

CP-2507

**M. A. / M. Sc. (First Semester) Examination,
Nov.-Dec. 2018**

MATHEMATICS

Paper : Fifth (iii)

(Differential Geometry of Manifolds-I)

Time Allowed : Three hours

Maximum Marks : 50

Note : Attempt questions of all two sections as directed.

Section-'A'

(Short Answer Type Questions) 5×4=20

Note : Attempt all five questions. Each question carries 4 marks.

[2]

1. Define differential manifold. Give an example.

Or

Explain Tangent space.

2. Define Lie derivative of tensor field.

Or

What is Exterior Algebra?

3. Define Lie groups with example.

Or

Explain Lie Algebra.

4. Show that the Lie algebra of $SO(n)$ is isomorphic to the Lie algebra of Skew symmetric matrix with Lie bracket

$$[X, Y] = XY - YX . \text{ http://www.ujainstudy.com}$$

Or

Explain Smooth subspace distribution.

5. Define isomorphism with example.

Or

What is General Linear Groups?

Section-'B'

(Long Answer Type Questions) 5×6=30

Note : Attempt all five questions. Each question carries 06 marks.

6. The topology of a topological space X is induced by C^0 compatible atlas iff each point of X has a nb homeomorphic to R^n .

Or

Let $f: R^n \rightarrow R^k$ be a smooth mapping the image of which contains $0 \in R^k$ then pre image

$$X = \{x \in R^n / f(x) = 0\}$$

of the point O .

7. Prove that for a smooth function f on M , $L_X f = X f$.

Or

If X and Y are smooth test vector fields on M then prove that $L_X Y = [X, Y]$.

8. The flow of vector field X leaves the tensor field S invariant iff $L_X S = 0$.

Or

Explain product of two Lie groups.

9. Explain commutator relation of Lie groups.

Or

Explain examples of Lie groups.

10. Prove that Lie derivation and exterior derivation of differential forms commute.

Or

State and prove Cartan's formula for Lie derivative.

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