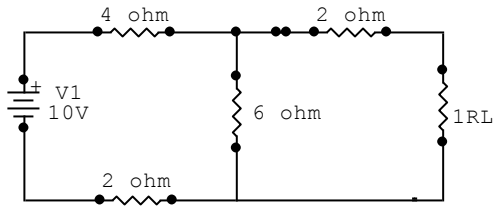
Floating point variable:p,q

5 mark questions

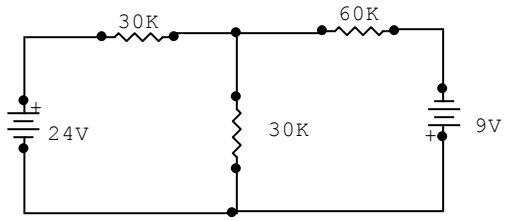
1. Sate and explain Thevenin's theorem.
2. State and explain Norton's theorem.
3. State and explain superposition theorem.
4. State and explain Maximum power transfer theorem.
5. Using Norton's theorem, calculate the current following through 12Ω resistor shown in fig. Given below



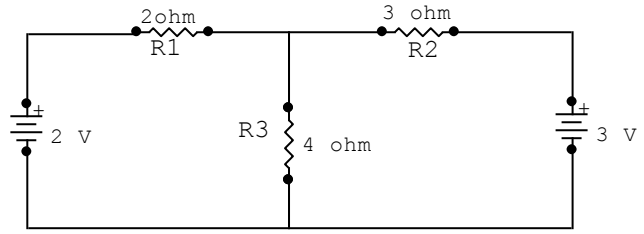
6. In the circuit given below compute the value of load resistance for maximum power transfer theorem and also calculate max power delivered.



7. Calculate current in each branch of the network shown below and verify using superposition theorem



8. In a circuit given below calculate the current through resistance R_3 using superposition theorem



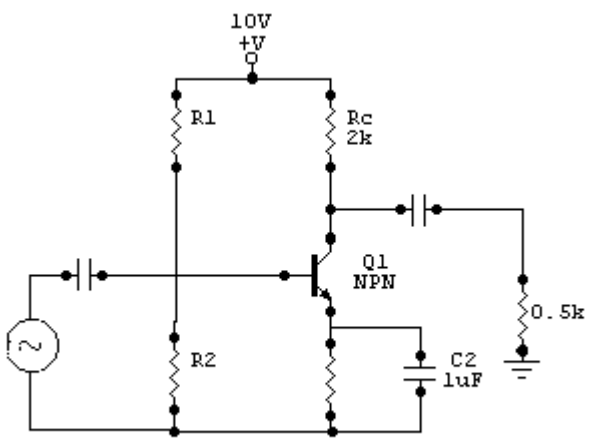
1. Explain the action of diode as a half wave rectifier.
9. Explain the action of diode as a full wave rectifier
10. Explain the action of diode as a Bridge wave rectifier
11. Derive an expression for efficiency of half wave rectifier.
12. Derive an expression for efficiency of half wave rectifier
13. Derive an expression for efficiency of full wave Bridge rectifier.
14. Obtain a ripple factor of a half wave rectifier.
15. Give Comparision between, half wave and full wave and full wave Bridge rectifier.
16. Explain zener breakdown and avalanche break down.
17. Draw and explain characteristics of zener diode
18. Explain the working of capacitor filter.
19. Explain the choke input filter with neat diagram.
20. Describe the working of capacitor input filter or π- filter.
21. What are like L- section filter? Explain the working of it.
22. Explain the working of shunt capacitor filter with neat circuit diagram.
23. Why we need filter in power supply? What or meant by regulation of a power supply?
24. Explain with circuit diagram the working LC choke input filter. π-section filter and explain the ___ of bleeder resistor in the choke input filter.

25. In a center tap full wave rectifier the load resistance RL=3kΩ voltage across the half the secondary winding or 230 sin 314 t.

Find i. Peak value of the current. ii. The dc or avg value of current.

iii. rms or avg value of current. Iv. Ripple factor and the rectification efficiency.

26. What are hybrid parameter? Define hie, hoe hfe a hre of a transistor in CE-configuration.
27. With neat circuit diagram explain the working of emitter follower.
28. With neat circuit diagram explain the working Hartley oscillator. Write expression for frequency relation.
29. With neat circuit diagram explain the working Wein Bridge. Oscillator and write expression for frequency relation.
30. Find the frequency of Astable. Multivibrator based on IC-555 Timer with (R_1= Twice the R_2) = $R_1=2R_2$ Where R1=3.9kΩ C=530 nf.
31. With neat circuit diagram describe the working of a single stage RC coupled amplifier.
32. An amplifier when loaded with by 2kohm resistor has a voltage gain of 80 and a current gain of 120.Determine the necessary signal voltage and current to give an output voltage of 1V.What is the power gain of the amplifier?
33. In a transistor amplifier if Rc=10kohm $_{RL}$=10kohm Rin=2.5kohm β=100.Find the output voltage for an Input voltage of 1mV r.m.s
34. In the circuit diagram in fig below.Find the voltage gain given β=60 & Rin=1kohm.



