DERABIS COLLEGE
QUESTION BANK OF PHYSICS DEPARTMENT

+3 1st year Science

SEMESTER-1

Mathematical Physics I(Core 1)

Goup-A (Fill in the blank Question Carries 1 mark)

1. The scalar product of two perpendicular vectors is _____.
2. The scalar triple product of three vectors is _____ of a parallelepiped.
3. The differential equation M(x,y) dx + N(x,y) dy is an exact differential equation for which the necessary condition is ___+ ____.
4. The equation $y=ax^2+bx+c=0$ represents the equation of _____.
5. The value of div.grad ϕ is _____.
6. If $xy+x^2y^2$ = constant ,then $\frac{dy}{dx}$ is _____ .
7. Plot of equation $x^2 = 4ay$ is symmetric about _____ axis.
8. The expression for velocity in cylindrical coordinate is _____.=
9. The approximate value of $\sqrt{25.2}$ is _____.
10. The solution of sin 2x dy = y cos 2x dx is _____.
11. If f(x,y,z) = e^x siny then $\frac{\partial y}{\partial x} =$ _____ .
12. If $x = r\cos\theta$, $y = r\sin\theta$ then $\frac{\partial r}{\partial x} =$ _____ .
13. The solution of sin 2x dy = y cos 2x dx is _____.
14. The function f(x) =[x] is _____at all integers.
15. The vector product of two parallel vectors is _____.
16. One of the integrating factors of the equation –ydx +xdy = 0 is _____.
17. The equation sinx cosy dx + cosx siny dy = 0 is _____ differential equation.
18. The value equation of $\hat{\imath}\cdot(\hat{\jmath}\times\hat{k})$ is _____.
19. A unit vector perpendicular to both $\vec{A}$ and $\vec{B}$ is _____.

20. If the co ordinate surfaces are mutually perpendicular to each other, then they are called _____ system.

21. The expression for acceleration in cylindrical coordinate is _____.

22. δ(-x) = _____.

23. $\int_{-\infty}^{\infty} \delta(x)\ dx =$ _____ .

24. The value of $\vec{A}.(\vec{A} \times \vec{B})$ is _____.

25. The expression for arc length ds in terms of h_1 , h_2 and h_3 is given by ds^2 = _____.

26. The cylindrical coordinates of point P in space are represented as _____

27. The spherical coordinates of point P in space are represented as _____.

28. The plane polar coordinates of point P are represented as _____.

29. The value of $\vec{A} \times \vec{r}$ is _____.

30. The value of $\vec{A}.\vec{r}$ is _____.

(Answer in one word and each carries 1mark)

1. Is the plotting of tan x against x continuous or not ?
2. Every polynomial is continuous at every point of the real line. True or false.
3. Write the approaximate value of $\sqrt{98}$.
4. Write the solution of y" +4y =0
5. Write the solution of y"+6y' +9y =0 .
6. What is the formula for Wronskian W (y_1 , y_2)?
7. Does vector product of two vectors produce a vector?
8. Does scalar product of two vectors invariant under rotation?
9. The magnitude of a vector is independent of the rotation of the coordinate axes. Is it true or false?

10. Write the expression for the components $A^{\rightarrow}$ if the coordinate axes are rotated about z-axis by an angle θ.

11. Is x cos 2y dx – sin 2y dy an inexact differential?

12. Is flux of a vector field a scalar quantity?

13. Which theorem relates line integral with surface integral?

14. Which theorem relates surface integral with volume integral?

15. Write the mathematical form of Green's theorem in plane.

16. Find the value of $\bar{r}\,d\bar{r}$.

17. Write Green's first identity.

18. What the value of $\int_0^1 xyz\,dx\,dy\,dz$?

19. What the value of grad(1/r)?

20. What is the value of $\bar{A}^{\rightarrow} \times \phi A^{\rightarrow}$.

21. Is the vector product of two vectors commutative?

22. Draw the graph of δ(x) Vs x .

23. Write the expression for Dirac-Delta function in terms Gaussian function.

24. . Write the expression for Dirac-Delta function in terms rectangular function.

25. What is the area of the graph of δ(x) versus x ?

26. $\int_{-\infty}^{\infty} f(x)\delta(x)dx = f(0)$. Is it correct?

27. What is the value of $\int_{-1}^{1} e^x\,\delta(x-2)dx$?

28. Is scalar product commutative?

29. Write a physical quantity which is the scalar product of two vectors.

30. Torque is polar or axial vector?

Group B: Short question (each carries 1.5 mark)

1. Plot the graph of $y= x^2$.
2. What do you mean by continuity of a function?
3. What do you mean by discontinuity of a function?
4. What do you mean by differentiation of a function?
5. Find the approaximate value of $\sqrt{101}$using differential calculus.
6. What do you mean by differential equation ?
7. Define degree and order of a differential equation.
8. Write Bernoulli's equation in differential form.
9. Write Wronskian of a function.
10. State existence theorem.
11. State uniqueness theorem.
12. What do you mean by partial derivatives?
13. Write rotation matrix in two dimensions.
14. Write Euler's theorem.
15. What is integrating factor?
16. What is vector field? Give an example of vector field.
17. State Stoke's theorem.
18. State Gauss divergence theorem.
19. What do you mean by directionl derivative?
20. Write Laplacian operator in spherical polar coordinates.
21. What do you mean by curl of a vector function?
22. What do you mean by gradient of scalar function?
23. What do you mean by divergence of vector function?
24. What do you by solenoidal vector?
25. What do you by rotational vector?

26. Prove that position vector is irroational.

27. Find the value of curl grad ϕ.

28. Solve cos(x+y) dy = dx .

29. Explain the role integrating factor.

30. Find the approaximate value of $(1.001)^3$.

Group C : Short question (each carries 2.5 mark)

1. Find the value of $\lim_{x\to 3} \frac{x^2-9}{x-3}$.

2. Show that $\lim_{x\to 0} \sin(\frac{1}{x})$ does not exist.

3. Find the Taylor series of sin x at x=0 .

4. Find the Taylor series of cos x at x=0 .

5. Prove that scalar product of two vectors is commutative.

6. Show that scalar product of two vectors is invariant under rotation .

7. If $(x, y, z) = x^2 + y^2 + z^2$, $find \frac{d^2f}{dx^2}$.

8. Find the value of $\lim_{(x,y)=(0,0)} \frac{xy}{y^2-x^2}$.

9. Find the first order partial derivatives of $u = e^x siny$.

10. If u=xϕ(y/x), then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = u$.

11. Solve ydx-xdy = xy^3 dy .

12. Find the value of 'n' if $A^{\rightarrow} = \iota\hat{} + n\jmath\hat{} + 5\hat{k}$ is perpendicular to $\bar{B} = 2\iota\hat{} + \jmath\hat{} - \hat{k}$.

13. Find the unit vector perpendicular to these vectors $A^{\rightarrow} = 2\iota\hat{} - \jmath\hat{} + \hat{k}$ and $\bar{B} = 3\iota\hat{} + 4\jmath\hat{} - \hat{k}$.

14. If $|A^{\rightarrow} + \bar{B}| = |A^{\rightarrow} - \bar{B}|$, find the angle between $A^{\rightarrow}$ and $\bar{B}$.

15. Find the value of div curl $\vec{F}$.

16. Find the value of curl grad ϕ .

17. If $\vec{A}$ and $\vec{B}$ are irrotational , then prove that $\vec{A} \times \vec{B}$ is solenoidal.

18. Prove that $(k\vec{A}) = k div \vec{A}$, where k is a constant.

19. Evaluate the integral $\int_{x=0}^{1} \int_{y=0}^{2} xy dx dy$.

20. Show that $(\vec{A}) = div\vec{A} + \vec{A}.\vec{A}$.

21. Prove that $\vec{A}.(\vec{A} \times \vec{B}) = \vec{B}.(\vec{A} \times \vec{A}) - \vec{A}.(\vec{A} \times \vec{B})$.

22. Show that $\left(\frac{\vec{r}}{r^3}\right) = 0$.

23. Show that $JJ^* = 1$.

24. Show that the vector $\vec{A} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ is irrotational .

25. Find integral $\int_0^1 \int_0^{\sqrt{1-y^2}} dx dy$.

26. Find the value integral $\int_0^4 t^2 \delta(t-5)\, dt$.

27. Show that $x\delta'(x) = -\delta(x)$.

28. If $\vec{a}$ is a constant vector, show that $\vec{A}(\vec{r}.\vec{a}) = \vec{a}$.

29. Prove that $A^2\left(\frac{1}{r}\right) = 0$.

30. Write the Laplacian operator in spherical polar and cylindrical coordinates.

Group D : Long questions

1. Plot the graphs of exponential function, Logarithmic function and trigonometric functions.

2. Plot the curve of the function $y = x^3 - 12x - 16$.

3. Find the Talyor series for $f(x) = \sin x$ abot $x = \pi/2$.

4. Find approximate value of $\sqrt{10}$ using Binomial series.

5. Plot the curve $= \frac{x^2}{x^2-9}$.

6. Find $\lim_{x\to a} \left(\frac{x^n-a^n}{x-a}\right)$.

7. Solve the equation iR + L(di/dt) = E.

8. solve the equation (y+x)y' = y-x

9. solve the equation (2x+4y-6)dy =(2x-5y+3)dx .

10. Derive the rotation matrix in 2-dimensional Cartesian co-ordinate system and show that it is an

orthogonal matrix.

11. Show that volume of a parallelepiped is equal to the scalar triple product of three vectors.

12. Using Lagrangian multiplier , find the point on the plane ax+by+cz = p at which the function

f(x,y,z) = x^2 +y^2 +z^2 has a minimum value.

13. Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube.

14. Explain Lagrange's method to solve partial differential equation.

15. Solve (1+xy)ydx + (1-xy)xdy = 0

16. Find the extreme value of x^3 +8y^3 +64z^3 when xyz=1.

17. Solve x(3ydx + 2xdy) + 8y^4 (ydx +3xdy) = 0 .

18. Derive scale factors in curvilinear co-ordinate system .

19. Derive gradient of a scalar function in curvilinear co-ordinate system.

20. Derive divergence of a vector function in curvilinear co-ordinate system.

21. Derive curl of a vector function in curvilinear co-ordinate system.

22. Derive Laplacian operator in orthonogal curvilinear system.

23. Derive gradient, divergence and curl in cylindrical co-ordinate system.

24. Derive gradient, divergence and curl in Spherical polar co-ordinate system.

25. Derive gradient, divergence and curl in rectangular co-ordinate system.

26. State and Prove Gauss divergence theorem.

27. State and prove Stoke's theorem.

28. Derive Green's theorem in plane.

29. Derive divergence of a vector function and give its physical significance.

30. Derive curl of a vector function and give its physical significance.

MECHANICS (CORE-2)

Group A: fill in the blank (question carries 1 mark)

1. Angular momentum is a _____ quantity.

2. Torque is a _____quantity.

3. Mathematical formula of M.I. of ring is _____.

4. Mathematical formula of M.I. of circular disc is _____.

5. Mathematical formula of M.I. of solid sphere is _____.

6. The expression for coriolis force is _____.

7. The expression for centripetal force is _____.

8. The formula of twisting torque on a wire is _____.

9. The poiseuilles formula for liquid flow is _____.

10. The dimensional formula of coefficient of viscosity is _____.

11. The unit of coefficient of viscosity is _____.

12. The general formula of moment of inertia is _____.

13. In S.H.M. a = _____y.

14. In damped harmonic motion resistance force proportional to _____.

15. The value coriolis force at the equator is _____.

16. The value of gravitational field intensity inside the spherical shell is _____.

17. Clock paradox related with _____.

18. The expression of gravitational potential of solid sphere outside it is _____.

19. The expression of gravitational potential of solid sphere inside it is _____.

20. The expression of gravitational potential of sphere shell outside it is _____.

21. The expression of gravitational potential of spherical shell inside it is _____.

22. Areal velocity of a planet is _____.

23. The weight of a body on the surface of an artificial satellite is _____.

24. The weight of a freely falling body is _____.

25. The value of 'g' at the pole is _____than 'g' at the equator.

26. The shape of orbit of a planet is_____.

27. The value of orbital time period of a geostationary satellite is _____.

28. Relativistic mass is _____than rest mass of a body.

29. Relativistic length is _____ than rest length of a rod.

30. Moving clock runs _____.

(Answer in one word and each carries 1mark)

1. Give an example of a body whose centre of mass outside the body.
2. What is the mathematical formula of moment of inertia?
3. Which are constant in elastic collision?
4. Which is constant in an inelastic collision?

5. What is the relation between torque and angular momentum?

6. Write the relation between acceleration and displacement in S.H.M. .

7. Give an example of centrifugal force.

8. Which is more elastic: steel or rubber ?

9. Write Einstein's mass-energy relation.

10. Write the dimensional formula of co-efficient of elasticity.

11. Elastic constants depend on nature of the material. (True or False).

12. The value of acceleration due gravity is greater at pole than equator. (True or False)

13. Which Kepler's law is based on areal velocity?

14. Write the relation between gravitational field and potential.

15. Write length contraction formula.

16. Write mass variation formula.

17. What is the rest mass of photon?

18. The viscosity of a liquid increases with rise in temperature. (correct the sentence)

19. Which property of liquid decreases with rise in temperature?

20. The rate of liquid flow is independent of its viscosity. (correct the sentence)

21. Write the range of Poisson's ratio.

22. What is the value of "g" at the centre of the earth?

23. How "g" varies with altitude from the surface of earth?

24. How "g" varies with depth of earth?

26. Write down the expression of excess pressure inside a soap bubble.

27. Write down the expression of excess pressure inside a liquid drop.

28. Write Mathematical form of Newton's law of gravitation.

29. Write an expression for total energy in S.H.M.

30. Give an example of fictitious force.

Group B: Short questions (each carries 1.5 mark)

1. Define radius of gyration.
2. Define torque.
3. Define angular momentum.
4. State the law of conservation of linear momentum.
5. State the law of conservation of angular momentum.
6. Define centripetal and centrifugal force.
7. Define frames of reference.
8. Define inertial and non-inertia frame of reference.
9. What is rotational K.E? Express it mathematically.
10. What is cariolis force?
11. What causes cariolis force?
12. What is the effect of cariolis force?
13. What do you mean by elasticity?
14. Define plasticity.
15. Define Young's modulus, Bulk modulus and Shear modulus of elasticity.
16. Define bending moment.
17. Define elastic limit.
18. State Hooke's law.
19. What is flexural rigidity?
20. What is the unit of flexural rigidity?
21. What is cantilever?

