

A-1039

Total Pages : 3

Roll No.

MT-509

M.A./M.Sc. Mathematics (MAMT/MSCMT)

Differential Geometry and Tensor-II

Examination, 2026 (Feb.)

Time : 2:00 Hrs.

Max. Marks : 70

Note :- This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. *Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.*

Section-A

Long Answer Type Questions $2 \times 19 = 38$

Note :- Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

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(1)

P.T.O.

1. Derive the differential equations of a geodesic in Gauss coefficient.
2. State and prove Schur's theorem.
3. Show that the metric of a Euclidean space, referred to cylindrical coordinates is given by :

$$ds^2 = (dr)^2 + (rd\theta)^2 + (dz)^2$$

Determine its metric tensor and conjugate metric tensor.

4. Prove that the Christoffel symbols are not tensor quantities.
5. State and prove Ricci's theorem on fundamental tensors, also prove the intrinsic derivatives of g_{ij} , g^{ij} and δ_i^j are zero.

Section–B

Short Answer Type Questions 4×8=32

Note :- Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Define the following :
 - (a) Kronecker delta and Geodesic curve
 - (b) Contravariant vector and covariant tensors
2. Prove that the unit tangent vectors form a field of parallel vectors along a geodesic.

3. Obtain the equation of Weingarten and use them to establish Mainardi-Codazzi equations.
4. Prove that the law of transformation of a contravariant vector is transitive.
5. Prove that the contracted tensor A_i^j is a scalar.
6. Calculate the Christoffel symbols corresponding to the metric

$$ds^2 = (dx^1)^2 + G(x^1, x^2) (dx^2)^2$$

where G is a function of x^1 and x^2 .

7. Define covariant derivative of a contravariant vector.
8. Prove that magnitude of all vectors of a field of parallel vectors is constant.