35. In the transistor amplifier find the output voltage if I/P resistance is Rin= 0.5kohm, β=50 Vin=1mV, R1=10kohm, R2=3kohm, RE=3kohm, RL=6kohm $R_{C=}$2Kohm.
36. Draw the freq response of an CE amplifier and state reasons for its shape at mid – band frequency ,low frequency and high frequency region.
37. Draw the freq response of an CE amplifier and state reasons for its shape at mid – band frequency ,low frequency and high frequency region.

    Explain the construction of FET.

38. Explain the working of FET.
39. What is the difference between FET and a bipolar transistor?
40. How do you determine drain characteristics of FET?
41. Define the FET parameters and establish relation between them.
42. Describe practical applications of FET.
43. Explain the construction of MOSFET.
44. Explain the working of MOSFET.
45. The RC network of the Wein bridge oscillator consists of capacitors and resistors of values C1=C2=250μF and R1=R2=220Ω. Determine frequency of oscillation.
46. Explain the general theory of feedback (or principle of feedback).
47. Sketch the four basic feedback connections and explain them.
48. List the properties of negative feedback.
49. List the advantages of negative feedback.
50. Derive an expression for input impedance of a feedback amplifier.
51. Prove that output impedance reduces due to negative feedback.
52. Show that negative feedback in amplifier decreases lower cutoff frequency.
53. Show that negative feedback in amplifier increases upper cutoff frequency.
54. Show that negative feedback in amplifier increase bandwidth.

55. Explain Barkhausen's criterion for sustained oscillation.
56. The overall gain of an amplifier is 140.when negative feedback is applied, the gain is reduced to 17.5.find the fraction of output that is feedback to the input.
57. When negative feedback is applied to an amplifier of gain 100, the overall gain falls to 50. Calculate
58. The fraction of output feedback.
59. If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain is to be 75.
60. With a negative feedback amplifier gives an output of 10V with an input of 0.5V. When feedback is removed it requires 0.25V input for the same output. Calculate (i) Gain without feedback (ii) β.
61. An amplifier with negative feedback has voltage gain 100. It is found that without feedback an input 50mA is required to produce a given output, where as with feedback, input signal must be 0.6V for the same output. Calculate the A_V and β.
62. An amplifier has bandwidth 20KHz and voltage gain 40. Compute the bandwidth and gain if a negative feedback of 1% is given to this amplifier.
63. An amplifier has bandwidth 20KHz and voltage gain 40. Calculate the bandwidth and voltage gain after a negative of 2% is supplied to this amplifier.
64. State & prove Thevenin's theorem
65. State & prove Norton's theorem
66. State & prove Superposition theorem
67. State & prove Maximum power transfer theorem
68. Write a note on Number system
69. Explain the procedure to convert decimal integer to any other base with example

70. Explain the procedure to convert binary integer to any other base with example
71. Explain the procedure to convert binary fraction to any other base with example
72. Explain the procedure to convert hexa decimal fraction to any other base with example
73. Discuss the laws of Boolean algebra
74. State & explain the concept of duality principal with example
75. What is Boolean algebra? Discuss 3 boolean operators
76. What is AND gate? Explain the concept of AND gate using switching circuit
77. With neat circuit diagram explain the working of 2 input diode AND gate
78. What is OR gate? Explain the concept of OR gate using Switching circuit, draw truth table & graphic symbol
79. With neat circuit diagram explain the working of 2 input diode OR gate
80. What is NOT gate? Explain the concept of NOT gate using Switching Circuit draw the truth table & graphic symbol
81. What is NAND gate? Explain the concept of NAND gate using Switching Circuit draw the truth table & graphic symbol
82. What is NOR gate? Explain the concept of NOR gate using Switching Circuit draw the truth table & graphic symbol
83. Write a note on XOR gate
84. Write a note on XNOR gate
85. Why NAND gate is called universal gate? Justify with 2 examples
86. Why NOR gate is called universal gate? Justify with 2 examples
87. State & prove anyone Demorgan's theorem. Explain circuit implications
88. With neat circuit diagram explain the principle of RTL NOR gate
89. With neat circuit diagram explain the principle of DTL NAND gate
90. With neat circuit diagram explain the principl of TTL NAND gate

91. Draw neat functional diagram of 555 Timer as astable multi vibrator & explain its working
92. Draw neat functional diagram of 555 Timer as monostable multi vibrator & explain its working
93. Discuss the construction & working of half adder.
94. Discuss the construction & working of full adder.
95. Obtain the expression for amplitude modulated wave. And the expression for original carrier wave, upper side and lower side frequencies.
96. What are the differences between AM & FM?
97. The r. m .s. value of carrier voltage is 100 V after amplitude modulation by a sinusoidal voltage. The r. m. s. value becomes 110 v. Calculate the modulation index. If modulations index is 0.5, what fraction of total power is carried by side-bands.
98. Explain frequency modulation. What are its advantages over AM?
99. Explain amplitude modulation frequency spectrum..
100. A frequency-modulated wave is represented by the equation.
    a. $e = 10 \sin (8x 10^8 t + 4 \sin 1200 t)$
    b. Calculate i) Carrier frequency ii) Modulating frequency iii) Modulation index ; & iv) Maximum deviation
101. Write a note on frequency modulated transmitter.
102. A Carrier of frequency 3 MHz & amplitude 110 Volts is amplitude modulated by a signal of frequency 12 KHz producing 60% modulation. Calculate the frequency & the amplitude of the upper & the lower side bands.
103. A Carrier of frequency 12 MHz & amplitude 120 Volts is amplitude modulated by a signal of strength 10 KHz. if the amplitude of each side band is 25 Volts, find the i) modulation index. ii) The frequency of USB & iii) frequency of LSB.