22. What is the purpose of a cantilever?
23. What do you mean by bending of beams?
24. Define surface tension of a liquid.
25. What is the effect of surface tension of a liquid with rise of temperature?
26. Explain why oil floats on water?
27. What is streamlined flow?
28. Define turbulent flow.
29. Define equation of continuity.
30. Define viscosity?
31. Define co-efficient of viscosity?
32. What is the S.I unit of coefficient of viscosity?
33. What do you mean by gravitational field?
34. Define gravitational field of intensity.
35. What do you mean by gravity?
36. What is acceleration due to gravity?
37. Define gravitational potential.
38. Define gravitational potential energy.
39. Define inertial mass.
40. Define central force.

Group c: Short questions (each carries 2.5 mark)

1. What is meant by the centre of mass of an object and how do you find the centre of mass?
2. What is moment of inertia and what is its mathematical formula?
3. By keeping moment of inertia of a body constant, if we double the time period, then what will be its angular momentum?
4. By increasing the angular velocity of an object by 10%, the kinetic energy has to b e increased by what?

5. Explain why a dancer on ice spins faster when she folds her arms.
6. Why cariolis force is zero at the equator?
7. If a solid sphere, disc and cylinder, are allowed to roll down an inclined plane from the same height then which will reach bottom first.
8. A wheel of mass 2k.g having practically all the mass concentrated along the circumference of a circle of radius 20cm is rotating on its axis with an angular velocity of 100 rad/sec. What will be the rotational K.E of the wheel?
9. What is the moment of inertia of a uniform circular disc about the diameter?
10. Define angular acceleration and what is its unit?
11. If an object changes its angular velocity from 10rad/sec to 25rad/sec in 3sec, then calculate its angular acceleration.
12. Discuss the practical use of centrifugal force.

13. The modulus of rigidity and Poisson's ratio of the wire are $2.87*10^6 N/m^2$ and 0.379 respectively.

14. What is the value of Young's modulus of the material of the wire?

15. How the surface tension of a liquid varies with dissolving organic and in-organic solute?

16. What is the co-efficient of viscosity with change of temperature?

17. What do you mean by kinetic viscosity?

18. Define gravity wave.

19. Define ripple.

20. What is the difference between bending moment and bending stress?

21. What do you mean by conservative field and conservative force?

22. Define kepler's 3^{rd} law of planetary motion.

23. What is GPS and how it works?

24. Discuss the use of GPS.

25. What is the principle of GPS?

26. How does GPS determine your position on earth?

27. How does the GPS help?

28. Does GPS work without internet?

29. What is the gravitational field at a point inside a spherical shell?

30. What is meant by geosynchronous orbit?

31. What is the value of universal gravitational constant "G"?

32. What do you meant by weightlessness?

33. What is the altitude of a geosynchronous orbit?

34. Calculate the potential energy of a body of mass 10k.g at a distance a 25m above the ground.

35. What is the dimensional formula of "G"?

36. What are the characteristics of geo-stationary satellite?

37. Write down any two applications of geo-stationary satellite?

38. Define escape velocity.

39. State Kepler's laws of planetary motion.

40. Write the expressions for four vector coordinates.

Group D: Long Questions-

1. Calculate gravitational field and potential due to a spherical shell.
2. Calculate gravitational field and potential due to solid sphere.
3. Derive the equation of two body problem and its reduction to one body problem.
4. Derive differential equation of motion with central force and its solution.
5. State and explain Kepler's law of planetary motion.
6. What is a geo-stationary satellite? Discuss about geo-synchronous orbits.
7. Discuss about basic idea about global positioning system.
8. Discuss about physiological effects on astronauts.
9. State and prove the law of conservation of angular momentum of a single particle and a system of particle.

10. State and prove perpendicular axis and parallel axis theorem of moment of inertia.

11. Derive the Euler's equation of motion for a rigid body.

12. Discuss the derivation of moment of inertia of a solid sphere.

13. Discuss the derivation of moment of inertia of a solid cylinder.

14. Explain about combined rotational and translational motions.

15. Discuss about the moment of inertia of a big whell.

16. Explain motion in a non-inertial frame.

17. Explain about rotating co-ordinate system.

18. Discuss about cariolis force and its application.

19. Derive the relation between elastic constants.

20. Discuss about twisting torque in a cylinder.

21. Derive the expression for bending moment.

22. Discuss about the bending beams.

23. Discuss about the theory of single cantilever.

24. Discuss about the theory of double cantilever.

25. Derive Poiseuille's equation for flow of liquid through a capillary tube.

26. Discuss about the corrections in the Poiseuille's formula.

27. Discuss about gravity wave and ripple.

28. Describe Michelson and Morley Experiment.

29. Derive Lorentz transformation equations.

30. Derive relativistic addition formulae for velocity.

31. Derive mass variation formula and mass energy relation.

32. Derive relativistic Doppler's effect.

SEMESTER-2

Electricity and Magnetism(Core 3)

Group A: fill in the blank (question carries 1 mark)

1. Electric flux is _____quantity.

2. The unit of electric flux is _____.

3 Electric field lines represent the _____ of electric field intensiy.

4. Electric potential is _____quantity.

5. The S.I. unit of electric potential is _____.

6. Electric flux is the _____ product of electric field intensity and area.

7. The S.I. unit of capacitance is _____.

8. The capacity of a parallel capacitor varies _____with distance between two plates.

9. The capacity of a parallel capacitor varies _____ with common area of two plates.

10. Magnetic field intensity on the axis of a current carrying conductor is _____.

11. Magnetic field intensity at the centre of the current carrying circular coil is _____to its plane.

12. Magnetic flux is the _____ product of magnetic field intensity and area.

13. The S.I. unit of magnetic flux is _____.

14. The S.I. unit of magnetic field intensity is _____.

15. The S.I. unit of electric flux is _____.

16. Two field lines do not _____each other.

17. The S.I. unit of magnetic moment is _____.

18. The S.I. unit of electric dipole moment is _____.

19. $K = 1 +$ _____.

20. $\mu_r = 1 +$ _____.

21. Lenz's law is based on _____.

22. Faraday's second law gives the _____of induced emf.

23. The dimensional formula of electric flux is _____.

24. The dimensional formula of magnetic flux is _____.

25. Magnetic moment = _____x Area

26. The dimensional formula magnetic field intensity is _____.

27. Polarization vector is numerically equal to _____.

28. The susceptibility of a diamagnetic substance is _____?

29. Electro magnets are made of _____?

30. The resultant magnetic moment for _____ materials is zero in the absence of external magnetic field.

(Answer in one word and each carries 1mark)

1. What is the relation between volt and stat volt?

2. Write the expression for electrostatic energy density.

3. Write the expression for magnetostatic energy density.

4. Write the S.I. unit of mutual inductance.

5. Write the relation between polarization vector and electric susceptibility.

6. Write the relation between dielectric constant and electric susceptibility.

7. Write the relation between relative permeability and magnetic susceptibility.

8. Magnetic susceptibility is positive for diamagnetic substance. (correct the sentence)

9. Write Curie's law.

10. Write the expression for resonance frequency.

11. Write the relation between electric displacement vector and electric field intensity.

12. Write the expression for inductive reactance.

13. Write the expression for capacitive reactance.

14. Write the expression for torque on an electric dipole in a uniform electric field.

15. Write the expression for torque on a magnetic dipole in a uniform magnetic field.

16. What is the use dielectric in a capacitor?

17. Write the expression for energy stored in a capacitor.

18. What is the unit of permittivity?

19. Write the alternate name magnetic flux density.

20. Write the dimensional formula of magnetic flux density.

21. What is the angle between equipotential surface and electric line of force?

22. What is the shape of equipotential surface in the electric field of a point charge.

23. What is the intensity of electric field inside a charged spherical shell ?
24. What is the direction of electric dipole moment ?
25. Write the S.I. unit of self inductance.
26. What is the reactance of inductor to d.c. ?
27. What is the reactance of capacitor to d.c. ?
28. Write the for force on a moving charge in a magnetic field.
29. Write the for force on a current carrying conductor in a magnetic field.
30. Write the expression for capacitance of a spherical condenser.

Group B: Short questions (each carries 1.5 mark)

1. Define electric field intensity. Give its S. I. Unit ?
2. What is an electric lines of force ?
3. Why two electric lines of force cannot intersect each other ?
4. What do you understand by electric flux ?
5. Does the intensity of electric field due to an infinite plane sheet of charge depends upon the distance of observation from it ?
6. Define types of electric flux ?
7. Write dimensional formula and unit of electric flux ?
8. State Gauss law in electrostatics?
9. Write down Differential form of Gauss law ?

10. State Coulombs law in electrostatics ?
11. Calculate the number of electric lines of force originating from a charge of 10 coulomb ?
12. What do you mean by Gaussian Surface ?
13. What is the electric field at any point between two oppositely charge particle ?
14. Define electric potential and potential energy ?
15. What is an equipotential surface ?
16. How do the electric potential and electric field due to a dipole vary with distance ?
17. Write down Poissons and laplace equipotential ?
18. What is electric dipole moment what is its unit in S.I ?
19. What is the torque acting on electric dipole in an uniform electric field ?
20. What is the potential energy of dipole in a uniform electric field ?
21. What do you mean by magnetic effects of electric current ?
22. Define magnetic flux density ?
23. What is the force acting on a change moving through a uniform magnetic field ?
24. State Fleming's left hand rule ?
25. What is the force acting on a current carrying conductor of length 'L' Placed in a uniform magnetic field 'B' ?
26. State Biot-Savert's law ?
27. State Ampere's circuital law ?
28. What is Lorntz's force ?
29. What is a Galvanometer ?
30. On What factors does the capacitance of a parallel plate capacitor depend ?

Group C: Short questions (each carries 2.5 mark)

1. The electric field near earth's surface is 600 v/m What is the surface charge density on earth's surface.
2. Write down the properties of electric lines of force ?
3. Electric field in a region is zero. Should the electric potential also be zero in the region ?
4. How much is the workdone in moving 0.0005 C Charge between two points on an equipotential surface ?
5. What is the relation between electric field intensity and potential gradient ?

6. When a charged particle moves in a magnetic field. Explain why its kinetic energy remains same ?
7. Why is phosphor benzene alloy preferred for the suspension wire of a ballistic galvanometer ?
8. What is a solenoidal field Give one example?
9. State the condition under which the magnetic scalar potential ?
10. What are the conditions for a moving coil galvanometer to be ballistic ?
11. What is the physical significance of a critical damping ratio ?
12. What are the conditions for a moving coil galvanometer to be dead beat ?
13. What is the use of lagerithemic decrement ?
14. What is the physical significance of magnetic vector potential ?
15. A capacitor of capacitance 50 microfarad is charged to a potential of 1000v. Calculate the energy stored in the capacitor ?
16. What is the electric field between two plates 4cm apart and connected to 12v battery ?
17. What is a dielectric ? Define dielectric constant .
18. What is the difference between free changes and bound charges ?
19. Distinguish between polar and non polar dielectric ?
20. What is the differential form of Gauss law for dielectric ?
21. What is the relation between peak value & rms value of A.C ?
22. What is the relation between peak value & rms value of Emf ?
23. Why A.C are more dangerous then D.C for same voltage ?
24. What is the impendance of LCR series in A.C circuit ?
25. In series LCR A.C circuit what is the expression of quality factor ?
26. How the quality factor, Resonance and band width of LCR circuit are related ?
27. What is the resonance frequency of a parallel LCR circuit ?
28. Why a parallel LCR circuit is called resistor circuit. ?
29. Define the Thevenin resistance and define the Thenenin equivalent.
30. Define the Transistor current and define super position theorem .

Group D: Long Questions-

1. State and prove Gauss law. Write down its differential form ?
2. Applying Gauss law calculate the intensity of electric field at a point due to a uniformly changed straight wire
   having change density 'P' ?
3. Using Gauss Law, Calculate electric field inside a hollow spherical change distribution ?

4. Using Gauss Law, Calculate electric field due to uniformly changed solid sphere ?
5. State Gauss Law in differential form Derive Poisson's equation and Laplace equation ?
6. State and prove uniqueness theorem ?
7. Derive the electropotential energy of a charged sphere ?
8. Applying Biot-savert law find the magnetic field due to long staright current carrying conductor ?
9. Using Biot-savert law calculate the strength of magnetic field at the center of a circular coil carrying current ?
10. State and prove Ampere's circuital law and calculate its differential form ?
11. Define vector potential and derive an expression for the vector potential ?
12. What is a ballistic galvanometer. Explain the construction and theory of it ?
13. Explain :-
    i) Electro magnetic damping ii) Critical damping
    iii) Lagerithemic decrement

14. Derive the expression for capacitance of a parallel pate capacitor with
    i) Air ii) A dielectric slab
15. Find the expression for the capacitance of a parallel plate capacitor with a dielectric medium.
16. Calculate the capacitance of a spherical capacitor in a dielectric medium.
17. Calculate the electro static pen unit volume in a dielectric.
18. Derive the differential and integral form of Gauss law in dielectric ?
19. Obtain an expression for electrostatic energy stored per unit volume in a dielectric medium.
20. Describe the formation and the significance of the hysteresis loop.
21. What is a hysteresis ? Derive an expression for the work done per unit volume during cycles of magnetization ?
22. Discuss the importance of hysteresis curve ?
23. Derive Maxwell's equation for electromagnetic waves ?
24. What is mutual induction. Derive the expression for the reciprocity theorem ?
25. What is an impedance of an electric circuit. Derive an expression for impedance of an A.C LCR series circuit ?
26. Find an expression for the current in an AC circuit containing resistance, inductance, capacitance in series calculate the condition of resonance .

27. What is meant by resonance in a parallel resonant circuit ? Why is the circuit known as resistor circuit ?
28. Calculate the frequency in series resonance LCR circuit and define Q-factor .
29. What do you understand by the resonance in an electrical circuit ? Discuss the characteristics of a series and parallel resonant circuits .
30. Describe Thevenin theorem, Norton theorem and Reciprocity theorem.

