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SUBJECT CODE NO:- B-2021
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. S.Y (Sem-III)
Examination November/December- 2022
Physics -VII
Mathematical Statistical Physics and Relativity

[Time: 1:30 Hours] **[Max. Marks:50]**

Please check whether you have got the right question paper.

N.B i) Attempt all questions.
ii) Use of logarithmic table and electronic pocket calculator is allowed.

Q.1 a) Explain second order differential equation with constant coefficient of real and unequal roots and real and equal roots. 10

b) Derive Maxwell-Boltzmann's Law of energy distribution. 10

OR

a) Distinguish between Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics. 10

b) Derive Lorentz transformation equations. 10

Q.2 a) What is exact differentiation? Explain. 05

b) If $F = x^3y + x^2y + xy^2$ find dF. 05

c) Explain basic postulates of Fermi-Dirac Statistics. 05

d) Five bosons are distributed in two compartments, first having 3 cells and second having 4 cells. Find thermodynamic probability of the macro state (3, 2) 05

OR

a) Explain the term phase space. 05

b) A card is drawn from a well shuffled pack of 52 cards. Find the probability for this card is king or queen. 05

c) Explain Galilean transformation equation 05

d) At what speed is a particle moving if its mass is $5/4$ times its rest mass. (Velocity of light $C = 3 \times 10^8 m/sec$) 05

Q.3 Multiple choice questions. 10

1) Order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 + y = x$ are.

   a) 1, 2 b) 2, 1 c) 2, 3 d) 3, 2

2) If $y = \sin x^2$ then $\frac{dy}{dx}$ is

   a) $2x\ cos\ x^2$ b) $2\ cos\ x^2$ c) $-2x\ cos\ x^2$ d) $-2\cos x.$

3) If a die is thrown, then the probability that the die coming up with an even number is.

   a) $\frac{1}{6}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) $\frac{2}{3}$

4) Thermodynamic probability of the macro-state (1,3) is

   a) 1 b) 2 c) 3 d) 4

5) The value of probability of an event cannot be...

   a) zero b) 1 c) negative d) $\frac{1}{2}$

6) Plank's radiation law is derived using _____ Statistics.

   a) Fermi-Dirac b) Maxwell-Boltzmann c) Bose-Einstein d) Classical

7) Particles obeying Bose-Einstein Statistics are.

   a) Identical, in distinguishable with integral spin.

   b) Identical, distinguishable without any spin.

   c) Identical, indistinguishable without any spin.

   d) Identical, distinguishable with $\frac{1}{2}$ integral spin.

8) Rest mass energy of electron of mass 9.1×10^{-31} kg is _____

   a) 8.19×10^{-16} J. b) 8.19×10^{-14} J. c) 81.9×10^{-16} J. d) 81.9×10^{-14} J.

9) According to Fermi-Dirac Statistics $n_i =$

   a) $\frac{gi}{e^{\alpha+\beta ui-1}}$ b) $\frac{gi}{e^{\alpha+\beta ui+1}}$ c) $\frac{gi}{e^{\alpha-\beta ui+1}}$ d) $\frac{gi}{e^{\alpha-\beta ui-1}}$

10) According to Michelson-Morley experimental setup, A beam of light falls on a half silvered glass plate which is placed at an angle of _____ to the beam.

   a) 45° b) 30° c) 60° d) 90°