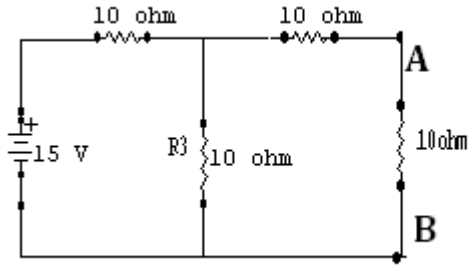
104. The carrier power radiated from the transmitter is 75 KW. If the percentage of modulation is 48, calculate the total power.
105. What are frequency modulation & the phase modulation?
106. The load current in the transmitting antenna of an un modulated AM transmitter is A. What will be the antenna current when the modulation is 35%.
107. What is the Power developed by an amplitude modulated wave in a load of 60 Ω when the peak voltage of the carrier is 100 V & the modulation index is 0.5
108. A Carrier Wave of power 400 watts is amplitude modulated to a depth of 100%. Find the power of the modulated wave & also in side bands.
109. The load current in the transmitting antenna of an unmodulated AM transmitter is 8A what will be the antenna current when the modulation is 40%.
110. An amplitude-modulated carrier wave has the maximum & the minimum amplitude is 170 mv & 250 mv respectively. Calculate the modulation index & the percentage modulation.
111. A FM wave represented by the voltage equation V = 16 Sin (4 x 10^7 t + 6 Sin 200 t) Find the carrier & modulating frequencies, the modulation index & the maximum frequency deviation in the FM. What power will this FM voltage dissipate in a 12Ω resistor.
112. A Carrier voltage of frequency 2 MHz & amplitude 100 Volts is amplitude modulated by a signal frequency 10 KHz, producing a 50% modulation. Calculate the frequency & amplitude of the upper and lower side bands. To get the amplitude of 40 V for the LSB. What is the required modulation index.
113. Find the Carrier frequency modulating frequency. Modulating index and maximum frequency deviation of FM wave giver by the expression
    i. V = 12 cos [6 x 10^8 t + 5 Sin 1250 t]

114. Explain the working of transistor as AM detector with Circuit diagram.
115. A Carrier voltage of frequency 1 MHz & amplitude 50 Volts is amplitude modulated by a signal frequency 5 KHz, producing a 50% modulation. Calculate frequency and amplitude of the upper and lower side band.
116. Define Amplitude modulation. Derive an expression for instantaneous amplitude of AM wave.
117. Define modulation index. Derive an expression for modulation index in terms of peak amplitudes of carrier modulating signal.
118. Discuss and compare the merits and demerits of Amplitude modulation technique with that of frequency modulation technique.
119. Define frequency modulation and derive an expression for modulation index. Define deviation ratio.
120. Define phase modulation. Derive an expression for instantaneous voltage of P.M
121. Distinguish between machine language and high level language.
122. With necessary block diagram describe the functions of Input and output units and CPU of a computer system.
123. Write the symbols of Flow charts, draw the flow chart to find the largest among three numbers.
124. When do you prefer if-else statement? Differentiate it with for loop statement with suitable flowchart.
125. Give the syntax and Flow chart for if and if-else statement in C language.
126. Write the important characteristics of C language .
127. Write the Basic Structure of C program explain each part .
128. Explain the difference between while and do-while loops with respect to the minimum number of times the body is executed.
129. Write a C Program to compute the roots of a quadratic equation
130. Write a C Program to show the year given is leap year.

Ten Marks Questions.

1. State and prove maximum power transfer theorem Obtain the expression for maximum power and explain load matching
2. State and prove superposition theorem
3. a) State and explain Norton's theorem.

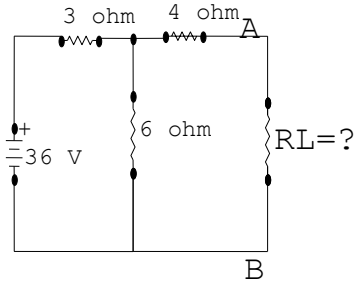
   b) In circuit diagram given below find load current load voltage using Norton's theorem and also draw Norton's circuit



4. State and prove Thevenin's theorem. Draw equivalent circuit
5. How can be a star network converted into a delta network and delta network into a star network?
6. a) State and explain superposition theorem.

   b)Calculate current through each branch and verify using superposion theorem.
7. a) State and explain Maximum power transfer theorem.

   b). In the circuit shown below find value of load resistance R_L and maximum power delivered.