Waves and Optics (Core 4)

Group A: fill in the blank (question carries 1 mark)

1. Rainbows are formed by _____.

2. In Fresnel's biprism the central fringe is_____.

3. The condition for minimum spherical aberration for two thin lenses of focal lengths f_1 and f_2 separated by

distance "d" is_____.

4. A pair of conjugate points on the axis of a lens having unit positive angular magnification is known as_____.

5. The achromatic condition for two lenses of focal lengths f_1 and f_2 separated by distance "d" is_____.

6. If the focal length of eye lens of Huygens's eye piece is 'f' then what the distance of separation between two

lenses is_____.

7. Mechanical wave in a gas is _____.

8. Mechanical waves on the surface of a liquid are_____.

9. In a Fabry-Perot interferometer the circular fringes are formed at fringes of_ .

10. Fabry-Perot interferometer is based on the principle of interference by_ .

11. Fabry-Perot interferometer is based on the principle of interference by_ .

12. The fringes formed in Michelson's interferometer are localized _____.

13. In Fraunhofer diffraction from a slit the light wave front incident on the slit is _____.

14. In a single slit diffraction, for a slit of width'd' and wave length lambda, the angular separation between central

maximum and 1st minimum is_____.

15. In single slit Fraunhofer diffraction, the width of the central maximum is greatest for _____colour.

16. Resolving power and limit of resolution are _____of each other.

17. The intensity of principal maximum in the spectrum of grating having N slits is proportional to_____.

18. To be able to see diffraction pattern, the size of obstacle must be _____of the wave length of light.

19. In a transmission grating, the transparent and opaque strips are of equal width, the absent spectra are

_____.

20. If the widths of transparent strips are double of the width of opaque strips then the absent orders are _____.

21. Diffraction phenomenon is usually divided into _____classes.

22. In _____type of diffraction, the screen and the source are kept at finite distance.

23. The spreading of waves into the regions of the geometrical shadow is called _____.

24. Crone's spiral is a _____.

25. A device that is based on the concept of Fresnel's half period zone is called_____.

26. zone plate is based on _____phenomenon.

27. The shape of fringes in Newton's ring are _____.

28. The expression for central fringe width of single slit is _____.

29. The unit of power of a lens is _____.

30. In wave propagation _____is transferred from one point to another point.

(Answer in one word and each carries 1mark)

1. Write the differential equation of a wave.

2. When a sound wave goes from one medium to another then which quantity remains unchanged.

3. In which type of wave energy is not transferred?

4. What is the ratio between group Velocity and phase velocity in a dispersive medium

5. What is the shape of wave front originating from a point source of light?

6. What is the shape of wave front for a liner source?

7. What is the expression of electromagnetic wave in medium?

8. What is the relation between coherence length and coherence time?

9. To which property of a medium will you relate to the potential energy of a wave?

10. Under which condition the group velocity is equal to phase velocity?

11. On reflection from a denser medium, what will be the path difference?

12. Give an example of phenomenon of the interference of division of amplitude.

13. Give an example of interference due to division of wave front.

14. Can we produce interference with white light?

15. Do interference effects occur for sound waves?

16. What is diffraction?

17. Define power of a lens.

18. What is the relation between path difference and phase difference?

19. What is the wave front?

20. What are the essential properties of a medium to have a wave motion through it.

21. What is optical path?

22. What is dispersion of light?

23. What is dispersive power of material of a prism?

24. What is an eye piece?

25. What are the cardinal points of an optical system?

26. What is a wave?

27. Write a relation between group velocity and phase velocity.

28. What is the differential equation of a simple harmonic oscillator?

29. Is sodium light really a coherent source?

30. Is multi-colour fringe possible in case of an oil film?

Group B: Short questions (each carries 1.5 mark)

1. State and explain Huygens's principle.
2. What is Fermat's Principle of least time?
3. What is Fermat's principle of stationary time?
4. Define Transverse and longitudinal wave.
5. Explain why wave velocity is also called phase velocity.
6. What is the difference between normal dispersion and anomalous dispersion?
7. Distinguish between wave velocity
8. Describe temporal and spatial coherence.
9. Define coherence length and coherence time.

10. Write down the properties of electromagnetic wave.
11. Define intensity of a wave. Write an expression for it.
12. What are the characteristics of Ramsden's eye piece?
13. What should be the thickness of an oil film on the water surface to see the colours in it?
14. State Stoke's law in terms of phase change on reflection.
15. What is an interferometer?
16. What is the working and principle of Michelson-Morley interferometer?
17. Why a compensating plate is used in Michelson's interferometer.
18. Name the fringes produced in Fabry-Perot interferometer.
19. What will happen when Young's double slit experiment is performed in water?
20. In Young's double slit experiment, fringes appear at straight line. Explain?
21. Compare the pattern of fringes formed in biprism and Lloyd's mirror.
22. How are Newton's ring formed?
23. Why is the centre of ring dark in Newton's ring set up?
24. What will happen to Newton's rings if a drop of water is inserted between the lens and the glass plate?
25. How coherent source of light waves are produced?
26. What is the condition of interference?
27. What happens when the width of the slit in Fresnel's biprism is increased?
28. Explain the necessity of broad source of light for observing colours in thin films.
29. What happens to the Newton's, when liquid is filled in the air?
30. What is Michelson's interferometer? Give its principle?

Group C: Short questions (each carries 2.5 mark)

1. Why do we get circular rings in the Michelson's interferometer?
2. Why Fabry Perot interferometer is very useful for resolving very small wavelength difference?

3. What are interference filters?
4. What do you mean by Finesse?
5. What are the main advantages of Fabry Perot interferometer than Michelson's?
6. How localised fringes are produced in the Michelson's interferometer?

7. Why does a Michelson interferometer produce fringes with an extended source but not with an extended

source but not with a point source?

8. What is the use of Michelson interferometer?

9. What is the difference between Fresnel's and Fraunhofer's diffraction?

10. Define Fresnel's half period zone.

11. Why does a zone plate half multiple foci?

12. How is Fresnel's diffraction represented graphically?

13. What are Rayleigh's criteria of resolution?

14. What is the difference between the magnification and resolution?

15. How do we measure the half width of the nth order principal maximum of diffraction pattern of a grating?

16. Show that whether matrix ($\begin{matrix} 3 & 2 \\ 3 & 4 \end{matrix}$) is a system matrix of optical system.

17. The equivalent focal length of a Huygens's eye piece is 6 cm. Calculate focal length of the field lens.

18. The focal length of each lens of Ramsden's eye piece is 12 cm. Calculate the equivalent focal length of the eye

piece.

19. Two thin Plano-convex lenses of the same material in a Huygens eye piece are 10 cm apart. Find the focal lengths

of the eye piece.

20. A travelling wave has a rating of 440 Hz at 360 m/sec .How far will two position be from each other if the

corresponding displacement differ in phase by π rad.

21. Ruby laser is operating at wave length 6943 ^{0}A with emission bond width of 10^7 Hz. Calculate the coherence

length.

22. Find the coherence length for white light .The wave length of white light ranges from $7*10^{-7}$m to $4*10^{-7}$m.

23. Light of wave length 700 nm has coherence length $14*10^{-6}$.Find coherence time.

24. Find the Q-factor of a laser beam having wave length $8*10^{-7}$ and coherence length 7m.

25. Comparison between Michelson's and Fabry-Perot interferometer.

26. Write down uses of Fabry-Perot interferometer.

27. When a movable mirror of Michelson interferometer is shifted through 0.006180mm then 22 fringes move

across the field of view. Find the wavelength of light.

28. The mirror in Fabry-Perot interference has a reflection co-efficient of 0.089. Determine the co-efficient of

fringes.

29. The movable mirror of Michelson's interferometer is moved through a distance of 0.03201mm. Find the number

of rings shifted across the cross wire if the wave length of light is 6000Å.

30. What will happen to Newton's rings if monochromatic light is replaced by white light?

31. Explain colour produced in thin film.

32. In Young's double slit experiment, light of wave length 5000Å is used. The fringe width changes by 2.5mm when

the screen move towards the slit by 100cm. Find the distance between two slits.

33. Newton rings are observed in reflected light of wavelength 6000Å. The diameter of the 10^{th} dark ring is 0.5cm.

Find the radius of curvature and thickness of air film.

34. What would be the minimum number of lines drawn on diffraction grating so as to resolve the 1^{st} order sodium

doublet having a difference of wave length 6Å at a wavelength 5893Å?

35. Compare a zone plate and convex lens.

Group D: Long Questions-

1. Discuss Fermat's principle and prove laws of reflection and refraction.

2. Define system matrix of an optical system. Obtain the system matrix for a thick lens and derive the lens formula

for thin lens from the system matrix.

3. Define cardinal points of a system of co-axial lenses. State their properties.

4. Describe the construction and working of a Ramsden's eyepiece. What are its merits and demerits?

5. Describe the construction and working of a Huygens eyepiece.

6. Discuss the comparison between Ramsden's and Huygens's eyepiece.

7. Derive an expression for pressure amplitude of a plane progressive wave and express the intensity of a wave in

terms of pressure amplitude.

8. What do you mean by progressive wave? Derive the equation of a progressive wave.

9. State Huygens principle and using it prove laws of reflection.

10. State Huygens principle and using it prove laws of refraction.

11. Explain temporal coherence, spatial coherence, and coherence length and coherence time. Write the relation

between coherence length and coherence time.

12. Describe Young's experiment for interference of light and find an expression for fringe width.

13. Describe the Fresnel's biprism method for determining the wavelength of light.

14. Explain how Newton's rings are formed and determination of wavelength of light.

15. Discuss the interference in thin films due to transmitted system of rays.

16. Describe the interference in thin films due to transmitted system of rays.

17. Describe the construction of Michelson interferometer and explain the formation of fringes in it.

18. Explain the principle of Fabry-Perot interferometer. Obtain an expression for the intensity of transmitted light

and also explain the visibility and sharpness of the fringe.

19. Derive an expression for Fraunhofer diffraction pattern with a narrow slit and by a parallel beam of mono-

chromatic light.

20. Describe Fraunhofer's diffraction at a double slit.

21. Describe Fraunhofer's diffraction due to a single slit.

22. Give the construction and theory of plane transmission grating and explain the spectra formed by it.

23. What is a zone plate? Describe the construction and theory of zone plate.

24. Give the mathematical treatment of Fresnel's diffraction at a straight edge.

25. Describe diffraction through multiple slit.

DERABIS COLLEGE

QUESTION BANK

DEPARTMENT OF PHYSICS

+3 2nd year Science

SEMISTER-3

Mathmetical Physics-I

Short Type Question

1. What is periodic function?
2. What do you mean by period of periodic function?
3. What is the value of period of the function sin(nx)?
4. Find the period of $sin\ (\frac{\pi x}{l})$
5. What do you mean by even function? Give an example of even function.
6. What do you mean by odd function? Give an example of odd function.
7. State dirichlet conductions.
8. Write the Fourier series of f(x) in the interval [-L,L]
9. Write half range Fourier cosine series.
10. Write half range Fourier sine series.
11. Write complex form of Fourier series.
12. State theorem for differentiation of Fourier series.
13. State theorem for integration of Fourier series.
14. Write parsevales identity.
15. Write the value of $\sum_{n=0}^{\infty} \frac{1}{(2n+1)^2}$
16. What do you mean by ordinary point of differential equation?
17. What do you mean by singular point of a differential equation

18. Find the nature of singular point of the equation xy''+y'+xy=0
19. Find the ordinary point and singular points of Legendre's equation.
20. Write Rodrigue's formula for Legendre's polynomial.
21. Write orthogenality condition of Legendre's polynomial.
22. Write orthogonality condition of Hermit's polynomial.
23. Prove that $P_n'(1) = n(n+1)^2$
24. Show that $P_n(1) = 1$
25. Prove that $P_n(-x) = (-1)^n P_n(x)$
26. Show that $H_{2n}'(0) = 0$
27. Prove that $H_n(-x) = (-1)^n H_n(x)$
28. Write orthogonality property of associated Legendre's polynomial.
29. What do you by generating function?
30. Write laplace's en from spherical harmonic.
31. Write Laplacian operator in spherical polar co-ordinate system.
32. Write Rodrique's formula for hermit's polynomial.
33. Show that $H_n(x) = 2x$
34. Write gamma function in terms of improper integral.
35. Find the value of $\Gamma(1/2)$
36. Prove that $\Gamma(n+1) = n\Gamma(n)$
37. Write gamma function in logarithmic function.
38. Write gamma function in infinite limit(Euler's form).
39. Find the value of $\Gamma(1)$
40. Evaluate $\int_0^\infty e^{-ax^2} dx$

41. Evaluate $\int_0^\infty x^3 e^{-x} dx$
42. Write the relation between beta function and gamma function
43. Write beta function in terms of trigonometric functions.
44. Show that $\beta(m,n) = (\frac{m+n}{n})\,\beta(m,n+1)$
45. Write different types of errors.
46. What do you mean by systematic errors
47. What do you mean by random errors
48. Define relative error and percentage of error
49. State principle of error in a sum of difference
50. State principle of error in product and quotient.
51. What do you mean by standard error
52. What do you mean by probable error
53. The side of cube measured as (2.00 ± 0.02)cm. Find the volume of the cube.
54. What do you mean by partial differential equation?
55. Give an example of partial differential equation.
56. Write Laplace equation in Cartesian co-ordinate system.
57. Write Laplace equation in spherical polar co-ordinate system.
58. Write Laplace equation in cylindrical co-ordinate system.
59. What is the value of electric field inside a conductor.
60. Write clausiuss Mossoti formula.
61. Write one dimensional wave equation.
62. What do you mean by nodes?
63. What do you mean by antinodes?
64. What do you mean by overtones? Write the frequencies of overtones.
65. What do you mean by harmonics?
66. Write the expression for frequency in 3rd mode vibration.
67. What is the order of partial differential equation?
68. What the expression for potential in spherical polar co-ordinate system.

Long Questions

1. State fourier series and derive fourier co-efficients.

2. Prove that (i) $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$ and (ii) $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$

3. Drive fourier expansion of x^4 in $[\pi,-\pi]$ and prove that $\sum_{n=1}^{\infty} \frac{1}{n^4} = \frac{\pi^4}{90}$

4. Represent $x+x^2$ in fourier series in the internal $-\pi < x < \pi$ and deduce $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + - - - -$.

