(Pages : 3) **P – 5269**

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, September 2022

Physics

PH 221 : MODERN OPTICS AND ELECTROMAGNETIC THEORY

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. **Each** carries **3** marks.

1. Distinguish between Fresnel and Fraunhofer diffraction.
2. Give an account of third harmonic generation of non-linear optics.
3. Explain the propagation of EM waves through linear media.
4. What are vector and scalar potentials?
5. Obtain the expression for power radiated by an arbitrary charge.
6. Discuss the significance of Smith chart.
7. Write a short note on rectangular waveguides.
8. What are antenna arrays?

($5 \times 3 = 15$ Marks)

P.T.O.

PART – B

Answer **any three** questions. **Each** carries **15** marks.

9. (a) Demonstrate the first experiment to show the existence of second harmonic generation.

   (b) Elaborate the concept of phase matching.

OR

10. (a) Write a note on Raman Nath diffraction and Bragg diffraction.

    (b) How will you demonstrate the occurrence of interference with multibeam?

11. Explain the electric dipole radiation. Obtain the expressions for the fields due to oscillating electric dipole and deduce the power radiation.

OR

12. Discuss the propagation of electromagnetic waves in conductors and derive an expression for skin depth.

13. (a) List the advantages of waveguides over transmission lines.

    (b) Explain the propagation of waves through waveguides.

OR

14. (a) Explain the radiation from Hertzian dipole.

    (b) Explain EIRP and Friis equations of antenna.

($3 \times 15 = 45$ Marks)

PART – C

Answer **any three** questions. **Each** carries **5** marks.

15. A distortion less line has $Z_0 = 60\Omega$, $\alpha = 20mNp/m, u = 0.6c$, where c is the speed of light in vacuum. Find R and L at 100 MHz.

16. An electric field of strength $10\mu V/m$ is to be measured at an observation point $\theta = \pi/2{,}500\,km$ from a half-wave (resonant) dipole antenna operating in air at $50MHz.$ find the average power radiated by the antenna.

17. In a rectangular waveguide for which $a = 1.5cm$, $b = 0.8cm$, $\sigma = 0.\mu = \mu_0.$ and $\in = 4 \in_0$, $H_x = 2\sin\left(\frac{\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right)\sin(\pi \times 10^{11}t - \beta z)A/m.$ Determine

    (a) The mode of operation

    (b) The cut off frequency

    (c) The phase constant β

18. Obtain gauge transformation conditions.

19. A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second-order diffraction.

20. Obtain the expression for energy and momentum in electromagnetic waves.

(3 × 5 = 15 Marks)

———————

(Pages : 2) **P – 5270**

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, September 2022

Physics

PH 222 : THERMODYNAMICS, STATISTICAL PHYSICS AND BASIC QUANTUM MECHANICS

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

SECTION – A

Answer any **five** questions. **Each** question carries **3** marks.

1. What do you meant by partition function?
2. Explain is Nernst's Theorem and explain its importance.
3. What do you meant by statistical equilibrium?
4. What is Gibbs function and prove that Gibbs function decrease during isothermal isobaric process and is equal to the net work obtained.
5. Write the most probable distributions in Maxwell Boltzman statistics, Bose Einstein Statitics and Fermi dirac Statistics.
6. Explain quantum mechanical tunneling.
7. Write a short note on Dirac notation.
8. Briefly explain Schrödinger representation or Schrödinger picture.

($5 \times 3 = 15$ Marks)

P.T.O.

SECTION – B

Answer **any three** questions. **Each** question carries **15** marks.

9. Derive Maxwell's thermodynamic relations and hence derive Clausius Clapeyron equation.

OR

10. Derive an expression for the distribution of speeds of particles in a classical gas.

11. Explain Fermi dirac statistics and distribution law.

OR

12. Discuss Bose Einstein Condensation.

13. Solve linear harmonic oscillator problem using Schrödinger method.

OR

14. Discuss particle moving in a spherically symmetrical potential.

(3 × 15 = 45 Marks)

SECTION – C

Answer **any three** of the following questions. **Each** question carries **5** marks.