9. Describe construction and working of half wave rectifier and obtain expression for
   a) Average dc current b) rms value of current c) efficiency of the circuit.
10. Discuss the construction and working of half wave rectifier Derive an expression for efficiency and ripple factor.
11. Describe construction and working of full wave rectifier and obtain an expression for
   a) Average dc current b) rms value of the current c) efficiency
12. Describe construction and working of bridge rectifier and obtain an expression for a) Average dc current b)rms value of the current c)efficiency
13. a) . why we need filter in a power supply?
   b) explain the term percentage voltage regulation.
   c) explain with neat circuit diagram working of LC section filter.
14. a) . why we need filter in a power supply?
   b) explain the term percentage voltage regulation.
   c) explain with neat circuit diagram working of π section filter.
15. a) what is a zener diode
   b) with neat circuit diagram explain the characteristic of zener diode.
   c) explain the use of zener diode as a voltage regulator.
16. a)Draw the circuit of a practical single stage transistor amplifier. Explain the function of each component.
   b) What do you understand by ac and dc load lines? How would you construct them on the output characteristics?
17. Obtain expressions 1) input impedance 2) out put impedence 3) current gain 4) voltage gain 5) power gain using hybrid equivalent circuit of single stage CE transistor amplifier
18. Using circuit diagram explain the working of a single stage RC coupled CE amplifier. Discuss the frequency response curve.
19. .a) What are hybrid parameters?

b) Discribe an experiment to hybrid parameters of transistor in CE mode.

20. a)What is feedback in amplifier.

b) Distinguish between positive feedback and negative feedback

c) Explain the working of emitter follower as an example of negative feedback.

21. Explain the working of Hartley oscillator with necessary circuit. Find the condition for sustained oscillation.

22. (a) State and Explain Barkhausen criterion for sustained oscillations.

(b) Explain the working of phase shift oscillator with a circuit diagram.

23. Explain the phase shift oscillator with necessary circuit. Hence derive an expression for the frequency of oscillation. Obtain the condition for sustained oscillations.

24. (a) Sketch the four basic connections of feedback using block diagrams.

25. (b) Explain the working of tuned collector oscillator with circuit diagram.

26. Explain the construction and working of tuned collector oscillator. Hence calculate the frequency of oscillations. Mention the advantages.

27. a) What is an oscillator? Mention the different types of Oscillator.

28. b) Explain the working of Wein-bridge oscillator

29. Explain the working of Wein-bridge oscillator. Hence find frequency of oscillation. Obtain the condition for sustained oscillations

30. a) What is an oscillator? Mention the different types of Oscillator.

b) Explain the working of Hartlely oscillator

31. Explain the construction and working of FET.

32. What is FET?.mention different types of FET.

b) Describe an experiment to determine different parameters of FET.

c) Define drain resistance, transconductance and amplification factor.

33. What is the difference between FET and a bipolar transistor?

34. Explain the construction and working of MOSFET.

35. How do you determine drain characteristics of FET?

36. Describe practical applications of FET.

38. a. What is an oscillator ? Mention different types of oscillator based on ____

b. Explain Barkhausen criterion for sustained oscillator

39. With neat circuit diagram explain the working_Wein Bridge oscillator.

With neat circuit diagram explain the working Hartely oscillator.

a. What is feedback in amplifier? .

b. Write the distinguish between the negative feedback. And positive feedback.

c. Explain the working of emitter follower as an example of negative feedback.

40. a. With neat circuit diagram FET as an amplifier in common source mode..

b. Explain the working of MOS FET

41. a. What is FET?. Mention different types FET.

b. Describe an experiment to determine different parameters of FET.

c. Define drain resistance, trans conductance & amplification factor of FET

42. With neat circuit diagram, Describe the operation of IC based astable multivibrator.

43. With neat circuit diagram, Describe the operation of IC based bistable multivibrator.

44. With neat circuit diagram, Describe the operation of IC based monostable multivibrator.

45. a. Explain the steps involved converting decimal integer to binary integer and vice versa with two examples.

b. Explain the steps involved converting Hexdecimal fraction to binary faction and vice versa with two examples.

46. What adder? With neat circuit diagram, Explain of half adder and give its truth table.

47. What adder? With neat circuit diagram, Explain of full adder and give its truth table.

48. What a logic family? Mention the different logic families.

49. Explain the working of RTL NOR gate.
50. What a logic family? Mention the different logic families.
51. Explain the working of DTL NOR gate.
52. What a logic family? Mention the different logic families.
53. Explain the working of TTL NOR gate.
54. Draw the logic symbol and truth table for each of the following gates.
    a. Three Input OR gate b. Two Input NAND gate c. Three Input XOR gate.
55. State and prove a. Commutative and Associative property of Boolean algebra
56. Distributive property of Boolean algebra
57. Write a note on Programming languages
58. What are the preliminaries of a programming ? Give an example in C .
59. Explain the role of the initialization, test and update expressions in a for loop .
60. Write a program to accept a string and an integer, and Print the string as many times the integer value.
61. Write a C Program using if else statement to compute the gain of an Inverting and Non-Inverting amplifier using op-amp.
62. A)Explain different types of operator and expressions.
    b) Give the syntax of IF-ELSE and for loop statement.
63. a) Derive an expression of instantaneous Voltage of AM Wave. b) Obtain the relationship between the total power and carrier power of an AM Wave.
64. a) Derive an Expression for instantaneous voltage of an FM Wave.
    b) Obtain the relationship between total power and carrier power of an AM wave.
1. a) Obtain an expression for amplitude-modulated wave.
    b) With a neat circuit diagram, explain the working of balanced slope detector.
66. a) Explain the terms “Modulation and De modulation”? Why are they required?
    b) Explain amplitude modulation and frequency modulation with suitable waveforms.
67. Distinguish between AM & FM. Obtain an expression for the instantaneous Voltage of an amplitude modulated wave