5. Obtain Fourier series to represent the function f(x) = Ix I for $-\pi<x<\pi$ and deduce $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + - -$

6. Find fouries series for f(x) = Isin x I for $-\pi<x<\pi$.

7. Derive fourier series of a function having arbitrary period. Hence device fourier series for even and odd

functions.

8. If f(x) = x, $0 < x < \pi/2$

$= (\pi - x)$ $\pi/2 < x < \pi/2$

9. Find the half range four cosine series of $f(x) = x^3$ in (0,L)

10. Find the complex fourier series of $f(x) = x,\ 0 \le x < 1$

$= 2x,\ 1 \le x < 2$

11. Derive series solution of Legendre's differential en.

12. Derive series solution of hermite's differential equation.

13. Derive sol of associated Legendre's differential equation.

14. Derive orthogonality relation of legendre's polynomial.

15. Derive orthogonality relation of hermite's polynomial.

16. Derive Rodroigues formula for Legendre's polynomial.

17. Derive rodrigues formula for hermites polynomial.

18. Derive orthogenality relation of associated Legendre's polynomial.

19. Solve the differential equation

20. Derive Legendre's polynomial from its generating function.

21. Derive weierstrass form of gamma function

22. Find the value of $\Gamma(1/2)$.

23. Derive the relation between beta function and gamma function.

24. (a) prove that $\Gamma(m)\Gamma(1-m) = \frac{\Pi}{sinmx} \quad 0 < m < 1$

(b) show that $\int_0^{\frac{\pi}{2}} sin^m\theta cos^n\theta \, d\theta = \frac{\Gamma(\frac{m+n}{2})\Gamma(\frac{n+1}{2})}{2\Gamma(\frac{m+n+2}{2})}$

25. (a) show that $\beta(m,n) = \beta(m+1,n) + \beta(m,n+1)$.

(b) prove that $\Gamma(2n) = 2^{2n+1}\, \pi^{-1/2}\, \Gamma(n)\, \Gamma(n+(1/2))$

26. (a) show that $\frac{\beta(m,n+1)}{n} = \frac{\beta(m+1,n)}{m} = \frac{\beta(m,n)}{m+n}$

(b) Find the value of $\Gamma(-5/2)$

27. What is error function? Write the characteristics of error function.

28. Prove that $\int_0^1 \frac{x^2}{\sqrt{1+x^4}}dx + \int_0^1 \frac{1}{1+x^4}dx = \frac{\pi}{4\sqrt{2}}$

29. Evaluate $\int_0^\infty e^{-x^2}\{4x^4 - 12x^2 + 3\}dx$

30. Find Γ(3/2), Γ(5/2), Γ(-3/2), Γ(-5/2)

31. Find the solution of $2\frac{\partial u}{\partial x} + 5\frac{\partial u}{\partial y} = 0$ using the method of separation of variables.

32. Find the solution Laplace equation in Cartesian co-ordinate system.

33. Find the solution Laplace equation in spherical polar co-ordinate system.

34. Find the solution of Laplace equation in cylindrical co-ordinate system.

35. Using Laplace equation find the electric field at any point due to conducting sphere placed in uniform electric

Field.

36. Find the potential and electric field of an dielectric placed in a uniform electric field.

37. Derive one dimensional wave equation and find its solution.

38. A tightly stretched stiring with fixed end points x=0 and x=l is initially in a position given by $y=y_0 \sin^2(\pi x/l)$.

If it is released from rest to this position, find the displacement y(x,t).

39. Solve $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$, $u(0,y)8e^{-2y}$ by the method of separation of variables.

40. Solve $y^3\frac{\partial z}{\partial x} + x^2\frac{\partial z}{\partial y} = 0$ by the method of separation of variables.

Thermal physics (Core 6)

Short Answer Questions:-

1. What is thermodynamics.
2. State the zeroth law of thermodynamics.
3. What do you mean by thermal equilibrium.
4. Explain the concept of temperature on the basis of thermodynamics.

5. Define a thermodynamics. Distinguish between opn and closed system.
6. What do you mean by indicator diagram or P-V diagram.
7. What is the area of P-V diagram represent.
8. State the first law of thermodynamics.
9. What is the significance 1st law of Thermodynamics.
10. What is the quasi-static process.
11. What is Isothermal Process.
12. What is an adiabatic process.
13. What is isobaric process.
14. What is isochoric process.
15. What is the equation of state for isothermal process.
16. What is the equation of state for adiabatic process.
17. Compare the slope of isothermal and adiabatic curve.
18. Which quantity is constant in adiabatic process.
19. The first law of thermodynamics is the conservation of _____.
20. What is a heat engine.
21. What is reversible process.
22. What is irreversible process.
23. Why Carnot's engine is called reversible engine.
24. State second law of thermodynamics.
25. State Carnot's theorem.
26. Explain the efficiency of a heat engine.
27. Why both source and necessary for heat engine.
28. Why efficiency of an engine can not be 100%.
29. Show that on absolute scale of temperature, negative temperature is not possible.
30. Calculate the efficiency of a Carnot engine working between 500k and 1000k.
31. The device which converts heat into mechanical work is _____.
32. What is a refrigerator.
33. What will happen the efficiency of the Carnot's engine if the temperature of the source is increased.
34. How do you define zero on absolute scale of temperature.
35. What do you mean by entropy?

36. What is the unit of entropy?
37. State 3rd law of thermodynamics.
38. Calculate the entropy of Steam and ice.
39. Explain that 2nd law of thermodynamics is the law of increase of entropy.
40. Explain the concept of entropy and disorder.
41. Is the absolute zero of temperature achieved?
42. Formulate the 2nd law of thermodynamics in terms of entropy.
43. Explain why unavailable energy in universe tends to increase.
44. Show that the entropy of universe increase in natural process.
45. What is temperature entropy diagram. what is its importance.
46. Find the expression for efficiency of Carnot's engine with the help of T-5 diagram.
47. 10kg of ice at 0^0c is converted at the same temperature. Calculate the change in entropy. Latent heat of ice is 3.4×10^5 J/Kg.
48. The gain in entropy of working substance in Carnot's cycle is _____.
49. When water vapour condenses into water its entropy_____.
50. In adiabatic process entropy_____.
51. The entropy of a system in an irreversible process_____.
52. What do you mean by extensive variables.
53. What do you mean by intensive variables.
54. Define internal energy.
55. Define enthalpy.
56. Define Helmholtz free energy.
57. Define Gibb's free energy.
58. What are the thermodynamic potentials.
59. How does surface tension vary with temperature.
60. Using adiabatic demagnetization, the minimum temperature produced is _____.
61. Change of entropy in Carnot's cycle is _____.
62. A piece of ice is added to water in a cup. The entropy_____.
63. In a reversible process, the entropy of the system_____.
64. In all natural process, the entropy of the universe_____.
65. What do you mean by phase transition.

66. What is Latent heat.
67. Define latent heat of fusion.
68. Define latent heat of vapourisation.
69. What is the unit of latent heat.
70. What is the latent heat of fusion of ice.
71. What is latent heat of vapourisation of water.
72. Why steam produces severe burn than boiling water?
73. Explain 1^{st} order phase transition.
74. Explain 2^{nd} order phase transition.
75. When the pressure is increased, the melting point of ice_____.
76. The melting point of a solid is lowered by increase in pressure. When this solid melts its volume_.
77. Specific heat of saturated water vapour at 100^0c is _____.
78. During a change of phase the Gibbs function of a system_____.
79. Explain why the temperature of a gas drops when it is subjected to aidiabatic expansion.
80. What do you understand by inversion temperature.
81. Define specific heat at constant pressure.
82. Define specific heat of a gas at constant volume.
83. Why C_p is greater than C_v.

86. State postulates of kinetic theory of gases.

87. What do mean by free path.

88. What is kinetic interpretation of temperature.

89. Define degrees of freedom.

90. What is the degrees of freedom of a mono-atomic gas.

91. What is the degrees of freedom of a di-atomic gas.

92. What is the degrees of freedom a poly-atomic gas.

93. State law of equipertition of energy.

94. Define mean energy or internal energy.

95. Define most probable speed.

96. Define average speed.

97. Define RMS speed of gas.

98. The average energy of monoatomic gas at temp. **T** is _____.

99. The RMS speed of the molecule of an ideal gas is _____.

100. How the mean square speed of gas molecule is proportional to temperature.

101. What is the difference between a perfect gas and a real gas?

102. How real gas behavior has been explained by Vander Waal's equation.

103. What is Vander Waal's equation of state?

104. Write a note on Andrew's experiment on Carbon dioxide.

105. Define Critical temperature.

106. During Joules expansion, what remains constant.

107. In which process the enthalpy remains constant.

108. In Joule-Thomson effect, cooling is due to _____.

109. In Joule-Thomson effect, the temperature of a perfect gas_____.

110. What is Boyle's temperature.

111. State law of corresponding states.

112. Define critical pressure.

113. Define critical volume.

114. Define gas and vapour.

115. Define temperature of inversion.

Long Answer Questions:-

1. Derive the expression for work done due to isotherml and adiabatic process.
2. Derive the equation of state for adiabatic process.
3. State and explain 1st law of thermodynamics and apply it to isothermal and adiabatic process.
4. What is Carnot's engine? Explain Carnot's cycle and derive the expression for the efficiency of Carnot's cycle.
5. State and prove Carnot's theorem.
6. Explain the Principle of absolute scale of temperature. Compare the ideal gas scale with absolute scale of temperature.
7. Deduce the thermodynamics scale of temperature? Show how this scale agrees with an ideal gas scale.

8. Derive an expression for the change of entropy of a perfect gas.

9. What is T-S diagram. Find the expression for efficiency of a reversible Carnot's engine with the help of T-S

diagram.

10. Define thermodynamic potentials and derive Maxwell's equations.

11. Deduce the Maxwell's four thermodynamic relations.

12. Explain the four thermodynamic potentials U,F,G and H.

13. Which do you mean by adiabatic demognetisation? How it is used to produced at lowest temperature.

14. Establish Clausius Clapeyron equation.

15. Derive the second latent heat equation of Clausius.

16. Derive Ehrenfest's equation for second order phase transitions.

17. Derive Maxwell's thermodynamic relations.

18. What is Joule Thomson effect? Derive expression for Joule Thomson cooling.

19. Explain “inversion temperature in relation to Joule Thomson effect. Obtain an expression for it for a Vander

Waal’s gas.

20. Derive T ds equations.

21. Explain maxwell’s distribution law of velocities. How can it be verified experimentally?

22. Derive the expression for Maxwell distribution of velocities.

23. State and prove law of equipartition of energy.

24. Derive the expression of most probable speed, average speed and RMS speed of molecules.

25. What is mean free path. Derive its mathematical expression.

26. What are transport phenomenon. Derive the expression of viscosity on the basis of Kinetic theory.

27. Explain transport of mass and transport of energy on the basis of kinetic theory.

28. What is Brownian motion. Discuss Einstein’s theory of Brownian motion.

29. Derive and discuss Vander Waal’s equation of state.

30. Draw Andrew’s curves for a gas at different temperature and obtain expression for critical constants.

31. Derive reduced equation of state.

32. Discuss Joule-Thomson Porous plug experiment.

33. Discuss Joule Thomson effect for real and Vander Waal gas.

Digital Systems and Applications (Core 7)

Short questions:

1. Write the difference between analog and digital circuits

2. What do you mean by decimal number system?
3. What do you mean by binary number system?
4. Convert $(101.01)_2$ to decimal system.
5. What do you mean by octal system?
6. What do you mean by Hexadecimal number system?
7. Express $(13.12)_8$ in decimal system.
8. Convert $(38)_{10}$ to binary system.
9. Convert $(749)_{10}$ to BCD.
10. Convert $(3A2)_{16}$ to octal.
11. What is AND gate?
12. Write Boolean equation for AND gate.
13. Write truth table of OR gate with three inputs.
14. Write truth table of AND gate with three inputs.
15. Give circuit for OR gate.
16. Give circuit for AND gate.
17. Write truth table? Write logic symbol of NOT gate.
18. What is NOR gate? Write truth table for NOR gate.
19. What is NAND gate? Write truth table for NAND gate?
20. What is XOR gate?
21. What is multiplexer?
22. What is multiplexing?
23. What is de multiplexing?
24. What is encoding?
25. What is decoding?
26. Distinguish between multiplexing and demultiplexing.
27. Distinguish between an encoder and a decoder.
28. Why is a multiplexer called a data selector?
29. Why is a demultiplexer called a distributor?
30. What is binary adder?
31. What is half adder?
32. What is full adder?
33. What is binary subtractor?
34. What is half subtractor?
35. What is full subtractor?
36. What is 4-Bit binary adder?
37. What is 4-bit binary subtractor?
38. Add binary numbers 101.11 and 111.01.

39. Write rules of binary addition.
40. Write rules for binary subtractor
41. What are active components?
42. Write the examples of active components?
43. What are passive components?
44. Write the examples of passive components
45. What is a chip?
46. What is a water?
47. What do you mean by medium scale integration?
48. What do you mean by small scale integration?
49. What do you mean by large scale integration?
50. What do you mean by very large scale integration?
51. Write examples of linear ICS.
52. Write examples of digital ICS.
53. What do you mean by multiple ICS?
54. What do you mean by linear integrated circuits?
55. What do you mean by digital integrated circuits?
56. What do you mean by monolithic ICS?
57. What is the function of trigger circuit of a CRO?
58. Why is a fluorescent screen used in a CRT?
59. How can the current be measured by a CRO?
60. White different types of CRO
61. What are analog computers?
62. What are digital computers?
63. What is micro-computer?
64. What do you mean by software?
65. What do you mean by hardware?
66. What is main memory?
67. What is data memory?
68. What is program memory?
69. What do you mean DVD?
70. Explain about hard disk
71. Write note on magnetic memory
72. Write note on magnetic tape
73. What do you mean by compact disk?
74. Explain about floppy disk
75. What are counters?

76. What is decade counter?
77. What is a ring counter?
78. What do you mean by shift register?
79. What is twisted ring counter?
80. What do you mean by memory map?