15. With the help of Maxwell's relations, show that $TdS = C_v dT + T\left(\frac{\partial p}{\partial T}\right)_V dV$ And $TdS = C_p dT - T\left(\frac{\partial V}{\partial T}\right)_P dP$

16. Derive the co-relation of partition function Z with entropy S for ideal gas obeying classical statistics.

17. Prove that for Maxwell Boltzman statistics, the total energy E = (3/2) RT.

18. Derive Richardson Dushman equation of thermionic emission.

19. Show that the zero point energy of ½ $\hbar\omega$ of a linear harmonic oscillator is a manifestation of the uncertainty principle.

20. Show that operator can be expressed in matrix form.

(3 × 5 = 15 Marks)

(Pages : 3) **P – 5271**

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, September 2022

Physics

PH 223 : COMPUTER SCIENCE AND NUMERICAL TECHNIQUES

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. Each question carries **3** marks.

1. Explain the terms: bit, word and address bus.
2. What is a list in Python? Discuss any two methods or functions for fist operations.
3. How is microcontroller5 different from microprocessor?
4. What is the difference between structure and class in C++?
5. How data is read from and written to files in C++?
6. Write forward, backward and central difference formula for the first order derivative.
7. Derive Simpson's 1/3 rule from general quadrature formula.
8. Explain how Schrodinger equation (one dimensional) is numerically solved.

(5 × 3 = 15 Marks)

P.T.O.

PART– B

Answer any **three** questions. Each question carries **15** marks.

9. (a) Explain the addressing modes in 8085 microprocessor.

   (b) Explain the different registers in 8085 microprocessor.

10. (a) Discuss various topologies.

    (b) Explain OSI model for computer networks.

11. (a) Discuss how multidimensional arrays are represented in C++ and how it is stored in memory.

    (b) Write a program to print the upper and lower triangles of an $N \times N$ matrix.

12. (a) How are files declared in C++? Explain the basic file operations.

    (b) Explain how arrays are passed as arguments of functions.

13. (a) Explain how Laplace's equation in two dimensions is numerically solved.

    (b) Derive Newton's backward difference interpolation formula.

14. (a) Discuss in brief Euler's method of solving ordinary differential equations.

    (b) Derive Lagrange interpolation formula.

($3 \times 15 = 45$ Marks)

PART – C

Answer any **three** questions. Each question carries **5** marks.

15. Differentiate RAM and ROM.

16. Explain Pin diagram in 8085 microprocessor.

17. Write a C++ program that implements the bisection method for finding the roots of a nonlinear equation.

18. Write a C++ program to find the factorial of an integer.

19. The velocity of a car running on straight road in the intervals of two minutes is given below

Time (Minutes)	0	2	4	6	8	10	12
Velocity (In Km/hr)	0	22	30	27	18	7	0

Apply Simpson's rule to find the distance covered by the car.

20. Derive Gauss's backward formula of interpolation.

($3 \times 5 = 15$ Marks)

(Pages : 3) **P – 5275**

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, September 2022

Physics

PH 221 : MODERN OPTICS AND ELECTROMAGNETIC THEORY

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer **any five** questions. Each question carries **3** marks.

I. (a) Define radiation resistance of an antenna.

(b) Explain the term characteristic impedance.

(c) What are proper time and proper velocity?

(d) What is depth of penetration?

(e) Write a short note on energy and momentum in electromagnetic waves.

(f) Discuss Raman Nath and Bragg regimes of diffraction.

(g) Explain multiquantum photoelectric effect.

(h) What do you meant by wave guide and distinguish TE and TM waves?

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **all** questions. Each question carries **15** marks.

II. (a) What is Fraunhofer diffraction and derive diffraction formula.

OR

(b) Explain harmonic generation, second harmonic generation and third harmonic generation.

III. (a) Discuss

(i) Electrodynamics in tensor notation

(ii) Relativistic potentials.

OR

(b) Discuss electric dipole radiation.

