

**M.Sc. MATHEMATICS
THIRD SEMESTER
SPECIAL THEORY OF RELATIVITY
MSM-305 A**

Duration: 3 Hrs.

Marks: 70

PART : A (OBJECTIVE) = 20
PART : B (DESCRIPTIVE) = 50

[PART-B : Descriptive]

Duration: 2 Hrs. 40 Mins.

Marks: 50

[Answer question no. One (1) & any four (4) from the rest]

1. What do you mean by Space time Geometry? Explain Minkowski's Geometry of Space time. (1+9=10)
2. What is result of Michelson-Morley Experiment? Proof the Michelson Morley Experiment with picture. (2+8=10)
3. What is Longitudinal Doppler Effect? Describe Doppler Effect. (2+8=10)
4. What is energy momentum tensor? Find out relativistic energy momentum tensor for a fluid. (1+9=10)
5. State and Proof any two consequence of Lorentz Transformation. (5+5=10)
6. Write Maxwell's electromagnetic equation? Find the invariance of Maxwell's electromagnetic equation. (2+8=10)
7. What is the impact of Fresnal Drag Effect? Proof the Fresnel Drag effect. (3+7=10)
8. What do you mean by moving charged particle? Describe electromagnetic field of a uniformly moving charge particle. (1+9=10)

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[PART-A : Objective]

Choose the correct answer from the following:

1×20=20

1. An example of Uniform Relative motion is:
 - a. A Train moving in a certain direction with a certain speed relative to others.
 - b. A Train starts from rest.
 - c. The earth is moving around the Sun.
 - d. A ball drawn downwards.

2. $\sigma = \frac{Ne}{l_0^3 \sqrt{1 - \frac{u^2}{c^2}}}$ is called:
 - a. Current density
 - b. Electric coefficient
 - c. Charge density
 - d. Both (i) and (ii)

3. In electromagnetic equation $c = ?$
 - a. $\frac{1}{\sqrt{\mu_0}}$
 - b. $\frac{2}{\sqrt{\mu_0}}$
 - c. $\frac{2}{\sqrt{\mu_0 \epsilon_0}}$
 - d. $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$

4. "Light is electromagnetic phenomenon"-result of:
 - a. Galilean Transformation
 - b. Maxwell's law
 - c. Lorentz Transformation
 - d. Uniform motion

5. $\frac{\partial F_{\mu\nu}}{\partial x_\nu} = j_\mu$ is called:
 - a. Lorentz Equation
 - b. Lorentz force equation
 - c. Maxwell's equation
 - d. Maxwell's 2nd equation

6. Momentum of a body is:
 - a. $P=mv$
 - b. $P=mu$
 - c. both of these
 - d. $E = mc^2$

7. According to Galilean Transformation:
 - a. $x' = x - vt$
 - b. $x' = x + vt$
 - c. $x' = vt$
 - d. $x' = t$

8. $g^{\mu\nu} g_{\nu\alpha} = ?$
 - a. g_ν^α
 - b. g_μ^ν
 - c. g_ν^μ
 - d. g_α^ν

9. The four dimensional force F^μ is called:
 - a. Lorentz force
 - b. Minkowski's force
 - c. Four-dimensional vector
 - d. None of these

10. $m - m_0$ is called:
 - a. Rest mass
 - b. Total mass
 - c. Dynamic mass
 - d. Kinetic mass

11. Michelson Morley experiment gives:
 - a. Non existence of ether.
 - b. Existence of ether.
 - c. Correction of Einstein's Rejection.
 - d. None of the above.

12. Electromagnetic energy momentum tensor is:
 - a. $T^\alpha_\nu = \frac{1}{4} g^\alpha_\nu (F_{\mu\beta} F^{\mu\beta}) - F_{\mu\nu} F^{\mu\alpha}$
 - b. $T^\alpha_\nu = \frac{1}{4} g^\alpha_\nu (F_{\mu\beta} F^{\mu\beta}) + F_{\mu\nu} F^{\mu\alpha}$
 - c. $T^\alpha_\nu = -\frac{1}{4} g^\alpha_\nu (F_{\mu\beta} F^{\mu\beta}) + F_{\mu\nu} F^{\mu\alpha}$
 - d. $T^\alpha_\nu = -\frac{1}{3} g^\alpha_\nu (F_{\mu\beta} F^{\mu\beta}) + F_{\mu\nu} F^{\mu\alpha}$

13. Covariant electromagnetic tensor denoted by:
 - a. F
 - b. F_μ
 - c. $F_{\mu\nu}$
 - d. Uniform motion

14. Maxwell's first equation is:
 - a. $\frac{\partial F_{\mu\nu}}{\partial x^\alpha} + \frac{\partial F_{\nu\alpha}}{\partial x^\mu} + \frac{\partial F_{\alpha\mu}}{\partial x^\nu} = 0$
 - b. $\frac{\partial F_{\mu\nu}}{\partial x^\alpha} + \frac{\partial F_{\nu\alpha}}{\partial x^\mu} + \frac{\partial F_{\alpha\mu}}{\partial x^\nu} \neq 0$
 - c. $\frac{\partial F_{\mu\nu}}{\partial x^\alpha} + \frac{\partial F_{\nu\alpha}}{\partial x^\mu} - \frac{\partial F_{\alpha\mu}}{\partial x^\nu} \neq 0$
 - d. $\frac{\partial F_{\mu\nu}}{\partial x^\alpha} + \frac{\partial F_{\nu\alpha}}{\partial x^\mu} - \frac{\partial F_{\alpha\mu}}{\partial x^\nu} = 0$



15. Principle of Relativity deals with:
 - a. Non-Uniform motion
 - b. Relative motion
 - c. Uniform motion
 - d. Absolute motion

16. Galilean Transformation gives:
 - a. Maxwell's law
 - b. Newton's law
 - c. Both
 - d. None of these

17. Gauss's law in magnetism is one of the law of:
 - a. Law of electromagnetism.
 - b. Gauss law in electricity.
 - c. Maxwell's law of electromagnetic induction.
 - d. None of the above.

18. According to principle of Relativity:
 - a. Velocity of light not constant.
 - b. Speed of light is Universal constant
 - c. Ether exist.
 - d. None of the above.

19. In Lorentz Force Equation $F = q_0(E + uB)$
 - a. B represent magnetic force.
 - b. B represent magnetic field.
 - c. Both (i) and (iii).
 - d. B represent electric field.

20. $v' = \frac{v' \left(1 + \frac{v}{c} \cos \theta' \right)}{\sqrt{1 - \frac{v^2}{c^2}}}$ is called:
 - a. Relativistic equation.
 - b. Relativistic equation for aberration of light.
 - c. Relativistic equation for Doppler effect.
 - d. None of these.

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Course :

Semester : Roll No :

Enrollment No : Course code :

Course Title :

Session : 2017-18 Date :

Instructions / Guidelines

- The paper contains twenty (20) / ten (10) questions.
- Students shall tick (✓) the correct answer.
- No marks shall be given for overwrite / erasing.
- Students have to submit the Objective Part (Part-A) to the invigilator just after completion of the allotted time from the starting of examination.

Full Marks	Marks Obtained
20	

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Scrutinizer's Signature

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Examiner's Signature

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Invigilator's Signature