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Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, March 2022

Physics with Specialization in Nano Science/Physics with Specialization in Space Physics

PHNS 521/PHSP 521 : MODERN OPTICS AND ELECTROMAGNETIC THEORY

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. **Each** question carries **three** mark.

1. Describe parametric generation of light.
2. Differentiate dextrorotatory crystals with laevorotatory crystals.
3. Account on second harmonic generation.
4. Define electromagnetic field tensor? What are its properties?
5. How can you conclude that magnetism is a relativistic phenomenon?
6. Discuss the theory of wave guides with reference to TM mode.
7. Briefly mention the approximations to electric dipole radiation.
8. Using voltage and current variations along an ideal transmission line, obtain telegraphist's equation.

(5 × 3 = 15 Marks)

P.T.O.

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16. Using Fourier transform method, discuss Fraunhofer diffraction due to two nearby parallel narrow slits illuminated by monochromatic light.

17. A plane electromagnetic wave is incident on a plane surface of area A normally and is perfectly reflected. If energy E strikes the surface in time t, then find the average pressure exerted on the surface?

18. Find the charge and current distributions that would give rise to the potentials V = 0 and A=

    Where k is a constant and c speed of light.

19. A rectangular wave guide has cross section dimensions, a = 2.28 cm and b = 1.01 cm. what TE mode will propogate in this wave guide if the drivinig frequency is 17 GHz.

20. How Antenna can be used as a matching device between the guiding structure and the surrounding medium?

(3 × 5 = 15 Marks)

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PART – B

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

9. Briefly explain

   (a) Raman-Nath acoustic-optic modulator

   (b) Bragg modulator and

   (c) Faraday rotation

Or

10. "Two photons are simultaneously absorbed to excite a material system". Brief the theory and experimental techniques behind the process.

11. Discuss reflection and transmission of electromagnetic wave at oblique incidence?

Or

12. Derive the inhomogeneous wave equation for V and A.

13. Derive the field equation for the TE waves in the rectangular wave guides.

Or

14. What are the transmission lines? Derive the transmission line equations and explain any two losses in transmission lines.

(3 × 15 = 45 Marks)

PART – C

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

15. A Fabry–Perot interferometer just resolves two lines of width $\Delta\lambda = 0.1$ Å at $\lambda = 5000$ Å. find the minimum separation between reflecting surfaces with reflectivity 0.95.

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Second Semester M.Sc. Degree Examination, March 2022

Physics with Specialization in Nano Science / Physics with Specialization in Space Physics

PHNS 522/PHSP 522 : THERMODYNAMICS, STATISTICAL PHYSICS AND BASIC QUANTUM MECHANICS

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

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

1. What is Nerns't theorem and explain its importance.
2. What is Gibbs function and prove that Gibbs function decrease during isothermal isobaric process and is equal to the net work obtained.
3. What is the role of chemical potential in chemical equilibrium.
4. Explain Planks radiation law.
5. Derive Fermi Dirac distribution law.
6. Explain quantum mechanical tunneling.
7. Write a short note matrix representation of operators.
8. Write a short note on duterion.

(5 × 3 = 15 Marks)

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PART – B

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

9. State and derive Liouville's theorem.

OR

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

11. Derive Maxwells Boltzmans distribution law.

OR

12. Explain Fermi Dirac statistics and distrubution law.

13. Solve linear harmonic oscillator problem using Schrodinger method.

OR

14. Derive General Uncertainty principle, minimum uncertainty wave packet and energy time uncertainty relation.

(3 × 15 = 45 Marks)

PART – C

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

15. The partition function of a system is given by $Z = \exp(\alpha T^3 V)$ where α is a constant. Calculate the pressure, entropy and the internal energy of the system.

16. Obtain the expression for partition function in terms for every energy state of the given molecule.

17. What is the use of density matrix formulation? Obtain the equation of motion for the density matrix $\rho_{mn}(t)$.

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18. Calculate the fermi energy in electron volts for sodium assuming that it has one free electron per atom. Given density of sodium is 0.97 gm/cm^3 atomic weight of sodium is 23.

19. Derive Geiger Nuttal Law representation.

20. Derive general uncertainty relation.

(3 × 5 = 15 Marks)

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Second Semester M.Sc. Degree Examination, March 2022

Physics with Specialization in Nano Science /
Physics with Specialization in Space Physics

PHNS 523/PHSP 523 : COMPUTER SCIENCE AND NUMERICAL TECHNIQUES

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions, **each** question carries **3** marks.

1. Write a short note on operating system.

2. Write a short note on registers in microprocessor 8085.

3. Interpret the following microprocessor 8085 commands.

   MVI A, 08H

   SUB A

   JNC 1600 H

4. Briefly discuss about Python objects.

5. Distinguish between C++ classes and objects with a situation each where it can be used.

6. Explain briefly about built-in and user define functions in C++ with one example for each.

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7. Discuss about numerical integration using Simpson's 1/3 rule.

8. Write a short note on Gauss's forward interpolation formula.

(5 × 3 = 15 Marks)

PART – B

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

9. (a) Briefly discuss about interrupts of microprocessor 8085. **9**

(b) Discuss about how memory interfacing in 8085. **6**

OR

10. (a) Write a short note on computer data communication and computer networks. **4+5**

(b) Briefly discuss about Python file input and output functions one example for each. **6**

11. (a) Discuss the method of file handling in C++ language with examples. **8**

(b) Write a C++ program for reading the name and total marks of 10 students from a file and rank them according to the marks scored and save it to another file. **7**

OR

12. (a) Discuss briefly about arrays and storage classes in C++ language wit examples. **4+**

(b) Write a C++ program for reading a 3 × 3 matrix from a file and writing transpose to another file.

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(a) Derive the general quadrature formula and obtain Simpson's 1/3 rule. 9

(b) Compute the integral with Simpson's 1/3 rule and find the error in the evaluation. 4+2

$$\int_0^{\pi/2} \sin(x)\,dx$$

OR

(a) Discuss Runge-Kutta methods for finding numerical solution of ordinary differential equation. How higher order differential equations are solved using RK method with an example. 5+2

(b) Solve the differential equation $\frac{dy}{dx} = -y$ with condition $y(0) = 1$ for $y(0.01)$ with $h = 0.01$ using 4^{th} order Runge-Kutta method. The exact solution is $y = e^{-x}$. 8

(3 × 15 = 45 Marks)

PART-C

nswer any **three** questions, each question carries **5** marks.

5. Write a Python program for finding the sum of two 3 × 3 matrices.

6. Write an assembly language program for adding and subtracting an 8-bit binary numbers kept in the memory location 1600 H from 1500 H and save the result at 1700 and 1701 H.

7. Write a C++ program for reading a 3 × 3 matrix from a file and do row operations to make the first diagonal element to be unity and all the elements below it to be zero.

8. Write a C++ program for writing the prime numbers between 1000 and 2000 to a file.

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19. From the set of values given, find the value of log10 (π) using Lagrange's interpolation formula.

x	log x
3.100	0.491362
3.141	0.497068
3.142	0.497206
3.145	0.497621
3.200	0.505150

20. Find the inverse of the given matrix using Gauss Jordan method.

$$\begin{pmatrix} 3 & 4 & 1 \\ 2 & 4 & -2 \\ 2 & -3 & 2 \end{pmatrix}$$

(3 × 5 = 15 Marks)

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