Long questions:

1. Explain NAND gate as Universal gate.
2. Explain NOR gate as Universal gate.
3. Explain XOR gate and X-NOR gate.
4. With neat logic symbol explain the operation of AND gate and give its truth table.
5. What is an OR gate? Explain the operation of OR gate with near circuit diagram and write its truth table.
6. State and prove De Morgan's theorem.
7. Write short notes on sum of products and product of sums.
8. Simplify the Boolean function Y=AB'C'D'+AB'C'D.
9. Explain canonical form of Boolean function.
10. Simplify the Boolean function Y=A'BC'D'+A'BCD'+AB'CD'+ABCD'+A'B'CD+A'BCD+AB'CD+ABCD by using Karnaugh Map.
11. What is multiplexer? Explain 2-to-1 and 4-to-1 multiplexers
12. What is demultiplexer? Explain 1-to-4 line and 1-to-8 line demultiplexers.
13. What is decoder? Explain 3-to-8 line decoders.
14. Explain 8-to-3 line encoder and 10-to-4 line encoder.
15. Explain full adder with logic circuit.
16. Write short notes of half adder and half subtractor.
17. Explain full subtractor.
18. Explain 4-bit binary adder and subtractor
19. Draw the block diagram of an IC-555 timer and describe the functions of all the parts of IC-555 timer.
20. Describe the application of IC-555 timer as astable multivibrator and mono stable multivibrator.
21. Describe the construction and working of CRT.
22. Draw the block diagram of a CRO and explain briefly the function of each component.

23. Derive an expression for the electrostable deflection sensitivity of a CRT
24. Derive an expression for the magnetic deflection sensitivity of a CRO
25. Discussthe advantages and disadvantages of integrated circuits.
26. Discuss the classification of integrated circuits
27. What do you mean by scale of integration? Explain SSI,MSI,LSI,VLSI,SLSI and VSLI
28. Explain different parts of integrated circuits
29. Discuss the applications of CRO
30. Describe the function of various controls of a CRO.
31. Draw the block diagram of a digital computer. Explain the function of its different units.
32. Explain the working of a microprocessor with near block diagram.
33. Write short notes on memory map and memory interface.
34. Explain in details about memory organization and addressing.
35. Explain the working of a serial-in-serial-out phase shift register and serial-in-parallel-out shift register
36. Explain the working of parallel-in-serial-out and parallel-in-parallel-out shift registers
37. Wish a near logic diagram explain the working of a twisted ring counter
38. Explain the working of a decode counter.
39. Explain the working of synchronous counter.
40. Explain the working of a ring counter.

SEMESTER-4

Mathematical Physics III (Core 8)

SHORT QUESTION:

1. Find the real part and imaginary part in 3+4i.
2. If $z_1=x_1+ iy_1$ and $z_2=x_2+ iy_2$, find z_1z_2.
3. What is addition identity of z.
4. What do you mean by Argand diagram?
5. What do you mean modulus of complex number?

6. Write complex conjugate of z=x+iy.
7. Write Euler's formula.
8. Find the value of i'.
9. Express $\frac{1}{1+i}$ in terms of x+iy.
10. Find the complex conjugate of
11. State de moivre's theorem.
12. Express circular function of the complex variable Z.
13. What do you mean by analytic function?
14. Write Cauchy –Riemann conditions in polar co-ordinates.
15. Show that z* is not analytic.
16. Show that sin z is analytic.
17. What do you mean by harmonic function?
18. Evaluate $\int_0^{1+i} z^2\ dz$.
19. What do you mean by simply connected region
20. Find $e^z\ dz$ where C is the unit circle.
21. State Taylor's theorem.
22. Write Taylor expansion of e.
23. Write Laurent's theorem.
24. Find Taylor expansion of $\frac{1}{1+z}$.
25. What do you mean by singular point of a function?
26. What do you mean by isolated singularity?
27. What do you mean by zeros of complex functions.
28. What do you mean by removable singularity?
29. Find the order of zeros of f(z)=sin z
30. Classify the singular points of f(z)= $\frac{1}{z-z^3}$.
31. Write the expression for residue at simple pole.
32. Write an expression for residue at multiple pole.
33. State Cauchy's residue theorem.
34. State Fourier integral theorem.
35. Write Fourier cosine integral.
36. Write Fourier sine integral.
37. Write Dirac delta function in terms of Fourier integral.
38. Find the singularities of f(z)= $\frac{1}{(z+1)(z+2)}$.
39. What you mean by essential singularity?

40. Find the order of zeros of f(z)= e^z.
41. Prove linearity property of Fourier transform.
42. If F(w) is the Fourier transform of f(t) ,then show that Fourier transform of f(at)= $\frac{1}{a}F(\frac{w}{a})$.
43. If F(w) is the Fourier transform of f(t) ,then show that Fourier transform of f(t$\pm a$)= $e^{\pm iwa}$F(w).
44. Show that Fourier transform of f(t)cos(at)= $\frac{1}{a}$F(w-a)+ $\frac{1}{a}$F(w+a).
45. Write finite Fourier sine transform.
46. Write finite Fourier cosine transform.
47. State convolution theorem.
48. Write Fourier transform in three dimensions.
49. Write delta function in Fourier transform.∞
50. Find derivative of Fourier sine transform.
51. Find derivative of Fourier cosine transform.
52. Find finite Fourier sine transform of sin2x.
53. What is the value of $\int_{-\infty}^{\infty} e^{x^2}\, dx$.
54. Find the integral $\int e^x \cos bx\, dx$.
55. Find the integral $\int e^x \sin bx\, dx$.
56. Write Laplace transform of f(t).
57. Find the Laplace transform of 1.
58. Obtain the Laplace transform of t.
59. Find the Laplace transform of t^n.
60. Obtain the Laplace transform of a constant.
61. Find the Laplace transform of e^{at}.
62. Find the Laplace transform of sin(at).
63. Find the Laplace transform of cos(at).
64. Find the Laplace transform of sinh(at).
65. Find the Laplace transform of cosh(at).
66. Obtain Laplace transform of t sin(at).
67. Obtain Laplace transform of t cos(at).
68. Find the Laplace transform of $cos^2 2t$.
69. Find the Laplace transform of sint cost.
70. Prove linearity property of Laplace transform.
71. Find the Laplace transform of $e^{3t} + e^{-2t}$.

72. If L{f(t)}=F(s) ,then show that L{f(at)}= $\frac{1}{a}F(\frac{s}{a})$.
73. If L{f(t)}=F(s) , then show that L{e^{at} f(at)}= F(s-a)
74. If L{cos t}= $\frac{s}{1+s^2}$, find L{cos 2t}.
75. Find the Laplace transform of $\frac{\sin 4t}{t}$.

Long Questions:

1. State and prove Cauchy's theorem.
2. Derive Cauchy's integral formula.
3. Derive Cauchy-Riemann conditions.
4. State and prove De-moivre's theorem.
5. Use De-moivre's theorem to solve $x^7+ x^4+ x^3+1=0$.
6. If $u(x,y)=y^2-x^2$.,show that it is harmonic .find harmonic conjugate v(x,y) and f(z).
7. Show that $v(x,y)=e^{-x}(y\cos x- x \sin y)$ is harmonic and obtain it's conjugate harmonic function.
8. (a) Derive Milne Thomson method to find harmonic conjugate.

   (b)find the analytic function if $u=x^3-3xy^2$ is harmonic.

9. Evaluate $\frac{e^z}{z^2+1}\,dz$ if C is the circle such that |z|=2.
10. Evaluate $\frac{e^z}{z^2(z+1)^3}\,dz$ where C:|z|=2.
11. State and derive Taylor expansion.
12. State and derive Laurent expansion.
13. Express f(z)= $\frac{1}{(z+3)(z+5)}$ in Laurent's series for (i)|z|>5 (ii)3<|z|<5 (iii) |z|<3.
14. Expand f(z)= $\frac{4z+3}{z(z-3)(z+2)}$ in Laurent's series in the annular region between |z|=2 and |z|=3
15. Find Laurent series for f(z)= $\frac{1}{z^2+1}$ about its singular points.
16. Expand f(z)= $\frac{1}{(z+1)^2}$ in Taylor series about the point z=-i.
17. State and prove Cauchy's residue theorem.
18. (a) Evaluate $\frac{z}{\sin z}\,dz$ where C:|z|=5.

(b) Evaluate $\frac{5z-2}{z(z+1)}\,dz$ where C:|z|=5.

19. Evaluate the integral $\int_0^{2\pi} \frac{1}{3+2cos\boldsymbol{\theta}}\,d\theta$ by using residual theorem.
20. Find the Fourier cosine and sine integrals of f(z)=$e^{-\alpha x}$,x ≥ 0 and α is positive constant.
21. Obtain Fourier transform of a derivative and integral .Find Fourier sine and cosine transform of derivative.
22. State and prove convolution theorem.
23. Find the Fourier transform of e^{-ar^2} ,where 'a' is a constant and r=$\sqrt{x^2+y^2+z^2}$
24. Find the finite Fourier sine and cosine transform of e^{-ax} in$(0, \pi)$.
25. Obtain the solution of one dimensional wave equation by using Fourier transform.
26. Obtain the solution of heat equation by using Fourier transform.
27. Obtain the solution of differential equation of damped harmonic oscillator using Fourier transform.
28. (a)Find Fourier finite cosine transform of f(x)={ $\begin{matrix} 1, 0 < x < \frac{\pi}{2} \\ -1, \frac{\pi}{2} < x < \pi \end{matrix}$.

(b) Find the finite Fourier sine and cosine transform of e^{-ax} in$(0, \pi)$.

29. Verify convolution theorem of Fourier transform if f(x)=g(x)= e^{-x^2}.
30. Solve the equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 y}{\partial x^2}$ for $0 \leq x \leq \infty$, $t > 0$ if the initial conditions are (i) u(x,0)=0 for $x \geq 0$ (ii) $\frac{du(0,t)}{dx} = -$ where is a constant (iii) u(u,t) is bounded.
31. State and prove Laplace transform of periodic function.
32. Find the Laplace transform of$f(t) = \{t - 1, 1 < t < 2$. $\begin{matrix} t^2, 0 < t < 1 \\ 4, t > 2 \end{matrix}$
33. State and prove Laplace transform of derivatives and integrals.
34. Find Laplace transform of the functions (i) f(t)= t sin(3t) cos(2t) ,(ii) f(t)= $t^2e^t sin2t$.
35. Find Laplace transform of $\frac{1-cost}{t^2}$
36. State and prove convolution theorem of Laplace transform.
37. Solve the equation y''+y=2e^t by using Laplace transform y(0)=0 and y'(0)=2.

38. Using Laplace transform solve R-L circuit.
39. Solve R-C circuit by using Laplace transformation.
40. Sol the differential equation of damped harmonic oscillator by using Laplace transform. Hence obtain the sol for simple harmonic oscillator.

Elements of Modern Physics (core 9)

Very Short Answer Questions

1. What is a black body?
2. State Stefan's law of black body radiation.
3. What is Wien's displacement law?
4. Write down Rayleigh-Jeans law?
5. Write down Planck's law?
6. What is the absorbing power of a black body?
7. What is the reflecting power of a perfect black body?
8. What is photo-electric effect?
9. Define threshold frequency.
10. Define work function of a metal.
11. What is Compton effect?
12. What is the use of a photocell?
13. Define stopping potential.
14. How photo electric current varies with intensity of light.
15. Stopping potential depends upon_____of incident light.
16. What is Compton wave length?
17. What is inadequacy of classical physics.
18. Which part of atom was discovered by Rutherford?
19. What are the postulates of Rutherford atomic model.
20. What are the failures of Rutherford's model.
21. Write down postulates of Bohr's atomic model.
22. What are the limitations of Bohr's atomic model.
23. What do you mean by fine structure?
24. What is the value of fine structure constant?
25. What is the value of Rydberg's constant?

26. The radius of the 1st electron orbit of a hydrogen atom is 5.3×10^{-11}m. what is the radius of the second orbit?
27. Explain the significance of the Frank Hertz experiment.
28. Lymen series of hydrogen spectrum lies in the _____region.
29. Which of the following series of hydrogen spectrum lies in the visible region.
30. What is atomic spectra.
31. What is Bohr's correspondence principle.
32. Explain the assumption made by Sommerfeld to explain the fine structure of specified lines of hydrogen atom.
33. What is a photon?
34. What is wave particle duality?
35. What is the relation between the energy and momentum of a photon?
36. Write down de-Broglie wave equation?
37. What is matter wave?
38. An electron is accelerated through a potential difference of 100V. what is its energy in electron volt?
39. Define phase velocity.
40. What do you understand by group velocity.
41. A photon and an electron have same de-Broglie wave length. Which particle is moving faster.
42. Distinguish between normal and anomalous dispersion.
43. In which condition group velocity is equal to phase velocity.
44. What do you mean by wave function.
45. What is the condition for normalised wave function.
46. Write the equation of a wave packet.
47. What is an operator.
48. The linear momentum operator is _____.
49. The energy operator is _____.
50. Write the relation between group velocity and phase velocity.
51. Write down expectation value of position, momentum and energy.
52. State Heisenberg's uncertainty principle.
53. What is time-energy uncertainty relation?

54. Uncertainty principle states that the error in measurement is due to _____.
55. If the uncertainty in position of an electron is 4×10^{-10}m. calculate the uncertainty in its position.
56. Find the uncertainty in the momentum of a determined within 0.01cm.
57. Calculate the wave length of a matter waves associated with a particle of mass 0.5gm moving with a speed of 40cm/sec.
58. Is it possible to observe de-Broglie wave associated with a material particle of 10^{-4}gm moving with a velocity of light? Planck's constant= 6.6×10^{-27}erg.sec.
59. In which units size of nucleus is measured?
60. What do you mean by mass defect?
61. What is the binding energy of the nucleus?
62. Define packing fraction of nucleus.
63. Give three properties of Nuclear forces.
64. Calculate energy equivalent to 1 a.m.u.
65. Show that the nuclear density is constant.
66. How the radius of nucleus varies with mass number.
67. The density of nuclear matter is of the order of _____.
68. Isobars have the same_____.
69. Nuclei having same number of neutrons are called_____.
70. Quadrupole moment for a spherical nucleus is _____.
71. What is shell model.
72. Shell model was suggested by _____.
73. What do you mean by parity.
74. Write down semi-empirical mass formula.
75. What are the failures of liquid drop model.
76. What are magic numbers.
77. What are the failures of shell model.
78. Derive the relation between mass number and nuclear radius?
79. What do you understand by radioactive substance?
80. Define radioactive decay constant.
81. What is half life of a radio active substance?