68. Obtain an expression for the instantaneous voltage of i) an amplitude modulated wave ii) an frequency modulated wave.
    a. Derive an expression for the amplitude-modulated voltage.
    b. Draw the circuit of square law diode detector and explain the function of each block.
69. Obtain an expression for the instantaneous voltage of an AM Wave in terms of side bands. Explain output spectrum.
70. Explain the construction and working of square law diode detector.
71. a) .What do you mean by superheterodying?
    b) Draw the block diagram of superheterodyne receiver and explain the each block.
72. a. Explain the steps involved in a decimal interger to binary integer and vice-versa with two example
    b. Explain the steps involved in a hexdecimal fraction to binary fraction and vice-versa with two example
73. What is an oscillator ? Mention different types of oscillators.
    b. Explain Barkhausen criterion for sustained oscillator.
74. With neat circuit diagram explain the working_Wein Bridge oscillator.
75. With neat circuit diagram explain the working Hartely oscillator.
76. a. What is feedback in amplifier .
    b. Distinguish between the negative feedback and positive feedback.
    c. Explain the working of emitter follower as an example of negative feedback._
77. With neat circuit diagram FET as an amplifier in common source mode..
    b. Explain the working of MOS FET
78a. What is FET?. Mention different types FET.
    b. Describe an experiment to determine different parameters of FET.
    c. Define drain resistance, trans conductance & Amplification factor of FET

79. What adder? With neat circuit diagram, Explain of half adder and give its truth table.
80. What adder? With neat circuit diagram, Explain of full adder and give its truth table.
    a. What a logic family? Mention the different logic families.
    b. Explain the working of RTL NOR gate.
81. What a logic family? Mention the different logic families.
82. Explain the working of DTL NOR gate.
83. What a logic family? Mention the different logic families.
84. Explain the working of TTL NOR gate.
85. Draw the logic symbol and truth table for each of the following gates. a. Three Input OR gate b. Two Input NAND gate c. Three Input XOR gate.
86. a.State and prove a. Commutative and Associative property of Boolean algebra
    b. Distributive property of Boolean algebra

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

2020-21

B.Sc. VI SEMESTER-PHYSICS PAPER-II

QUESTION BANK

2 Marks

Unit-I ATOMIC SPECTRA:

1. Write the two drawbacks of Thomson's atom model.
2. Write the postulates of Rutherford nuclear atom model.
3. What are the limitations of Rutherford nuclear atom model?
4. What are postulates of Bohr's atom model?
5. Discuss limitations of Bohr's theory.

   Or

   Discuss shortcomings of Bohr's theory.
6. Name spectral series of hydrogen atom.
7. Name the line and region when an electron jumps from n=4 to n=2 of hydrogen atom.
8. Name the line and region when an electron jumps from n=3 to n=2 of hydrogen atom
9. Write the postulates of Sommerfeld's atom model.
10. What is relativistic atom model?
11. What are the drawbacks of Sommerfeld's atomic model?
12. Mention the new concept introduced in the vector atom model.
13. What do you mean by space quantization?
14. What is spin quantization?
15. In what way Sommerfeld atomic model differs from Bohr's model.
16. Draw the vector diagram of space quantization for 'p' electrons.
17. Draw the vector diagram of space quantization for 's' electrons.
18. Mention the four quantum numbers of vector atom model.
19. What is the limit for number of sub shell in shell?
20. What is the limit for number of electron in shell?
21. State Pauli's exclusion principle.
22. Name any two elements which have single valance electron.
23. What are alkali metals? Give one example.

24. Write any two characteristics of spectra of alkali metals.
25. What are alkaline earth metals? Give one example.
26. Write any two elements which have two valance electrons.
27. Write any two characteristics of spectra of alkaline earth metals.
28. Define Critical potentials.
29. What is excitation potential?
30. What is ionization potential?
31. Write the principle of Franck- Hertz experiment.
32. Calculate the ionization potential of the hydrogen atom taking $h=6.625x10^{-34}$ Js, $e= 1.6x10^{-19}$ C and $m=9.1x10^{-31}$ Kg.
33. Calculate the excitation potential of the mercury atom given the wave length of the emitted radiation, when the excited atom returned to its normal state is 2531Å