IV. (a) What are transmission lines? Derive the transmission line equations and explain any two losses in transmission lines.

OR

(b) Derive the field equation for the TE waves in the rectangular wave guides.

($3 \times 15 = 45$ Marks)

PART – C

Answer **any three** questions. Each question carries **5** marks.

V. (a) Derive the expression for the efficiency of an antenna in terms of radiation resistance and ohmic loss resistance.

(b) Derive the expression for the cut off frequency of TM waves in rectangular wave guide.

(c) Find the radiation resistance in terms of λ and b for the oscillating magnetic dipole.

(d) A point charge q is at rest at the origin in the system S_1. What is the electric field of the same charge in system S, which moves to the right at a speed v_0 relative to S_1.

(e) Explain multi photon process.

(f) Raman-Nath modulators can be used at relatively low acoustic frequencies. Why?

($3 \times 5 = 15$ Marks)

———————

(Pages : 3) **P – 5276**

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, September 2022

Physics

PH 222 : THERMODYNAMICS, STATISTICAL PHYSICS AND BASIC QUANTUM MECHANICS

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

I. Answer any **five** questions. Each question carries **3** marks.

(a) What are extensive and intensive variables? Give examples.

(b) What is Enthalpy of a system? Show that the change in enthalpy is equal to the heat absorbed in a isobaric process.

(c) State and explain the third law of thermodynamics.

(d) Explain the postulate of equal apriori probability.

(e) Give the major differences between classical and quantum statistics.

(f) Maxwel Boltzmann distribution is a limiting case of Fermi Dirac and Bose Einstein distribution. Explain.

(g) What is a Hermetian operator? What is its significance?

(h) Briefly explain the three pictures of quantum mechanics bringing out their differences.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer A or B part of questions II, Ill and IV. Each question carries **15** marks.

II. (A) Derive Maxwell Boltzmann Distribution law and hence show that $n(E)dE = \frac{2\pi N}{(\pi kT)^{3/2}} E^{1/2} \exp\left(-\frac{E}{kT}\right) dE$, where $n(E)dE$ is the number of molecules with energies E and $E + dE$.

OR

(B) (a) What are thermodynamic potentials? Derive Maxwell's thermodynamic relations.

(b) Derive Clapeyron's latent heat equation using Maxwell's thermodynamic relations.

III. (A) What is Bose-Einstein statistics? What are the basic postulates used? Derive the expression for the most probable distribution of particles of a system obeying B.E statistics and hence deduce Planck's Black body radiation formula.

OR

(B) What are Fermions? Write down the postulates of Fermi-Dirac statistics. Derive the expression for the probability distribution of particles governed by Fermi-Dirac statistics? Derive the expression for the energy distribution of electrons in a metal and hence obtain the relation for the average kinetic energy of the electrons at absolute zero.

IV. (A) What are creation and annihilation operators? Explain its properties. Solve the harmonic oscillator problem using operator method? Sketch the form of the wave functions and probability densities for the first four lower energy states.

OR

(B) (a) Find the solution for the Schrodinger equation of a particle in a finite potential well.

(b) Applying appropriate boundary conditions find the probability for a particle to penetrate the barrier.

($3 \times 15 = 45$ Marks)

PART – C

V. Answer any **three** questions. Each question carries **5** marks.

(a) Calculate the pressure at which ice freezes at 272 K, if the change in specific volume when 1 kg of water freezes is 91×10^{-6} m^3 . Given latent heat of ice = 3.36×10^5 Jkg^{-1}.

(b) Using Maxwell's thermodynamic relations show that $\left(\partial C_p / \partial P\right) = T\left(\partial^2 S / \partial P \partial T\right) = -T\left(\partial^2 V / \partial T^2\right)_p$.

(c) Fermi energy of conduction electrons in silver is 5.48 eV. Calculate the number of such electrons per cm^3.

(d) A system consists of 5 particles arranged in two compartments. The first compartment is divided into 6 cells and the second into 8 cells. The cells are of equal size. Find the number of microstates in the macro state (2, 3), if the particle obeys Fermi-Dirac statistics.