82. What is mean life?
83. What is the laws of radio active decay.
84. What is the activity of a radioactive substance.
85. Explain nuclear fission reaction.
86. The amount of energy released due to fission of one uranium atom.
87. What is nuclear fusion reaction give an example.
88. Why nuclear fusion reaction is called thermo-nuclear reaction.
89.

Long Answer Questions

1. State Bohr's postulates of atom model and find out an expression for total energy of an electron in nth orbit.
2. Explain Bohr's correspondence principle and mathematically proof it.
3. Describe Frankz-Hertz experiment for the verification of the discrete energy states in atoms.
4. Discuss analytically the Bohr-Sommerfeld theory of elliptical orbits of hydrogen atom and compare its results with those of Bohr's theory of circular orbits.
5. Write down laws of photoelectric effect. Explain these laws from Einstein's photoelectric equation.
6. What is Compton effect? Derive an expression for change in wave length of scattered photon.
7. What is quantum theory of radiation? Derive Planck's law and derive wien's law and Rayleigh-Jeans law from it.
8. Describe Davisson and Germer experiment to verify the wave nature of electrons.
9. Define particle velocity, phase velocity and group velocity of a wave packet. Show that particle velocity is equal to group velocity of wave packet.
10. Derive the expression for expectation value of position, momentum and energy.
11. Explain Gaussian wave packet and derive the expression for it.
12. Explain uncertainty principle and show that it does not allow the presence of electrons in the atomic nucleus.

13. Using the uncertainty relation for position and momentum. Find the energy-time uncertainty. Write its physical interpretation.
14. Explain uncertainty principle and find the minimum energy of harmonic oscillator using uncertainty principle.
15. What do you understand by binding energy of the nucleus. Show how the energy of the nucleus. Show how the concept of binding energy is related to the stability of nucleus.
16. Write short notes on
    1. Electric quadrupole moment and its emportance.
    2. Partity.
17. What is semi-empirical mass formula? Explain significance of various terms.
18. What are the main assumptions of liquid drop model of nucleus? Give the significance of the various terms of the semi-empirical mass formula.
19. What are magic numbers? Give expermintal evidence for their existence.
20. Explain Gammow's theory of alpha-decay.
21. Discuss beta-decay and gama-decay.
22. State Geiger-Nuttal law and discuss its importance.
23. State and explain laws of radioactive disintegration. Define disintegration constant and half life period.
24. What are nuclear reactions? What is meant by Q-value of a nuclear reaction?
25. Explain nuclear fission on the basis of liquid drop model.

Analog Systems and Applications (core-10)

Short questions:

1. What is P-type semiconductor?
2. What is N-type semiconductor?
3. Define mobility.
4. Define conductivity.
5. What is drift velocity and what is the order of drift velocity?
6. Write the relation between current density and drift velocity.
7. What is the value of barrier potential of germanium junction diode?
8. What is rectifier?
9. Define ripple factor of rectifier

10. Define efficiency of rectifier
11. Explain energy level of a conductor
12. What is biasing of diode? Explain forward biasing and reverse biasing of diode
13. What is a photodiode? Explain the function of photodiode
14. What is solar cell?
15. What is LED? Write uses of LED.
16. What do you mean by a transistor? Explain PNP and NPN transistor s
17. Explain the construction of PNP and NPN transistor
18. Discuss the performance of common base amplifier
19. Discuss the performance of common emitter amplifier
20. Explain about operating point
21. What is a load line?
22. Explain active region
23. Explain saturation region
24. Explain cut off region
25. Explain stability factor
26. Explain bias stabilization
27. What is thermal runaway?
28. What are hybrid perometers?
29. What is transistor biasing?
30. Draw a fixed biased circuit
31. What do you mean by coupled amplifier?
32. What is band width?
33. What do you mean positive feedback?
34. Explain negative feedback
35. What do you mean by distortion?
36. What is noise?
37. What is oscillator?
38. Write Barkhausen criterian for oscillator
39. Write advantages of negative feedback
40. Write expression for voltage gain with feedback
41. Write the basic difference between Hartley and Colpilts oscillator.
42. Which type feedback used in oscillator?
43. Which type feedback used in amplifier?
44. Draw circuit diagram of phase-shift oscillator
45. Draw circuit diagram of Colpitt oscillator

46. What is an OP-AMP? Draw its equivalent circuit

47. Give block diagram of OP-AMP

48. Explain the open loop and closed loop of an OP-AMP

49. Explain the frequency response of OP-AMP

50. Explain the concept of virtual ground

51. What do you mean by slow rate?

52. Explain ideal and practical OP-AMPs

53. Write characteristics of ideal OP-AMP

54. Write characteristics of practical OP-AMP

55. Draw circuit diagram of inverting OP-AMP amplifier

56. Draw circuit diagram of OP-AMP as subtractor

57. Draw circuit diagram of OP-AMP as differentiator

58. Draw circuit diagram of OP-AMP as integrator

59. Draw the circuit diagram of logarithmic amplifier

60. Draw the circuit diagram of antilogarithmic amplifier

Long questions

1. Discuss the working of full waverectifier.Find its efficiency and ripple factor
2. What is a light emitting diode? Explain working. Write its applications
3. What is Zener Diode? Explain its working. How Zener diode is used as a voltage regulator.
4. Derive expression for current in a step function.
5. Derive expression for barrier potential and barrier width of a step junction
6. Describe current flow mechanism in PN junction
7. Derive relation between current density and drift velocity.
8. Explain the mechanism of current flow on PNP and NPN transistors
9. Draw the circuit diagram of CE amplifier. Explain the circuit operation. Derive the expression for its amplification factor

10. Draw the circuit diagram of common base amplifier. Explain its working. Derive the expression for its amplification factor
11. Draw the input and out characteristics of a transistor in common emitter configuration. Describe the saturation cut off and active regions of CE output characteristics
12. Draw the circuit of common base transistor. Explain the input and output characteristics. Indicate cut-off, active and saturation regions and explain them
13. Draw the DC load line of transistor? Write the importance of load line. Explain operating point
14. Explain a fixed bias circuit.Define the stability factor and obtain its value in fixed bias circuit
15. Explain voltage divider bias and calculate stability factor in this method
16. What are hybrid parameters? Explain the hybrid equivalent of a transistor
17. Explain class A,class B and class C power amplifiers
18. Explain RC coupled amplifier, Discuss the frequency response curve and band width
19. Discuss the effect of positive feedback on input and output impedance of an amplifier
20. Discuss the effect of negative feedback on input and output impedance of an amplifier
21. Discuss the effect of positive feedback on stability , distortion and gain of an amplifier
22. Discuss the effect of negative feedback on stability, distortion, gain and noise
23. Describe phase-shift oscillator and derive its of oscillation
24. Describe Hartley oscillator and derive its frequency of oscillation
25. Describe Colpilt oscillator with near circuit diagram and derive its frequency of oscillation
26. What is an OP-AMP? Give its block diagram. Explain the function of each part.
27. Draw the circuit symbol of CA-741 OP-AMP. Give its packing and pin outs
28. What do you mean by common mode rejection ratio (CMMR)
29. Describe inverting and non-inverting amplifiers
30. Describe OP-AMP as add and subtractor

31. Describe OP-AMP as integrator and differentiator
32. Discuss the OP-AMP operations of logarithmic and antilogarithmic amplifier
33. Discuss Wein-bridge oscillator using OP-AMP
34. Discuss inverting zero crossing detector the obtain the expression for hysteresis.

DERABIS COLLEGE
DEPARTMENT OF PHYSICS
QUESTION BANK
+3 3rd year Science
Semester-V

Quantum mechanics and Applications (Core 11)

Short Answer Questions

1. Why should the wave function f(x) be a single valued everywhere?
2. Explain the meaning of well-behaved wave function.
3. What is a wave function associated with a free particle?
4. What is a free particle?
5. Explain Born's interpretation of wave function.
6. What are the conditions that a wave function must obey?
7. What do you mean by normalization of a wave function.
8. Write down time dependent Schrodinger wave function.
9. What are the properties of the wave function.
10. What do you mean by expectation value of an observable.
11. What is probability current density.
12. What do you mean by linearity.
13. State superposition principle.
14. Show that probability density is always.
15. What is the wave function for a free particle.
16. Write down the relation between linear momentum and propagation constant.
17. Discuss limitation of free particle wave function.
18. What is the de-Broglie's wave length of an electron travelling with a speed of 3×10^6 m/sec.
19. What is the relation between linear momentum and propagation constant.
20. Define wave packet.
21. Why material particle can not be represented by a single wave?
22. What is an operator.
23. What is eigen value and eigen function of an operator.

24. What are the conditions for a linear operator.
25. What is momentum operator.
26. What is energy operator.
27. What is Hamiltonian operator.
28. Define commutator.
29. What do you mean by Hermitian operator.
30. Write down the properties of Hermitian operator.
31. Show that the momentum operator is hermitian.
32. What do you mean by adjoint of an operator.
33. Explain eigen value spectrum.
34. Explain simultaneous eigen functions.
35. What do you mean by degeneracy.
36. Is sinx a linear operator?
37. Prove that the operator $\frac{d}{dx}$ is non-Hermitian.
38. What are conjugate variables?
39. Find an expression for x-component of angular momentum operator in spherical polar co-ordinate.
40. Energy, time commutator is non-zero. Can they be determined simultaneously.
41. What is the significance of commutator in uncertainty principle?
42. Calculate the ground state energy of an electron in a one dimensional box of length $1A^{o}$.
43. A particle is in the ground state of an infinite square well of size 'a' what is the probability of finding the particle in a distance Δx=0.01a at

    (a)X=a/2 (b) x=a/4

44. In what factors allowed values of energy of a particle in rectangular well depends?
45. Show that sum of reflection and transmission co-efficient for a potential barrier is 1.
46. What is the condition for perfect transmission through a rectangular potential barrier.

47. How many minima and maxima are there in the 2^{nd} excited state wave function of the particle in infinite well.
48. What is stationary state.
49. What is ground state energy or zero energy.
50. What is reflection co-efficent.
51. What is transmission co-efficient.
52. The probability of occupation of a stationary state is_____.
53. The minimum energy of a particle in a box is not zero but if finite is called _____.
54. Write the energy eigen values of a particle in a box.
55. Show that the wave function of two lowest states of a particle in an infinite well are orthogonal.
56. What does quantum no. for a particle 'n' in a box determines.
57. Define Gyromagnetic ratio.
58. What is Bohr magneton?
59. Define Larmor frequency.
60. What is the significance of Stern-Gerlach experimental result?
61. The vector atom model is based on which principle?
62. What are the limitations of Bohr's atom model?
63. What are the short comings of Bohr-Sommerfield theory.
64. What do you mean by parity of eigen functions.
65. Wilson-Sommerfild theory explain the origin of fine structure of spectral lines by assuming_____.
66. What is Zeeman effect.
67. What is longitudinal Zeeman effect.
68. What is transverse Zeeman effect?
69. What do you mean by anomalous Zeeman effect?
70. Anomalous Zeeman effect is observed if the source is placed in _____ magnetic field.
71. Define Lorentz unit.
72. Define the Lande g-factor.
73. What is paschen-Back effect?
74. What is stark effect?

75. How many components are observed in Stark effect?
76. Does weak field Stark effect can be observed.

Long Answer Questions

1. Derive time dependent Schrodinger wave equation in one dimension and three dimension.
2. What are matter waves? What is their phase and group velocity?
3. Derive the expression of probability current density in three dimensions.
4. Discuss about the spread of Gaussian wave packet.
5. Explain time, position and momentum uncertainty of wave packet.
6. State and prove Ehrenfest theorem.
7. Discuss about commutation relation between Hamiltonian 'H' and components of orbital angular momentum.
8. Discuss about orthonormality of eigen function.
9. Discuss about commutation relations of angular momentum with linear momentum.
10. Discuss commutation relation between position and momentum.
11. Derive time independent Schrondinger wave equation and predict its solution.
12. What are stationary state solutions? Find them for time independent Schrodinger wave equation.
13. Write Schrodinger equation for a particle in a box and determine expression for energy eigen values and eigen functions?
14. Obtain the normalized wave function for a particle in a box. Represent them graphically.
15. Consider a particle incident on a potential step of high V_o. calculate the co-efficient of reflection and transmission.
16. What is quantum mechanical tunneling? Under what condition the transmission co-efficient is equal to one.
17. Describe an experimental set-up to study Zeeman effect.
18. What anamolous Zeeman effect? Discuss the Zeeman pattern of the resonance lines of sodium.

19. What is stark effect. Discuss about the weak field and strong field stark effect.
20. Describe Stern-Gerlach experiment.
21. Describe an expression for the Larmor precesional frequency. What is its importance.
22. Discuss Sommerfeld's extension of Bohr's model.
23. Discuss the quantum mechanical treatment of one electron atom.

Solid state physics(core 12)

Short questions

1. What is a crystal?
2. What do you mean by amorphous and crystalline solids?
3. What do you mean by a lattice
4. Define crystal structure
5. What are translation vectors.
6. Define a unit of cell and primitive unit cell
7. Explain a lattice with a base related to crystal structure
8. Name the four types of crystalline solids
9. Explain miller indices
10. What are miller indices? Give their importance
11. Discuss the different types of lattices
12. What do you mean by X-ray diffraction of crystals
13. State Bragg's law
14. Define reciprocal lattice
15. What is the atomic diameter of BBC lattice
16. Define atomic form factor
17. Define geometric structure factor
18. Discuss Brillouin zones
19. Give the significance of packing fraction
20. Calculate number of atoms per unit cell in different lattices.
21. What are lattice vibrations and phonons?
22. Which crystals exhibit optical phonon modes?
23. What do you mean by linear monoatomic and diatomic chains?
24. What are acoustical and optical branches in lattice vibrations?