VECTOR MODEL OF THE ATOM

34. Draw the vector diagram of LS coupling for two electrons.
35. Draw the vector diagram of jj coupling for two electrons.
36. Mention the expression for magnetic momentum of the electron due to orbital and spin motion.
37. Mention any two differences between LS coupling & JJ coupling

MAGNETIC FIELD EFFECT ON LIGHT

38. What is Larmor's precession?
39. Why Zeeman effect is called magneto-optical phenomenon?
40. What is Zeeman effect?
41. What is normal Zeeman effect?
42. Mention the expression for the magnetic interaction energy.
43. What is anomalous Zeeman effect?
44. Write expressions for normal Zeeman shift in terms of frequency and wavelength.
45. Write the expression for angular frequency of Larmor's theorem and describe the symbols.
46. Write the expression for total magnetic moment in anomalous Zeeman Effect.
47. What is Lorentz unit?
48. Draw the energy level diagram for sodium D lines with necessary spectral terms.

UNIT-II MOLECULAR SPECTRA

49. Write any two uses of pure rotational spectra of a diatomic molecule.
50. Write the selection rules for the rotational spectra of a molecule.
51. Write any two differences between atomic & molecular spectra?
52. Write any two general features of line spectra.

53. Mention the different types of spectra of a molecule.
54. Write the expression for the rotational energy of a diatomic molecule & explain the symbols.
55. In which region of the electromagnetic spectrum, rotational spectrum is obtained.
56. Write any two general features of band spectra.
57. What are incandescent sources? Give example.
58. What are luminous gas sources? Give example.
59. Write the frequency condition for vibrational spectra and explain the terms. Calculate the inter nuclear distance or bond length if moment of inertia of the molecule is 1.38×10^{-17} Kg m^2 & reduced mass $\mu=1.58 \times 10^{-27}$ Kg.
60. Determine the value of rotational constant for the HF molecule. If the moment of inertia of the molecule is 1.38×10^{-27} Kg m^2.

RAMAN EFFECT

61. What is Rayleigh scattering?
62. What is scattering of light? Mention two types of scattering.
63. What are coherent and incoherent scattering?
64. What is Raman scattering?
65. What is the difference between Rayleigh & Raman scattering?
66. Mention any two characteristics of Raman lines.
67. Write any two application of Raman effect.
68. What are strokes & anti strokes lines?

UNIT-III LASER AND HOLOGRAPHY

69. What is LASER?
70. What do you mean by optical pumping?
71. Define Einstein's A and B coefficients.
72. What is stimulated emission?
73. Write the expression for Einstein's A and B coefficients.
74. Mention different types of pumping.
75. What is spontaneous emission?
76. Define the term population inversion.
77. Write the characteristics of Laser light.
78. Write any two medical applications of Laser.
79. Write any two Industrial applications of Laser.
80. Write any two military applications of Laser
81. What is Lasing transition?
82. What is induced absorption?

83. Write any two types of Laser.
84. Write any two uses of holography.
85. What is holography?
86. What is metastable state?
87. Write the principle of holography.

FIBRE OPTICS

88. What is optical fibre?
89. What is coherent bundle?
90. Write any two applications of optical fibre.
91. What is numerical aperture in fiber optics?
92. Mention the types of optical fibre.
93. Write the expression for numerical aperture of fiber with usual notations.
94. Define acceptance angle in optical fibre.
95. What is core in optical fibre?
96. What is cladding in optical fibre?
97. On what factors numerical aperture depends?
98. Write any two differences between step index and multimode.
99. Write any two differences between graded index and multimode.
100. Write any two differences between graded index and monomode.

5 Marks

Unit-I ATOMIC SPECTRA

1. Write a note on Rutherford's atom model.
2. Write a note on Bohr's theory of nuclear atom model.
3. Write a note on Sommerfeld's relativistic atom model.
4. The velocity of an electron varies in its elliptical orbit.Justify.
5. State and explain the significance of four quantum number. How are they interrelated?
6. What is space quantization? Explain.
7. Explain the need for introducing the concept of electron spin.
8. Write note on vector atom model.
9. Explain with suitable example how Pauli's exclusion principle gives the logical reasoning of grouping of electron in shells and sub shells.
10. Explain electron configuration of an atom.
11. What are alkali spectra? Explain the characteristic of spectra.
12. What are alkaline earth metal spectra? Explain characteristic.

13. Based on Pauli's exclusion principle show that maximum number of electron in n^{th} orbit is $2n^2$.
14. The wavelength of first line in Balmer series is 6563Å. calculate the wavelength of the second line Lyman series.
15. Given that the spectral term corresponding to the ionization potential of energy atom is 84178.5/cm. calculate the ionization potential of mercury atom.
16. Calculate (i)Ionization potential (ii)First excitation potential of the hydrogen atom taking $h=6.625\times10^{-34}$Js ,$e=1.6\times10^{-19}$ C and $m=9.1\times10^{-31}$Kg.
17. In Stern Gerlach experiment silver atoms traverse a distance of 0.1m in a non homogeneous magnetic field of field gradient $55Tm^{-1}$. If the velocity of silver atom is $450ms^{-1}$. Calculate the separation between the traces on the photographic plate. Given $\mu_B=9.2\times10^{-24}JT^{-1}$.
18. For an orbital electron with l=2 calculate the possible values of j and mention the corresponding values of m_j.