(e) State and prove uncertainty principle

(f) Find the expectation value of position for a particle trapped in a box of width *L*.

($3 \times 5 = 15$ Marks)

———————

(Pages : 3) **P – 5277**

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, September 2022

Physics

Special Paper II

PH 223 : COMPUTER SCIENCE AND NUMERICAL TECHNIQUES

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **FIVE** questions. Each carries **3** marks.

I. (a) Explain the difference between machine language and assembly language.

(b) How does a microprocessor differentiate data and instruction code?

(c) Explain the 'jump' instruction in 8085.

(d) Explain the loop statement in python using the 'while' construct.

(e) What are data types in C++?

(f) Write down the precedence of arithmetic operations in C++.

(g) What is interpolation?

(h) Explain briefly the Simpson's 1/3 rule.

($5 \times 3 = 15$ Marks)

P.T.O.

PART – B

Answer **all** questions. Each carries **15** marks

II. A. (a) What is memory? Discuss its classification. **9**

(b) Distinguish between lists and tuples in python. **6**

OR

B. (a) Explain interrupts in 8085. **8**

(b) Write an assembly language programme for multiplication of two hexadecimal numbers in 8085. **7**

III. A. (a) What are functions in C++? **6**

(b) Using an example, distinguish calling function from called function in C++. **9**

OR

B. (a) What do you mean by scope of a variable in C++ **6**

(b) Explain the scope rule for functions and variables in C++. **9**

IV. A. (a) Given $dy/dx = y - x$, and y(0) = 2. Find y(0.l) using Runge-Kutta method, taking $h = 0.1$. **9**

(b) Derive second order Runge-Kutta formula and from Euler's formula. **6**

OR

B. (a) Solve the following equations Gauss elimination method

$27x + 6y - z = 85$

$6x + 15y + 2z = 72$

$x + y + 54z = 11$ **9**

(b) Compute the integral $\int_5^9 \frac{dx}{x}$ using Simpson's 3/8 rule. **6**

(3 × 15 = 45 Marks)

PART C

Answer any **three** questions. Each carries **5** marks

V. (a) What are peripherals?

(b) Explain a method to read contents from a text file using python.

(c) Explain the syntax of the 'switch' statement in C++.

(d) What is the difference between 'break' and 'continue' statements in C++?

(e) State and explain the trapezoidal rule.

(f) If $y_1 = 4$, $y_3 = 12$, $y_4 = 19$ and $y_x = 7$, find x using Lagrange's interpolation formula.

(g) Explain the Euler method for solving ordinary differential equation.

($3 \times 5 = 15$ Marks)

———————

(Pages : 3) **N – 6769**

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, June 2022

Physics with Specialization in Nano Science/Space Physics

PHSP 531/PHNS 531 : ADVANCED QUANTUM MECHANICS

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. Each question carries **3** marks.

1. Discuss Rayleigh-Ritz method.

2. Write the connection formula and explain why the WKB method is valid for system in which the potential is slowly varying.

3. Why the ground state of hydrogen atom will not show first order stark effect.

4. Prove that the total energy of the system is conserved if the system is invariant under translation in time.

5. Write the expression for scattering amplitude and discuss optical theorem.

6. Write an short note on spin vectors for spin half system.

7. Discuss the interpretation of Klein Gordon equation.

8. What are negative energy states and hole?

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **all** questions. Each question carries **15** marks.

9. Explain variational principle and discuss ground state energy of helium.

OR

10. Discuss time dependent perturbation theory and prove that the transition probability oscillates sinusoidal as a function of time.

11. Derive Hartree equation for an electron move in a spherical symmetric potential.

OR

12. Explain (a) Born approximation. (b) Scattering by a screened coulomb potential. (c) Validity of born approximation.

13. Discuss (a) Dirac equation for free particle and (b) Spin of Dirac particle.

OR

14. Explain (a) Addition of angular momenta and (b) Clebsh-Gordan coefficients.

($3 \times 15 = 45$ Marks)

PART – C

Answer any **three** of the following questions. Each question carries **5** marks.