25. State Dulons and Petit's law
26. Explain the basic ideas behind Einstein model for specific heat of solids
27. State Debye T^3 law
28. What is common between phonon and photon?
29. At what temp. the result of Dulons-petit's law is in agreement with the experimental values
30. Define photon
31. What are non-magnetic substances?
32. What do you mean by atomic dipole?
33. What is Bohr magneton?
34. How do you classify magnetic substances?
35. What do you mean by magnetization?
36. Why soft iron preferred in electromagnets?
37. How can a magnet be demagnetized completely
38. What do mean by domains?
39. State curie's law
40. What do you mean by hysteresis?
41. What is a dielectric?
42. Define dielectric constant
43. What is dielectric polarization
44. Define polarization vector
45. Is polarization possible in air or vacuum?
46. On what factors polarization of a dielectric depends?
47. What is atomic polarisability?
48. What do you mean by local field?
49. What do you mean by anomalous dispersion?
50. What is ionic polarization?
51. Name different types of polarization
52. Write the relation between dielectric constant and electric susceptibility
53. Explain dielectric less
54. What do you mean by LASER?
55. What is basic principle of LASER?
56. What is stimulated emission of light?
57. What do you mean by population in version?
58. What do you mean by pumping?
59. Why is the Ruby laser not very efficient?

60. Given an example of a four level laser
61. Explain the concept of band theory.
62. What is Fermi surface?
63. When does the velocity of electron become maximum?
64. Define forbidden energy gap as per Kronig-Penny model of atom
65. What is hole? What is hole current in semiconductor?
66. What is the value of energy gap in a semiconductor?
67. What is the charge on P and N- type semiconductors?
68. What is Hall effect?
69. What is the cause of Hall-potential?
70. Which type of charge has greater mobility?
71. Give the concept of effective mass.
72. Explain Hall co-efficient
73. Discuss P and N-type semiconductors
74. Give the cause of failure of free electron theory?
75. What is critical temperature of a super conductor?
76. What is the effect of magnetic field on super conductivity?
77. What is isotope effect on super conductivity?
78. What are type- I superconductors?
79. What are type-II superconductors?
80. Give the main characteristics of a cooper pair.

Long questions

1. Describe a unit cell. Discuss lattice parameters of a unit cell
2. Explain fourteen lattices with neat diagrams
3. What are miller indices? How are they calculated? What are (100),(110)and(111) planes of cubic crystal.
4. Derive an expression separation between inter planer planes
5. Explain atomic scattering factor with mathematical expression
6. Explain geometric structure factor with mathematical expression. How is it related to the atomic scattering factor?
7. (a) Derive Bragg's law of crystal diffraction
   (b) Discuss briefly the methods of crystal structure determination
8. What are Laue's equations for diffraction of X-rays by a crystalline solid? Show that these equations lead to Bragg's law for X-ray diffraction
9. Define reciprocal lattice? Derive the expression for the primitive translation vectors of the reciprocal lattice

10. Find the Brillouin zones in case of SC,BCC and FCC lattices.
11. Discuss Langevin's theory of diamagnetism
12. Discuss Langevin's theory of paramagnetism
13. Discuss the Weiss theory of ferromagnetism
14. Explain ferromagnetism on the basis of Domain theory
15. Explain hysteresis, Retentivity and coercivity. How will you determine the value of Retentivity and coercivity from a loop
16. Describe the lattice vibrations of monoatomic linear lattice and obtain for the dispersion relation for lattice vibration of monoatomic linear chain
17. Obtain the various vibrational modes of a linear monoatomic lattice
18. Discuss Dulons-petit's law of specific heat of solid
19. Discuss Debey's theory of specific heat of solid
20. Discuss Einstein's theory of specific heat of solid
21. What is meant by a local field in a solid dielectric? Obtain Clausius-Mossotti relation in dielectrics subject to static fields
22. Explain classical theory of electronic polarizability
23. Discuss different types of polarization. Discuss the frequency dependence of these polarization
24. Define polar and non-polar molecules. Deduce Clausius-Mossotti relation for polar dielectrics
25. Define local field at an atom. Derive the relation between local field and polarization of a dielectric.
26. What are Einstein co-efficient A and B? Derive Einstein's relation between them.
27. Discuss three and four levels laser.
28. Explain working principle and construction of Ruby laser
29. Explain the principle, construction and working He-Ne laser.
30. Explain the following terms: (a)Spontaneous emission (b) Stimulated emission(c) Population inversion (d)metastable state
31. Discuss Kronig-Penny model. Using this model show that the energy spectrum of electron consists of a number of allowed energy bonds separated by forbidden regions
32. What is Hall effect? Give an elementary theory of Hall effect.
33. Show that Hall co-efficient is independent of the applied magnetic field and is inversely proportional to current density and electronic charge

34. What do you mean by mobility of semiconductor? Derive an expression for the mobility.
35. Describe the four-probe method for measurement of conductivity.
36. Explain Meissner effect. Give the experimental demonstration of Meissner effect.
37. Describe Type-I and Type-II superconductors.
38. What is meant by superconductivity? Describe the effect of magnetic field on superconductor.
39. Explain BCS Theory of superconductors.
40. Define Londin penetration depth. Discuss the effect of temperature on penetration depth.

CLASSICAL DYNAMICS (DSE-1)

Short Answer Questions

1. Give example of types of constraints.
2. What are generalized co-ordinates.
3. Write the advantage of using generalized co-ordinates.
4. Write an expression for generalized acceleration.
5. Write an expression for generalized velocity.
6. Write an expression for generalized momentum.
7. What are forces of constraints.
8. If generalized co-ordinate is θ , what is the dimensions of corresponding generalized force.
9. If generalized co-ordinates has the dimension of velocity, generalized velocity has the dimensions of_____.
10. What are Euler-Lagranges differential equations.
11. What is Hamilton's variational principle?
12. What is D' Alembert's principle?
13. What is ignorable co-ordinate?
14. What is generalized momentum?
15. Show that generalized momentum conjugate to a cyclic co-ordinate is conserved.

16. What is Hamiltonian? Explain its physical significance.
17. What are Hamiltonian's equations of motion.
18. Write an expression for a charged particle in an electromagnetic field.
19. Under what conditions, Hamiltonian represents the constant of motion but not the total energy.
20. What is an inertial frame.
21. What are postulates of special theory of relativity.
22. Write down the Lorentz transformation equations.
23. What are inverse Lorentz transformations.
24. What is length contraction.
25. What is time dilation.
26. What is twin paradox.
27. Define world point and world line.
28. What is space like interval.
29. What is time-like interval.
30. What is proper time interval.
31. What is like interval.
32. What is Minkoski space.
33. What is world region.
34. What is light cone.
35. What are four vectors.
36. What is relativistic Doppler's effect.
37. What is four force.
38. What is mass-kinetic energy relation.
39. What is mass variation formula.
40. What are constraints?

Long Answer Questions

1. Derive Lorentz transformation equations.
2. What are four vectors. Find the components of the momentum four vectors.
3. Define a four vector. What are velocity, momentum and force four vectors.
4. Discuss relativistic Doppler's effect.

5. Derive energy momentum relation.
6. What are constraints? How do they affect motion of a mechanical system. Explain forces of constraints.
7. Define generalized co-ordinates and obtain the expression for generalized acceleration, generalized force.
8. Obtain the Euler-Lagrange differential equation by a variational procedure.
9. Prove Lagrange's equations of motion for a system of interacting particles.
10. State Hamilton's principle and use it to obtain the equation of motion.
11. Derive Hamilton's equation of motion using variational principle and applying it calculate frequency of oscillation of a harmonic oscillator.
12. Obtain Hamilton's equation of motion in spherical co-ordinates.
13. Derive Hamilton's Canonical equations of motion in general co-ordinates.

Nuclear and Particle Physics (DSE-2)

Short Answer Questions

1. Write a short note on size, mass and density of the nucleus.
2. What is nuclear spin.
3. What is magnetic dipole moment of nucleus.
4. What is electric quadrupole moment of nucleus.
5. What is binding energy of nucleus.
6. Define mass defect.
7. What is packing fraction.
8. Explain angular momentum of nucleus.
9. Write a short note on parity of nucleus.
10. Explain magnetic moment of nucleus.
11. Write down the properties of nuclear forces.
12. Calculate binding energy of an α-particle from the following data.

    Mass of helium nucleus=4.001265 a.m.u.

    Mass of proton=1.007277 a.m.u.

    Mass of neutron=1.008666 a.m.u.

13. Describe the liquid drop model.
14. Explain the assumptions of liquid drop model.
15. Explain nuclear stability by liquid drop model.
16. Discuss the different terms used in semi-empirical mass formula for liquid drop model.
17. What is volume energy correction.
18. What is surface energy.
19. What is Coulomb energy.
20. What is asymmetry energy.
21. What is pairing energy.
22. What is binding energy formula.
23. What is semi-empirical formula.
24. What is the condition of nuclear stability.
25. What are the drawbacks of liquid drop model.
26. What do you mean by magic number.
27. What is shell model.
28. What are the assumptions of shell model.
29. What are the merits of shell model.
30. What are the failures of shell model.
31. What is radioactivity.
32. Give the properties of different rays emitted by radio-active substance.
33. State the laws of radio active disintegration.
34. Define half life of a radioactive substance.
35. Define mean life.
36. Define radioactive decay constant.
37. What is α-decay.
38. Discuss the condition for α-decay.
39. Explain the concept of Gammow's teory of α-decay.
40. Explain β-decay.
41. Write a short note on Υ-decay.
42. Explain pair production.
43. What is nuclear reaction.
44. Explain different kinds of nuclear reaction.

45. What do you mean by Q-value for a nuclear reaction.
46. Obtain the expression for threshold energy.
47. Mention the conservation laws in nuclear reaction.
48. What is endoergic reaction.
49. What is exoregic reaction.
50. What is the concept of nuclear reactions channel.
51. Write a short note on nuclear detectors.
52. Explain the working of nuclear detectors.
53. Name the three methods for detection of nuclear radiations.
54. Explain the working of proportional counter.
55. Explain the working of Geiger-Muller counter.
56. Explain the working of Scintillation counter.
57. What are the characteristics required for a good perfect nuclear detector.
58. Distinguish between ionization chamber and G.M counter.
59. Write a short note on solid state detectors.
60. Why germanium detectors are more suitable than silicon detectors.
61. Explain photo multiplier tube.
62. Explain the working of a photo detector.
63. What are the characteristics of good neutron detector?
64. Describe the construction of a linear accelerators.
65. Write the principle of linear accelerator.
66. Give the principle of linear accelerator.
67. Give the principle of Van de Graff accelerator.
68. Write the working of cyclotron
69. What is the principle of synchro-cyclotron.
70. What is the principle of betatron.
71. What are elementary particle.
72. Explain weak and strong interaction.
73. What are bosons.
74. What are fermions.
75. Explain the family members of leptons.
76. Explain the family members of bosons.
77. Explain the family members of hyperons.

78. What are the different types of hyperons.
79. Give the properties of bosons.
80. Compare composite bosons and mesons.
81. What is lepton number?
82. What is Baryon number?
83. What is isospin?
84. Define strangeness.
85. Define hypercharge and strengeness.
86. What are quarks.
87. Give elementary idea about quarks and glun.
88. What are different types of quarks.
89. What is conservation of angular moment of angular moment of elementary particles.
90. Explain conservation of parity.

Long Answer Questions:-

1. What is mean by binding energy and binding energy per nucleon? Explain the variation of average binding energy with mass number.
2. What do you mean by electric quadrupole moment. Derive an expression of it.
3. Give the properties of the nucleus. Explain the terms magnetic dipole moment and electric dipole moment.
4. State the observation of liquid drop model. Obtain semi-empirical formula.
5. What are magic numbers? Explain how shell model accounts for the existence of magic number.
6. What is shell model? Give the various achievements of the shell model.
7. Explain α-decay. Give Gammow's theory of α-decay.
8. Give Fermi's theory of β-decay. Give Gammow's explanation of β-decay.
9. State Geiger-nuttal law and discuss its importance.
10. What are conservation law obeyed by a nuclear reaction? What is Q-value of nuclear reaction. Explain its importance.
11. What do you mean by threshold energy. Derive an expression for it.

12. Explain the principle of detection of particles. Explain the construction, principle and working of ionization chamber.
13. Describe the construction and working of Geiger-Nutter counter. What are its limitatios.
14. What are nuclear detectors. Describe principle, construction and working of Scintillation counter.
15. Describe the principle and working of solid state detectors.
16. Explain the construction and principle of a photomultiplier tube.
17. What is Van de Graaff accelerator? Describe the construction, principle and working of it.
18. Describe a cyclotron and explain how charged particles can be accelerated with it. What is its limitations.
19. What is the difference between a quark and gluon? Discuss the properties of quarks.
20. What are the conservation laws used with elementary particles.
21. What are hyperons and leptons? Give their decay processes.
22. What are the conservation laws used with elementary particles.
23. What are strange particles? Explain the principle of their production.
24. What are leptons. Discuss their properties.
25. What are baryons. Discuss their properties.

Semester-VI

Electromagnetic theory(Core-13)

Short Answer Questions

1. What is equation of continuity.
2. What is equation of continuity for steady current.
3. State Gauss law in electrostatics.
4. What is displacement vector.
5. What is differential form of Maxwell's 1^{st} equation.
6. What is differential form of Maxwell's 2^{nd} equation.
7. What is Ampere's circuital law.

8. What is displacement current density.
9. Explain conduction current and displacement current.
10. What are Maxwell's equations in free space.
11. What are the Maxwell's equations for static field.
12. What is Snell's law in electrostatistics.
13. What is Lorentz force.
14. What is magnetic vector potential.
15. State Poynting theorem.
16. What is Poynting vector.
17. What is Poynting vector in complex form.
18. What is Lorentz gauge.
19. What is Coloumb gauge.
20. Are vector and scalar potentials independent of each other.
21. What is the law of conservation of charge which resembles equation of continuity.
22. What is the nature of electromagnetic wave.
23. What do **E** and **H** represent in an electromagnetic wave.
24. What do you mean by wave impedance.
25. What is the phase difference between field vectors **E** and **H** in a good conductor.
26. What are isotropic and an-isotropic medium.
27. What do you mean by wave impedance?
28. What is penetration depth? Write its expression for a good conductor.
29. Explain skin depth on the basis of electromagnetic theory. What is its value for copper?
30. An electromagnetic wave propagates in a conducting media of conductivity .Write an expression for phase velocity of the wave.
31. Express refractive index of the conductive medium for an electromagnetic wave.
32. What is intrinsic impendance of a good conductor when an electromagnetic wave travels in conducting media of conductivity
33. What is an optical fibre?
34. What is the phenomenon on which optical fibre works.