VECTOR MODEL OF THE ATOM

19. Explain different coupling schemes with an example.
20. Explain spin orbit interaction due to single valence electron.
21. Write note on LS coupling.
22. Write note on jj coupling.
23. Explain LS coupling scheme with vector diagram.
24. Explain jj coupling scheme with vector diagram.
25. Derive an expression for magnetic momentum due to orbital motion of the electron.

MAGNETIC FIELD EFFECT ON LIGHT

26. What is Zeeman effect? Describe the experimental arrangement for studying the Zeeman effect.
27. Derive an expression for the magnetic interaction energy.
28. Explain the normal Zeeman effect on the basis of classical theory.
29. Explain the normal Zeeman effect on the basis of quantum theory.
30. Derive an expression for normal Zeeman shift.
31. Describe the anomalous Zeeman effect with help of quantum theory.
32. Derive an expression for Lande's splitting factor.
33. Explain anomalous Zeeman effect of sodium D line with help of Lande's splitting factor.
34. Calculate Zeeman shift in normal Zeeman effect. Given magnetic field=0.5T e/m $=1.76\times10^{11}$c/Kg wavelength=5500Å.

35. Normal Zeeman shift is 13.35×10^{-12}m when spectral line of wavelength 6000Å is subjected to magnetic field of 0.4T.Find the value of e/m.
36. What magnetic flux density is required to observe the normal Zeeman effect if a spectrometer can resolve spectral lines separated by 1Å in the wavelength region of 8000Å.

UNIT-II MOLECULAR SPECTRA:

37. Explain general features of molecular spectra.
38. Explain the Radiant energy sources?
39. A force constant of HCl molecule is 5.8×10^{2} N/m find the energy required to increase the nuclear separation.
40. Derive an expression for moment of inertia of diatomic molecule considering it as a rigid rotator.
41. Find lowest rotational energy J=1 for a CO-molecule. Given mass of C- atom is 12 amu and O-atom is 16 amu.

    1amu=1.66×10^{-27} Kg and bond length=0.15nm

42. The force constant of the bond in CO molecule is 187N/m and its reduced mass is 1.14×10^{-26} Kg compute the frequency of vibration of the molecule and the spacing between its vibrational energy levels.
43. Given that the rotational of CO has line spaced at 384.2/m apart. Calculate the moment of inertia and bond length of the molecule. Given[$\mu=1.139 \times 10^{-26}$Kg,$h=6.625 \times 10^{-34}$Js].

RAMAN EFFECT

44. Write a short note on Raman spectra.
45. What is Raman Effect? What are the characteristics of Raman lines .
46. With exciting line 4348 Å a sample gives strokes line 4445Å deduce the wavelength of anti -stokes lines.
47. The exciting line in an Raman experiment is 5460Å and stokes line is 5520Å.find the wavelength of the antistokes line.
48. Describe the experimental arrangement for the study of Raman Effect.

LASER AND HOLOGRAPHY

49. Define Einstein's A&B coefficients. Derive the relation between these coefficients.
50. Explain the construction of He-Ne laser with a neat diagram.
51. Explain the working of He-Ne laser.

52. Define the term population inversion. How is it achieved for laser action?
53. Write a note on applications of laser.
54. Explain the terms absorption, spontaneous & stimulated emission of radiation in a Laser.
55. Describe how images can be recorded & reproduced holographically.
56. What is optical pumping in Laser? Explain different types of pumping.
57. Explain the construction of Ga-As laser with neat daigram.
58. Explain the working of Ga-As laser.

FIBRE OPTICS

59. Discuss in detail any four applications of optical fibers in different fields.
60. The glass material a with which an optical fiber is made, has R.I.as 1.55.this material is claded with another material whose R.I is 1.57. The light in the fiber is launched from air. Calculate
    a. The numerical aperture of the fiber
    b. The acceptance angle.
61. The numerical aperture of an optical fiber is 0.29 and R.I. of core 1.535. calculate the R.I. of cladding and critical angle
62. Explain how optical fiber is used in communication system.
63. The numerical aperture of an optical fiber is 0.29 and refractive index of core is 1.535.calculate the refractive index of cladding and critical angle.

10 Mark Questions

Unit-I ATOMIC SPECTRA

1. State the Pauli's exclusion principle and explain how it helps in fixing up the electronic configuration of the elements in the periodic table.
2. Give an account of different quantum numbers required to specify the state of an electron in the atom.
3. Mention the salient features of vector atom model and Explain the different quantum numbers associated with it.
4. Explain seven quantum numbers.
5. Describe Stern-Gerlach experiment and discuss the results of it.
6. Explain Franck-Hertz experiment with neat diagram. Mention its drawbacks.
7. i) State Pauli's exclusion principle with two examples. ii) Based on Pauli's exclusion principle show that maximum number of electrons in the n^{th} orbit is $2n^2$.