15. Consider a perturbation of $H_1 = bx^4$ to the simple harmonic oscillator of Hamiltonian $H_0 = \frac{p_x^2}{2m} + \frac{mw^2x^2}{2}$. The potential is $V_x = bx^4 + \frac{mw^2x^2}{2}$. Calculate the first order shift in energy.

16. The potential of a particle confined to a positive x axis is mgx. The wave function tends to zero as *x* tends to zero and infinity. Use the trial wave function $x\, e^{-ax}$ and obtain the best value of parameter *a*.

17. Derive scattering amplitude in terms of differential scattering cross section.

18. What is time reversed wane function and prove that the Schrodinger equation satisfied by the time reversed function has also the same form as the original one.

19. A particle is in an eigen state of J_z. Prove that $\langle J_x \rangle = \langle J_y \rangle = 0$. Also find the values of $\langle J_x^2 \rangle$ and $\langle J_y^2 \rangle$.

20. Derive the covariant form of Dirac equation.

($3 \times 5 = 15$ Marks)

———————

(Pages : 3) **N – 6770**

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, JUNE 2022.

Physics with Specialization in Nano Science/Space Physics

PHSP 532/ PHNS 532 : ATOMIC AND MOLECULAR SPECTROSCOPY

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer **any five** questions. Each question carries **3** marks**.**

1. Write a short not photoelectron spectroscopy.
2. Briefly explain Paschen back effect.
3. What are the factors affecting the intensity of rotational spectral lines.
4. What do you meant by Fermi Resonance.
5. Explain pre-dissociation.
6. Write a short note on CARS.
7. Explain chemical shift in NMR spectroscopy.
8. Explain the recoil emission and absorption of Mossbauer spectroscopy.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **all** questions. Each question carries **15** marks.

9. Explain Normal and Anomalous Zeeman effect.

OR

10. Explain (a) molecular point group (b) Matrix representation of symmetry operators and (c) reducible and irreducible representation.

11. Explain the rotational fine structure of electronic vibrational transitions and Fortrat diagram.

OR

12. Discuss the diatomic vibrating rotator and explain the breakdown of born openheimer approximation.

13. Explain nonlinear Raman effect with three nonlinear Raman spectroscopic phenomena.

OR

14. Explain the recoil emission and absorption in Mossbauer spectroscopy and chemical isomer shift.

(3 × 15 = 45 Marks)

PART – C

Answer **any three** of the following questions. Each question carries **5** marks.

15. Consider an atom placed in a magnetic field of 1.0 webber/m^2 which has I = 2. Calculate the rate of precession and torque on the atom, given that the magnetic moment makes an angle of 450°.

16. Explain great orthogonality theorem.

17. What is the average period of rotation of HCl molecule if it is in the *j=1* state. The inter nuclear distance of HCl is 0.1274 nm. Given the mass of hydrogen and chlorine atoms are 1.673×10^{-27} kg and 58.06×10^{-27} Kg respectively.

18. The fundamental and first overtone transitions of $^{14}N^{16}O$ are centered at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate the equilibrium vibrational frequency, the anharmonicity constant, zero point energy and force constant of the molecule.

19. Calculate the NMR of F^{19} nucleus when it is placed in a magnetic field of 1.0T. given that $g_I = 5.256$ and $\mu N = 5.0504 \times 10^{-27}$ JT^{-1}.

20. In the rotational Raman spectra of MCI the displacements from the exciting line are represented by $\Delta v = \pm$ (62.4+41.6 J) cm^{-1}. Calculate the moment of inertia of HCI molecule.

($3 \times 5 = 15$ Marks)

———————

(Pages : 3) **N – 6771**

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, June 2022

Physics with Specialization in Nano Science

Space Physics

PHSP 533/PHNS 533 : CONDENSED MATTER PHYSICS

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer **any five** questions. Each question carries **3** marks.