35. Define acceptance angle?
36. Define numerical aperature?
37. What is step index fibre?
38. What is graded index fibre.
39. What are Fresnel's equation cases when electric field **E** is perpendicular to the plane of incidence.
40. What are Fresnel's equations when electric vector '**E'** is parallel to the plane of incidence.
41. What are evanescent waves?
42. What is the unit of Poynting vector.
43. What is the electrostatic energy density.
44. What is the expression of speed of electromagnetic waves.
45. What is the direction of flow of energy of an electromagnetic wave.
46. Write down the expression of refractive index of the non-conducting media.
47. what is polarization?
48. What is linear polarization?
49. What is elliptical polarization?
50. What is circular polarization?
51. Define Brewster's angle. Why is a Brewster angle also called a polarizing angle.
52. Define Parallel polarization.
53. Define perpendicular polarization.
54. State Brewster's law.
55. What is a wire grid polarizer.
56. What is absorption axis.
57. What is transmission axis.
58. What is polaroidx.
59. What do you mean by H-polaroids and K- polaroids**.**
60. What are the uses of polaroids.
61. State Malus law.
62. What do you mean by polarization by reflection.
63. What is optic axis.

64. What is double refraction.
65. Define O-ray and E-ray.
66. Refractive index of water is 1.33. calculate the angle of polarization for light reflected from the surface of a pond.
67. If the Brewster's angle is so. Find the refractive index of the material.
68. What is optical activity?
69. What do you mean by rotator polarization and rotator dispersion.
70. Define specific rotation.
71. What do you mean by retardation plates.
72. What is a quarter wave plate.
73. What is a half wave plate.
74. What are uniaxial and biaxial crystals.
75. Define plane of vibration and plane of polarization.
76. Write equation of continuity?
77. State equation of continuity?
78. Which conservation law obeyed by equation of continuity?
79. What is displacement current?
80. Write Maxwell's equation for harmonically varying fields?
81. What are electromagnetic vector and scalar potentials?
82. Write Lorentz gauge. What are the advantages of this gauge?
83. Write coulomb's gauge. What are its significances?
84. What do you mean by poynting vector and what does it represent?
85. Write Maxwell equations for linear, isotropic, dielectric media?

Long Answer Questions

1. Derive Maxwell's equations.
2. Write down differential and integral form of Maxwell's equation for free space and for static fields.
3. Discuss the boundary conditions at the interface of two di-electrics.
4. Derive the expression of magnetic vector potential.
5. Derive the wave equations in terms of magnetic intensity '**H**'.
6. Derive the wave equation interms of magnetic intensity '**H**'.
7. State and prove Poynting theorem.

8. Write down the Maxwell's equation involving the scalar and vector potentials. What are Lorentz and Coulomb gauge
9. Determine the boundary conditions satisfied by B,H and E and D at the interface between two media of different permeabilities and dielectric constants.
10. Derive Fresnel's equations for reflection and refraction of electromagnetic waves at a plane boundary separating two media.
11. Discuss metallic reflection and refraction. Find out an expression for the reflection power of a metallic surface.
12. Obtain the necessary relation between the incident and reflected electromagnetic field amplitudes for reflection at a plane metal surface.
13. Discuss the propagation of plane electromagnetic waves in an isotropic di-electric medium.
14. Obtain an expression for plasma frequency when electrom agnetic wave propagates in an ionized media.
15. Describe and explains the construction of Nicol prism and its action as polarizer and analyser.
16. Explain the construction and use of quarter wave plate and a half wave plate and give their uses in various types of polarized light.
17. Describe construction of a Babinet compensator. How is it used for analyzing elliptically polarized light?
18. Show that circularly polarized light and plane polarized light.
19. What do you understand by optical rotation? Give Fresnel's theory to explain optical rotation.
20. Define specific rotation of an optically active substance and how is it related to molecular rotation?
21. Describe construction and working of Laurents's half shade polarimeter.
22. Write down Maxwell's field equations and prove poynting's theorem relating to the flow of energy at a point in space in an electromagnetic field.
23. Derive Maxwell's equation in different form.
24. What do you mean by displacement current? Show that displacement current is the variation of electric displacement?

25. Obtain poynting theorem for conservation of energy in an electromagnetic field and discuss the physical meaning of each term.
26. Define and discuss poynting vector. Discuss its dimension.
27. What are electromagnetic potentials? Obtain Maxwell's equation in terms of potentials?
28. Show that electromagnetic potentials A and Ø are not unique. Explain Coulomb gauge and Lorentz gauge.
29. Derive boundary conditions at the interface of two media?

30. Determine the boundary condition satisfied by $\bar{B}$, $\bar{H}$ & $\bar{E}$, $\bar{D}$ at the interface between two media.
31. Discuss reflection and refraction of plane waves at the plane interface between two dielectric media.
32. Derive Fresnel's equations for reflection and refraction of EM waves at the plane boundary separating two media when incident wave is polarised with $\bar{E}$ normal to the plane of incidence.
33. Derive Fresnel's equation, when $\bar{E}$ parallel to plane of incidence.
34. Define co-efficient of reflection and transmission and derive expressions for them.
35. What is total internal reflection? Why is it produced? What are evanescent waves? Show that the amplitude of reflected wave is the same as that of incident waves?
36. Obtain expression for reflection co-efficient of EM wave incident of a metallic surface with E vector parallel to plane of incidence?
37. Distinguish between single mode and multi mode fibre.
38. Distinguish between step index and graded index fibre.
39. Explain the principle and working of an optical fibre.

Statistical mechanics (core-14)

Short Answer Questions

1. What is the difference between a microstate and a macrostate?
2. What is thermodynamic probability of a given macrostate?
3. What do you mean by entropy.
4. What is physical significance of entropy.
5. What is statistical definition of entropy.
6. What are intensive parameters?
7. What are extensive parameters?

8. Show that entropy is an extensive parameters.
9. What is the value of thermodynamic probability for a system in perfect order?
10. What is the third law of thermodynamics.
11. What is the change in entropy of a reversible process.
12. If the change in entropy is greater than zero then the process is _____.
13. Define second law of thermodynamics and show that it follows from the law of increase of entropy.
14. Why does entropy increase during expansion if gas.
15. Show that diffusion of gas is an irreversible process.
16. What are thermodynamic functions. Why they are thermodynamic potentials.
17. Enthalpy remains constant in_____process.
18. Helmholtz free energy remains constant in_____process.
19. Gibb's function remains constant in_____process.
20. What is the physical significance of Gibb's function.
21. What is phase space?
22. Define ensemble?
23. Define macrocanonical ensemble.
24. Define canonical ensemble.
25. Define grand canonical ensemble
26. What is the minimum size of a phase space cell in classical and quantum statistics?
27. What do you mean by degree of freedom.
28. What is partition function.
29. What is the significance of partition function.
30. How we can treat the identical gas molecules as distinguishable in classical statistics?
31. What is the purpose of dividing phase space in to cells.
32. Define phase space and momentum space.
33. What is thermal radiation.
34. What is a black body. Give an example.

35. State kirchhoff's law of radiation.
36. State stefan's law.
37. State wien's displacement law.
38. What is Saha's ionization formula.
39. What is ultraviolent catastrophe?
40. State planck's la of black body radiation.
41. What is quantized oscillator.
42. What is the significance of Saha's ionization formula.
43. Write down the properties of thermal radiation.
44. Define spectral energy density.
45. Compare black body radiation with perfect gas.
46. Define radiation pressure.
47. Define emissivity.
48. Define emissive power.
49. Define absorptive power.
50. What is Fery's black body.
51. Define solar constant?
52. Rest mass of photo is zero. Explain its physical significance?
53. What is degenerate gas.
54. What is electron gas.
55. Write down distribution law in **F-D** statistics. What are bosons?
56. What are fermions?
57. What is Fermi-Dirac statistics.
58. What is Bose-Einstein statistics.
59. Mention few phenomena which could not be explained using Maxwell-Boltzmann statistics?
60. Why a blackened platinum wire, when gradually heated appears first dull red then blue end finally white.
61. Explain why black body radiation is white.
62. Name few phenomena which can not be explained with Maxwell-Boltzman's statistics.
63. What is the basic difference between classical and quantum statistics?
64. Define Fermi energy?

65. What is fermi gas?
66. What is a photon gas?
67. What is the difference between photon gas and an ideal gas?
68. What is Fermi energy level?
69. What is Bose-Einstein's condensation
70. What is photon?

Long Answer Questions

1. Define thermodynamic variables and thermodynamic potentials. Derive Maxwell's thermodynamic relations from them.
2. Calculate the average and rms speed of molecules obeying **M-B** statistics.
3. Derive Maxwell-Boltzman law of distribution of molecular speed and obtain an expression of most probable speed of the molecules using it.
4. What do you mean by partition function. Express Helmholtz free energy and enthalpy from it.
5. State and prove law of equipartion of energy.
6. Prove that the entropy thermodynamic system remains constant in any reversible process.
7. Discuss the law of increase of entropy on the basis of statistical physics.
8. Derive Sacker Tetrode equation.
9. Derive partition function for an ideal mono-atomic gas.
10. State Stefan's law and prove it from thermodynamics.
11. State derive wien's distribution law.
12. Derive Saha's ionization formula.
13. State and derive ionization formula.
14. Explain graphically energy distribution of black body radiation with wavelength of different temperature.
15. Derive Planck's law and show that Wien's law and Rayleigh-Jeans la are special case of planck's law.
16. Derive an expression for the most probable distribution of particles for a system obeying Bose-Einstein statistics.
17. Derive an expression for the energy distribution of free electrons in a conduction using Fermi-Dirac distribution law.

18. Define Fermi energy? Derive an expression for it.
19. Using BE distribution law derive Planck's law of black body radiation.
20. What are the assumptions of Bose-Einstein statistics? Derive the Bose-Einstein distribution law of speeds.

Nano Materials and Applications (DSE 3)

SHORT QUESTIONS-

1. What are nanostructures?
2. What do you mean by nanostructure?
3. What do you mean by nanotechnology?
4. Write the name of three categories of solid?
5. What is critical length for the resistance of the material?
6. Which properties of the material are changed at nano-region?
7. What is the cause of the increase of in surface to volume ratio for the nano material?
8. What is critical length?
9. What are size dependent properties of solid?
10. When the nano material is in the quantum confinement regime?
11. What is exciton?
12. What is exciton Bohr radius?
13. What is the degree of freedom of zero dimensional nano-structured material?
14. Write two examples of 0D nano-structured material (NSM)?
15. What is the degree of freedom of 1D NSM?
16. What is the degree of freedom of 2D NSM?
17. What is the degree of freedom of 3D NSM?
18. What are 0D NSM?
19. What are 1D NSM?
20. What are 2D NSM?
21. What are 3D NSM?
22. What are quantum dots?
23. What are thin films?
24. What are nano-rods?
25. What are nano-wires?
26. Write an expression for density of states for 0D nano-crystal?
27. Write an expression for density of states for 1D nano-crystal?

28. Write an expression for density of states for 2D nano-crystal?
29. Write an expression for density of states for 3D nano-crystal?
30. Define density of states.
31. What is quantum confinement?
32. Write the time dependent Schrodinger equation in 1D.
33. Write the time independent Schrodinger equation in 1D.
34. Write an expression for the Eigen energy for infinite potential well.
35. Write an expression for the energy of an electron moving in 1D nano-wire?
36. What is compound microscope?
37. What is transmission electron microscopy?
38. What is scanning probe microscopy?
39. What is scanning tunnelling microscopy?
40. State Bragg's law.
41. Write examples of top-down approach.
42. Write examples of bottom-up approach.
43. What is electrolyte deposition?
44. In which method the heating is done by Joule heating?
45. What do you mean by spray pyrolysis?
46. Explore sol-gel techniques.
47. What do you mean by pulsed laser deposition (PLD)?
48. Which method is used for thin film deposition as well as synthesis of nano-material?
49. What do you mean by E-beam evaporation?
50. What do you mean by sputtering?
51. What are CNT based transistor?
52. Why nano-materials are different from other materials?
53. Why CNT has a very high strength?
54. Write examples of one dimensional application of nano-materials.
55. Write examples of two dimensional applications of nano-material?
56. What are photonic device?
57. What devices are less sensitive to light?
58. What is LED?
59. What is QDLED?
60. What is nano-dot solar cell?
61. What is single electron device?
62. What is single electron transistor?

63. What is CNT?
64. What are CNT based transistor?
65. Write examples of single electron devices?
66. What is used in fabricating nano-wire solar cell?
67. What is the function of quantum dot solar cells?
68. Explain fabrication of nano-wire LED.
69. How can LED fabricate?
70. Draw the transfer characteristics of P-channel CNTFET.

LONG QUESTIONS-

1. What do you mean by nano-structured material? Explain 0D, 1D, 2D, 3D nano-material?
2. Describe the density of states of materials at nano-scale?
3. Write notes on,
    a) Nano-dots
    b) Nano-rods
    c) Nano-wire
    d) Thin film
4. Explain the quantum confinement of a particle trapped in an infinite potential well by using time independent Schrodinger equation.
5. Discuss the application of Schrodinger equation to a particle moving along the positive X-axis towards a potential box.
6. Apply Schrodinger equation to explain the quantum confinement of a particle in 3D trapped inside a potential box.
7. Explain the quantum confinement of an electron in one dimensional and it is free to move along two other axes.
8. Explain the quantum confinement of an electron confined in two dimensions and it is free to move?
9. Explain quantum confinement of an effect in nano-structured materials and its consequences?
10. Write short notes on :
    a) Top-down technique
    b) Bottom top technique
    c) Photo lithography
    d) Ball milling
    e) Sputtering
11. Explain evaporation technique.
12. Explain pulsed laser deposition.

13. Explain chemical vapour deposition.
14. Explain electro deposition techniques for synthesis of nano-material.
15. Discuss about the spray pyrolysis method for the synthesis of nano-materials.
16. Describe X-ray diffraction technique for the characterisation of nano-particles.
17. Describe scanning electron microscopy technique for characterisation of nano-particles.
18. Describe the working principle of atomic force microscopy and scanning tunnelling microscopy.
19. Discuss about the principles and working of a quantum dot hetero structure laser diode.
20. Write notes on:
    a. Optical switching
    b. Optical data storage

21. Write notes on:

    a) Magnetic quantum well
    b) Magnetic quantum dots
    c) Magnetic data storage

22. Write short notes on:

    a) Micro electro mechanical systems.
    b) Nano electro mechanical systems.