MAGNETIC FIELD EFFECT ON LIGHT

8. State Larmor's theorem. Explain normal Zeeman effect on the basis of quantum theory.
9. What is normal Zeeman effect ? Explain classical theory of normal Zeeman effect.
10. What is Zeeman effect? Explain normal Zeeman effect on the basis of quantum theory.
11. Derive an expression for Lande's splitting factor and explain anomalous Zeeman effect.
12. Explain how D_1 and D_2 line of sodium splits into four and six lines in a magnetic field.

UNIT-II MOLECULAR SPECTRA:

13. Describe the vibrational energy of the diatomic molecule. Explain how force constant is determined using vibrational spectrum.
14. Obtain the expression for rotational energy levels of diatomic molecule and the frequency of rotational spectrum.

RAMAN EFFECT

15. What is Raman effect ? Explain the classical theory of Raman effect.
16. With a neat diagram describe an experimental set up to observe Raman effect and write the characteristics of Raman Effect.

UNIT-III LASER AND HOLOGRAPHY

17. What are Einstein's A and B coefficients? Obtain the relation between them.
18. Explain the construction and working of He-Ne laser and write its demerits.
19. Explain the construction and working of Ga-As laser and write its demerits.

FIBRE OPTICS

20. i) What is optical fiber? Name the types of optical fiber.
    ii) Discuss in detail applications of optical fiber.

Head of Department
Department of Physics
P. C. Jabin Science College
HUBBALLI

KLE SOCIETY'S
P. C. JABIN SCIENCE COLLEGE,
AUTONOMOUS, CPE PHASE -III
AFFILIATED TO KARNATAK UNIVERSITY DHARWAD
APPROVED BY UNIVERSITY GRANTS COMMISSION, NEW DELHI AND
GOVERNMENT OF KARNATAKA
Accredited at 'A' Grade by NAAC
VIDYANAGAR, HUBBALLI-580031

DEPARTMENT OF PHYSICS

BSc VI Semester Question Bank SEC – 2021-22

Nano Material for Energy Applications

Two marks questions

1. What is top-down and bottom-up approaches for nanoparticle?
2. What are the two approaches of synthesizing nano materials?
3. Which process is the top-down approach to synthesize metal nanoparticles?
4. What is the difference between top-down and bottom-up approach in nanotechnology?
5. How nanomaterials are synthesized?
6. What is the advantage of top-down approach?
7. What are the key advantages of bottom-up approaches compared to top-down approaches nanoscale fabrication?
8. What factors affect the synthesis of nanoparticles?

   Several factors such as the method used for synthesis, pH, temperature, pressure, time, particle size, pore size, environment, and proximity greatly influence the quality and quantity of the synthesized nanoparticles and their characterization and applications.
9. What is nanotechnology used for?

   Nanotechnology is helping to considerably improve, even revolutionize, many technology and industry sectors: information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, among many others.
10. What is XRD technique?

    X-ray diffraction analysis (XRD) is a technique used in materials science to determine the crystallographic structure of a material. XRD works by irradiating a material with incident X-rays and then measuring the intensities and scattering angles of the X-rays that leave the material.
11. What are the diffraction techniques?

    The diffraction method utilizes the interference of the radiation scattered by atoms in an ordered structure and is therefore limited to studies of materials with long-range order. The incoming X-ray beam can be characterized as a plane wave of radiation interacting with the electrons of the material under study.
12. Why the angle is 2 theta in XRD?

The angle formed between the x-ray source and the detector is 2θ. This configuration is most convenient for loose powders. Thus the 2 θ is the angle between transmitted beam and reflected beam.

13. What is the purpose of X-ray diffraction?

    X-ray diffraction, or XRD, is a technique for analysing the atomic or molecular structure of materials. It is non-destructive, and works most effectively with materials that are wholly, or part, crystalline.

14. What does XRD intensity depend on?

    The directions of possible diffractions depend on the size and shape of the unit cell of the material. The intensities of the diffracted waves depend on the kind and arrangement of atoms in the crystal structure.

15. Mention the bragg's equation and explain the terms.
16. Write the Sherr's formula to calculate crystallite size and explain the terms.
17. What is XPS?
18. Mention any two applications of XPS.
19. Mention any two advantages of XPS
20. Mention any two disadvantages of XPS
21. Mention any two advantages of SEM
22. What is Raman Spectroscopy?
23. What is IR Spectroscopy.

Five marks questions

1. Explain working and principle of X-Ray powder diffraction or XRD or X-Ray diffraction technique.
2. Explain working and principle of X-Ray Photoelectron spectroscopy or XPS.
3. Mention any five applications of XPS
4. Explain working and principle of SEM
5. Explain working and principle of TEM
6. Write neat labelled diagram of SEM .
7. Write neat labelled diagram of TEM .
8. Explain RAMAN Spectroscopy
9. What is spectroscopy? Explain UV-VIS, IR and Raman Spectroscopy?

Ten marks questions

1. Explain working and principle of X-Ray Photoelectron spectroscopy or XPS. Mention any five applications of XPS.
2. What is SEM? How does it work? Explain the construction of SEM with neat labelled diagram.
3. What is TEM? How does it work? Explain the construction of TEM with neat labelled diagram.