1. Explain Schotky. Frenkel and Compositional defects.
2. Discuss Normal and Umklapp process.
3. Explain Wiedemann Franz Lorentz law.
4. Write a short note on electrical conductivity of extrinsic semiconductors.
5. Write clausius mosotti equation and explain the term polarazability.
6. What is ferromagnetism and explain hysteresis loop of ferromagnetic materials.
7. Explain flux quantization in superconductor.
8. Briefly explain how AFM can be used for biological samples.

($5 \times 3 = 15$ Marks)

P.T.O.

PART – B

Answer **all** questions. Each question carries **15** marks.

9. Discuss three scattering mechanisms responsible for the thermal resistance of solids.

OR

10. Discuss nearly free electron model of solids.

11. Explain

    (a) Langevin theory of paramagnetism and

    (b) Quantum theory of paramagnetism.

OR

12. Discuss

    (a) Hall effect in semiconductor and

    (b) Electric conductivity of intrinsic semiconductor.

13. Discuss

    (a) London equation

    (b) penetration depth and

    (c) Coherence length in superconductor.

OR

14. What do you meant by electron microscopy and explain the working of SEM.

(3 × 15 = 45 Marks)

PART – C

Answer **any three** of the following questions. Each question carries **5** marks.

15. Copper has an atomic weight 63.5, the density 8.9×10^3 kg/m^3 $v_t = 2.32 \times 10^3$ and $v_1 = 4.76 \times 10^3$ Estimate Debye temperature and specific heat at 30 K.

16. Show that the reciprocal lattice of BCC is face centered.

17. Find the total polarizability of CO_2. if its susceptibility is 0.985×10^{-3} Density of CO_2 is 1.977nKg/m^3.

18. The magnetic intensity in a piece of ferric oxide is 10^6 A/m. If the susceptibility of the material at room temperature is 1.5×10^{-3}, Calculate the flux density and magnetization of the material.

19. The penetration depth of mercury at 3.5 K is about 75 nm. Estimate the penetration depth at 0K. Also calculate superconducting electron density.

20. Discuss Sol gel technique for the nanomaterial preparation.

(3 × 5 = 15 Marks)

———————

(Pages : 3) **N – 6772**

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, June 2022

Physics with Specialization in Spacephysics

PHSP 534 : PHYSICS OF THE ATMOSPHERE

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five,** each carries **3** mark.

1. Write briefly about the chemical Composition of Atmosphere.
2. Explain the importance of study Carbon Cycle in the earth's atmosphere.
3. Explain the terms eddies and Laminar in the atmospheric boundary layer dynamics.
4. What is virtual temperature?
5. What is geopotential?
6. What is Green House effect and mention the green house gases?
7. Explain Beer's law.
8. Define the terms coupled climate variability and externally forced variability?

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer any **three** questions, each carries 1**5** marks.

9. (a) Describe the vertical structure of earth's atmosphere and explain the propeties of each layer? **6**

(b) Write briefly about the Hydrology Cycle of Earth's and its importance in the various aspect of earth climate? **9**

OR

10. (a) What is virtual temperature and derive the relation connecting it with actual temperature and the pressure? **8**

(b) Deduce the expression for geopotential heights in terms of virtual temperature. **7**

11. (a) Discuss the theory of radiative transfer in the planetory atmosphere and deduce the expressions for absorptivity and optical depth. **9**

(b) Write the theory of Vertical Profiles of Radiative Heating in the Planetory atmospheres. **6**

OR

12. (a) Describe the theory of Dynamics of horizontal flow and discuss the various forces involved in the process. **6**

(b) Explain the following wnds

(i) Geostrophic Wind

(ii) Gradient Wind

(iii) Thermal Wind and deduce an expression for the velocity of the winds**. 9**

13. (a) Deduce the primitive equations that governs the evolution of large-scale atmospheric motions and discuss its solution over atmospheric heating and climatic variations. **8**

(b) Describe the theory of accoustic and Bouyancy waves in the atmosphere. **7**

OR

14. (a) Describe the theory of propagation of Rossby waves in three dimensional medium. **7**

(b) Describe the theory of Remote sensing and explain the various satellite datas used for climate prediction. **8**

(3 × 15 = 45 Marks)

PART – C

Answer any **three** questions, each carries **5** marks.

