

M.SC. MATHEMATICS
THIRD SEMESTER
SPECIAL THEORY OF RELATIVITY
MSM - 304A
[USE OMR FOR OBJECTIVE PART]

**SET
A**

Duration: 1:30 hrs.

Full Marks: 35

Time: 15 mins.

(Objective)

Marks: 10

1×10=10

Choose the correct answer from the following:

1. The Euclidean four-dimensional space-time length element is given by
 - a. $ds^2 = -dx^2 - dy^2 - dz^2 + c^2 dt^2$
 - b. $ds^2 = -dx^2 - dy^2 - dz^2 - c^2 dt^2$
 - c. $ds^2 = dx^2 + dy^2 + dz^2 + c^2 dt^2$
 - d. none of the above
2. The Fresnel drag coefficient is
 - a. $\left(1 + \frac{1}{n^2}\right)$
 - b. $\left(1 - \frac{1}{n^2}\right)$
 - c. $\left(1 - \frac{1}{n}\right)$
 - d. none of the above
3. The principle of Relativity are
 - a. The form of Galilean Transformation & Lorentz transformation are uniform
 - b. All Laws of Physics must be same in all Inertial Frame
 - c. All laws of Physics must be same in all Inertial frame & speed of light
 - d. Principle of Relativity & Universal constancy of speed of light c in Vacuum are non uniform
4. Which of the following option is correct, where l is the length of the rode measured from S observer and l' is the length of the rode measured from S' observer
 - a. $l' > l$, where l, l' are the length measured from S, S'
 - b. $l' < l$, where l, l' are the length measured from S, S'
 - c. $l' = l$, where l, l' are the length measured from S, S'
 - d. $l' < l$, where l, l' are the length measured from S', S

5. If t' is the time measured with respect to S' and t is the time w.r.to S frame, the which one of the following is correct

a. $\Delta t' = \Delta t$

b. $\Delta t' < \Delta t$

c. $\Delta t' \neq \Delta t$

d. $\Delta t' > \Delta t$

6. In Michelson-Morley Experiment path difference was found

a. $\Delta D = \frac{dv^2}{c^3}$

b. $\Delta D = 2 \frac{dv^2}{c^2}$

c. $\Delta D = -\frac{dv^2}{c^3}$

d. $\Delta D = \frac{dv^2}{c^2}$

7. Galilean transformation equations are

$x' = x - vt$

a. $y' = y$

$z' = z$

$t' = t$

$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$

$y' = y$

b. $z' = z$

$t' = \frac{t - \frac{vx}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$

$x' = \frac{x - vt}{\sqrt{1 + \frac{v^2}{c^2}}}$

$y' = y$

c. $z' = z$

$t' = \frac{t - \frac{vx}{c^2}}{\sqrt{1 + \frac{v^2}{c^2}}}$

$x' = x - vt$

$y' = y$

d. $z' = z$

$t' = t$

8. Faraday's law of Electromagnetic Induction is
- a. $Curl B = -\mu_0 \epsilon_0 \frac{\partial E}{\partial t}$
- b. $Curl E = -\frac{\partial B}{\partial t}$
- c. $Curl E = \frac{\partial B}{\partial t}$
- d. $Curl B = \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$
9. "A train moving in a certain direction with a certain speed relative to trees, houses etc". This motion is known as
- a. Uniform Motion
- b. Non-uniform motion
- c. Relative Motion
- d. Absolute Motion
10. Result of Galilean Transformation is
- a. Both of classical physics and electromagnetic laws are invariant under Galilean transformation.
- b. All classical physics laws are not invariant but Maxwell's electromagnetic laws are invariant under Galilean Transformation.
- c. All classical physics laws are invariant but Maxwell's electromagnetic laws are not invariant under Galilean Transformation.
- d. None of the above

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(**Descriptive**)

Time : 1 hr. 15 mins.

Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. What is Minkowski's Diagram. What are three types of particles describes in the Minkowski Geometry. 2+3=5
2. What is the purpose of Michelson Morley Experiment. Who is Michelson Morley?. Also prove that $v = 0$, v is the Earth velocity. 2+3+5=10
3. What do you mean by Inertial and Non Inertial frame of reference. Prove that Newton's laws of Mechanics are invariant under Galilean Transformation. 4+6=10

4. What are the real life example of consequence of Lorentz Transformation? Explain any two consequences of Lorentz transformation.

2+4+4
=10

5. Define

2×5=10

- a. Inertial and Non Inertial frame
- b. Uniform and Non uniform velocity
- c. Result of Galilean Transformation
- d. Tolman's Statement
- e. Lorentz Transformation

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