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Name.....

Reg. No

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2020

(CUCBCSS- UG)

CC15UPH1 B01 – METHODOLOGY OF SCIENCE AND PHYSICS

(Physics - Core Course)

(2015 Admission - Supplementary)

Time: Three Hours

Maximum: 80 Marks

Section A

Answer *all* questions. Each question carries 1 mark.

1. Author of Principia Mathematica is
2. Compton effect is associated with
(a) γ ray (b) β ray (c) X- ray (d) none of the above
3. Who discovered X ray?
4. The strength of photoelectric current is directly proportional to:
(a) frequency of incident light (b) Intensity of incident light
(c) potential difference between the plates (d) None of the above
5. Neutron was discovered by
(a) Wilson (b) Chadwick (c) Rutherford (d) Rontgen
6. A vector divided by its magnitude is vector.
7. Two forces 6N and 2 N are such that $[A + B] = [A - B]$. Then the angle between the vectors is
8. The magnitude of vector product of two non-zero vectors A and B is zero. The scalar product of A and A+B is equal to
(a) Zero (b) AB (c) A^2 (d) $A^2 + AB$
9. The eigen values of a unitary matrix are
(a) 0 (b) ± 1 (c) imaginary (d) None
10. If A is a Hermitian matrix, then iA is
(a) Hermitian (b) Skew Hermitian (c) Neither A or B (d) None of the above

(10 x 1 = 10 Marks)

Section B

Answer *all* questions. Each question carries 2 marks.

11. What is LASER? What is population inversion
12. What is a black body?
13. Explain auxiliary and ad-hoc hypothesis
14. What is Twin paradox
15. Define i) Transpose of a matrix ii) Conjugate of a matrix
16. State and explain the law of parallelogram of vector addition
17. State Gauss` Divergence Theorem.

(7 x 2 = 14 Marks)

Section C

Answer any *five* questions. Each question carries 4 marks.

18. Discuss the role of mathematics in scientific method.
19. Discuss scientific temper as an important aspect of scientific study. Discuss the phenomenon of spontaneous and stimulated emission.
20. Distinguish between induction and deduction
21. Prove that $(A \times B) \times C + (B \times C) \times A + (C \times A) \times B = 0$
22. Using spherical polar coordinates find the volume of a sphere of radius R?
23. Calculate the divergence of V and curl of V if $V = xi + yj + zk$

(7 x 2 = 14 Marks)

Section D

Answer any *four* questions. Each question carries 4 marks.

24. Find out eigen values of $A = \begin{bmatrix} 3 & -1 \\ 4 & -2 \end{bmatrix}$
25. If H is a Hermitian matrix and U is a unitary matrix, prove that $U^{-1} H U$ is Hermitian.
26. A particle acted upon by a force $F = 6i + j - 3k$ is displaced from a point $i + 2j + 3k$ to a point $5i + 4j + k$. Find the work done by the force.
27. Calculate the Laplacian of the following function $\theta = x^2 + 2xy + 3z + 4$
28. Solve the equations using Cramer`s rule.

$$2x - y + 2z + 2, \quad x + 10y - 3z = 5, \quad -x + y + z = -3$$

(2)

29. A space craft is moving relative to earth, an observer on earth find that, according to her clock, 3601 s elapsed between 1 pm and 2 pm on the space craft clock. What is the space craft`s speed relative to earth?

30. Find the de-Broglie wavelength of a 46 g golf ball moving with a velocity of 10 m/s

(4 x 4 = 16 Marks)

Section D

Answer any *two* questions. Each question carries 10 marks.

31. What are Eigen values and Eigen vectors of matrices? What is Hermitian matrix and Unitary matrix
32. What are the different steps involved in a scientific study? Explain
33. Write an essay on the development of Quantum mechanics
34. Explain spherical polar coordinates:
 - (a) Write down equations to connect Cartesian coordinate and spherical polar coordinate
 - (b) Express infinitesimal displacement dl in spherical polar coordinates
 - (c) Translate gradient and divergence in spherical polar coordinates

(2 x 10 = 20 Marks)

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