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Code No. 1305 / CORE

FACULTY OF SCIENCE

M. Sc. II – Semester (CBCS) Examination, December 2020

Subject : Physics/Applied Electronics /Astrophysics

Paper – I : Electromagnetic Theory

Time : 2 Hours **Max. Marks: 80**

PART – A

Note : Answer any five questions. **(5x7=35 Marks)**

1 What are Poisson's and Laplace's equations?
2 Explain the concept of Poynting Vector.
3 What is meant by attenuation and skin effect?
4 What are the boundary conditions for E,D,B and H.
5 Differentiate between normal and anomalous dispersion.
6 Briefly explain about retarded potentials.
7 Write the expression for reflection and transmission coefficients and explain.
8 Obtain inhomogeneous wave equation for potentials.

PART – B

Note : Answer any three questions. **(3x15=45 Marks)**

9 Obtain the Laplace's equation in spherical polar coordinates and cartesian coordinates.

10 Derive the Maxwell's equations in both differential and integral forms and explain about them.

11 Discuss the propagation of electromagnetic waves in homogeneous isotropic dielectric medium.

12 Discuss about the wave equations of electromagnetic radiation in free space and unbounded media.

13 Derive the Fresnal's equations at the plane boundary of a dielectric interface in the case of normal incidence.

14 Obtain the expressions for reflection and transmission coefficients and discuss about them.

15 What are retarded potentials? Discuss about the radiation form electric dipole and derive the expression for energy.

16 Give an account of oscillating electric dipole and magnetic dipole radiations.

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Code No. 1308 / CORE

FACULTY OF SCIENCE

M. Sc. II – Semester (CBCS) Examination, December 2020

Subject : Physics & Applied Electronics / Astrophysics

Paper – II : Statistical Mechanics

Time : 2 Hours **Max. Marks: 80**

PART – A

Note : Answer any five questions. **(5x7=35 Marks)**

1 Define the average of an ensemble. Does it depends on time? Explain.
2 What is a phase trajectory? Obtain the phase trajectories of a one dimensional harmonic oscillator
3 What are the properties of Fermi-Dirac distribution function.
4 Using Maxwell velocity distribution formula calculate the mean value of energy.
5 Derive Richardson – Dushman equation for thermionic current density.
6 Explain why Helium can not be liquefied at ambient pressure.
7 Give the Ehrenfest classification of phase transition.
8 Relate concentration fluctuations to appropriate response function.

PART – B

Note : Answer any three questions. **(3x15=45 Marks)**

9 What is Gibb's paradox? How can it be resolved? Derive Sackur – Tetrode equation.

10 State and prove Liouville's theorem.

11 What is a canonical partition function? Explain how the various thermodynamic quantities can be derived from canonical partition function.

12 In case of diatomic molecules calculate contribution to the specific heat due to vibrational degree of freedom. Explain why specific heat goes to zero as temperature approaches to zero.

13 Derive an expression for the electronic heat capacity in a metal.

14 Discuss the phenomenon of Bose – Einstein condensation. How does it differs from ordinary vapour condensation? Calculate the critical temperature at which the condensation into the lowest order starts.

15 Show that one dimensional Ising model cannot explain ferromagnetism.

16 Calculate magnetization and specific heat of one dimensional Ising model in the Bragg-Williams approximation.

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FACULTY OF SCIENCE

M. Sc. II – Semester (CBCS) Examination, December 2020

Subject : Physics & Applied Electronics / Astrophysics

Paper – III : Quantum Mechanics-II

Time : 2 Hours | Max. Marks: 80

PART – A

Note : **Answer any five questions.** (5x7=35 Marks)

1 Define differential and total scattering cross-section terms in scattering process.
2 What is optical theorem and write its significance.
3 What are the selection rules for dipole transitions?
4 What is the principle of method of variations?
5 What is Fermi's Golden rule? Write its significance.
6 A harmonic oscillator of natural frequency (ω) is placed in a small external potential $(1/2)bx$, then calculate the change in energy of the ground state.
7 What re the inadequacies of Klain Gorden equation?
8 Explain the Dirac Energy spectrum.

PART – B

Note : **Answer any three questions.** (3x15=45 Marks)

9 Discuss the method of partial waves and obtain an expression for scattering amplitude and scattering cross section.

10 Construct Green's function for an out going wave in scattering problem and use it to calculate the amplitude in first Born approximation.

11 Discuss the time independent perturbation theory for a non-degenerate stationary system and obtain the corrected eigen functions and energy eigen values.

12 Discuss the method of WKB approximation and derive an expression for transition probability through potential barrier and hence explain alpha decay.

13 Using the time dependent perturbation theory, derive an expression for the rate of transition to the continuum.

14 Discuss the Einstein coefficients of spontaneous and induced emission of radiation. Establish a relationship between A and B coefficients.

15 Drive Klein-Gorden relativistic equation for a free particle and write Klein Gardon equation in co-variant form.

16 Derive the Dirac's relativistic equation. Obtain the plane wave solutions of Dirac's equation for free particles and explain the existence of spin.

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Code No. 1314 / CORE

FACULTY OF SCIENCE

M. Sc. II – Semester (CBCS) Examination, December 2020

Subject : Physics & Applied Electronics / Astrophysics

Paper – IV : Electronics

Time : 2 Hours **Max. Marks: 80**

PART – A

Note : Answer any five questions. **(5x7=35 Marks)**

1 Draw the block diagram of series voltage regulator and explain its functioning.
2 What is Darlington pair? Explain its working with circuit diagram.
3 Discuss the characteristics of an ideal operational amplifier and explain the significance of CMRR in them.
4 Explain how Op-amp is used as an integration amplifier.
5 Explain the sum-of-product method to write a Boolean equation for a given truth table with suitable illustration.
6 Differentiate synchronous and asynchronous counters.
7 What are the various registers in 8085 microprocessor and explain their functions.
8 Write an Assembly language program for 8-bit addition.

PART – B

Note : Answer any three questions. **(3x15=45 Marks)**

9 Explain the construction and working of a variable series voltage regulator and obtain the expression for output voltage (V_o), stability factor (S_v) and output resistance (R_o).

10 Explain the working of an RC phase shift oscillator with a neat diagram and derive the expressions for the frequency and conditions for sustained oscillations.

11 Draw the internal block diagram of IC 555, explain how it can be used to construct of monostable multivibrator and obtain on expression for its pulse width.

12 What are inverting and non-inverting modes of operation of Op-Amp. Derive an expression for the voltage gain in non-inverting mode.

13 Draw the logic diagrams of J-K and MS-J-K flip-flops and explain their operation with truth tables and timing diagrams. How racing can be avoided in MS J-K flip flop?

14 What are the types of registers? Explain the construction and working of a serial-in parallel-out shirt register with timing diagram.

15 Explain the architecture of intel 8085 by drawing its functional block diagram.

16 Give the classification of instruction set of 8085 microprocessor into various groups and explain each one of them with suitable examples.

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