15. A heavy tropical storm dumps 20 cm of rainfall in a region of the ocean in which the salinity is 35.00 g kg^{-1} and the mixed layer depth is 50 m. Assuming that the water is well mixed, by how much does the salinity decrease?

16. Estimate how much the sea level would rise if the entire Greenland ice sheet were to melt. Given Surface area of earth and Land are 5.10×10^{14} m^2 and 1.45×10^{14} m^2 and the density of ice is 5×10^3 kgm^{-2}.

17. If air contains water vapor with a mixing ratio of 5.5 g kg^{-1} and the total pressure is 1026.8 hPa, Calculate the vapor pressure *e*. Given the relative Molecular weight of water vapour ε = 0.622.

18. Calculate the virtual temperature for moist air at 30°C that has a mixing ratio of 20 g kg^{-1}, Given the relative Molecular weight water vapour with density ε = 0.622.

19. Estimate the relative efficiencies with which red light (λ_r = 0.64 μm) and blue light (λ_b = 0.47 μm m) are scattered by air molecules.

20. Air at cloud base in a supercell updraft is observed to be in solid body rotation out to a radius of 2 km with a period of 15 minutes. Estimate the amplitude of the dynamically-induced radial pressure gradient. The density of the air at cloud base is 1 kg m^{-3}.

(3 × 5 = 15 Marks)

———————

(Pages : 3) **N – 6773**

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, June 2022

Physics with Specialization in Nano Science

PHNS 534 : NANOSTRUCTURED MATERIALS

(2020 Admission)

Time : 3 Hours Max. Marks : 75

SECTION – A

(Answer **any five** questions. Each carries **three** marks)

1. What are nanoparticles?
2. Give a note on quantum dots.
3. What are the optical properties of metal nanoparticles?
4. Account on homogeneous nucleation.
5. What are the advantages and disadvantages of sol-gel method?
6. Differentiate type I and type II core shell.
7. Write a note on electrospinning.
8. Explain quantum cutting.

($5 \times 3 = 15$ Marks)

P.T.O.

SECTION – B

(Answer **three** questions. Each carry **15** marks)

9. (a) What are the properlies of individual nano particles?

   (b) Write a note on the consequence of small particle size.

OR

10. (a) Discuss surface plasmon resonance (SPR).

   (b) What are the factors that depend SPR?

   (c) Brief the non-radiative decay of SPR.

11. (a) How will you synthesis metallic nanoparticles? What are the applications of metallic nanostructure?

   (b) How to Prepare amorphous silver nanoparticles.

OR

12. (a) What are semiconducting nanoparticles?

   (b) Considering the examples of CdSe. Write a note on synthesis of semiconducting nanoparticles.

13. (a) Based on form of products, how will you group technical approaches to fabricate nanostructures and nanomaterials?

   (b) Explain solution-liquid-solid (SLS) growth.

OR

14. (a) What are 1D nanostructures? What are the spontaneous growth technique in the synthesis and formation of one-dimensional nanostructured materials?

   (b) Brief evaporation condensation growth.

(3 × 15 = 45 Marks)

SECTION – C

(Answer **three** questions. Each carry **five** marks)

15. Find the surface energy of {100}, {110} and {111} surface in a FCC crystal.

16. Brief DLVO theory of interaction between two particles.

17. Show that during growth of nuclei, the radius difference decreases with increase of nuclear radius and prolonged growth time.

18. How will you synthesis colloidal dispersion of organic and hybrid materials by sol- gel process?

19. Plot and explain the phase diagram of gold-silicon binary system.

20. Using energy level diagram. represent oxidation and reduction process of a species ‘A’ in solution.

(3 × 5 = 15 Marks)

———————