Programme: M.Sc.(Mathematics) 4ʳᵈ semester

Course Differential Geometry

Code MAL 642

Important instructions

All questions are to be attempted in legible handwriting on the plane white A4 size papers and handed over for evaluation to the study centers concerned (University in case of Direct student). Total marks 30.

Part- 1   Max. Marks 15

Q. 1 Find the angle between two parametric curves drawn on the surface.

Q. 2 Define curvature, Gauss curvature, Mean curvature, Umbilic.

Q. 3 Obtain: $H[n, n_2\, r_1]$ = EN − FM.

Part- 2   Max. Marks 15

Q. 1 Find the edge of regression of the envelop of the family of planes:

$$xsint - ycost + z - at$$

Q. 2 Prove that torsion of an asymptotic line is equal to the torsion its geodesic tangent.

Q. 3 In the case of a curve of constant curvature find the curvature and torsion of the locus of its centre

of curvature.

Programme: M.Sc.(Mathematics) 3rd semester
Course   Methods of Applied Mathematics
Code   523
Important instructions
All questions are to be attempted in legible handwriting on the plane white A4 size papers and handed over for evaluation to the study centers concerned (University in case of Direct student). Total marks 30.

Part - 1   Max. Marks 15

Q. 1 Represent the vector $\vec{A} = 2y\hat{\imath} - z\hat{\jmath} + 3x\hat{k}$ into spherical coordinates.

Q. 2 Define partial and multiple correlations. Also obtain mean and variance for t – distribution.

Q. 3 Define Sine and Cosine transforms. Find the Fourier Cosine transforms of $f(t) = e^{-2t} + 4e^{-3t}$.

Part - 2   Max. Marks 15

Q. 1 Represent the vector $\vec{A} = 5y\hat{\imath} - 2z\hat{\jmath} + 3x\hat{k}$ into cylindrical coordinates.

Q. 2 Define normal distribution. Show that mean, mode and median of the normal distribution coincide.

Q. 3 Define Sine and Cosine transforms. Find the Fourier Sine transforms of $f(t) = e^{-4t} + 2e^{-5t}$.

Ordinary Differential Equations-II   **(MAL-524)**   **Assignment: I**

M.Sc. Mathematics (Sem. II)   **Max. Marks: 15**

Note: Attempt all questions. Each question carries 5 marks.

Q.1 Explain the procedure to reduce the order of a LH system and hence find the solution.

5

Q.2 Prove that a necessary and sufficient condition that a solution matrix Φ of

$X' = A(t)X$, be a fundamental   matrix is that $\det(\Phi(t)) \neq 0$ $for\ t \in I$.

5

Q.3 Given Φ is a fundamental matrix for LH system $x' = A(t)x$. Then prove that Ψ is a fundamental

matrix for its adjoint system $x' = -A^*(t)x$ iff $\Psi^*\Phi = C$, where C is a constant non-singular

Matrix.   5

Ordinary Differential Equations-II   **(MAL-524)**   **Assignment: II**

M.Sc. Mathematics (Sem. II)   **Max. Marks: 15**

Note: Attempt all questions. Each question carries 5 marks.

Q.1 State and prove the Fundamental Lemma of Calculus of Variation.   5

Q.2. Explain the concept of stability of critical points. Given that the roots of the characteristic equation
of linear autonomous system are conjugate complex with real part non-zero. Then find out the
nature of the critical point (0,0) of the system.

5

Q. 3 Define Geodesic. Find extremals in isoperimetric problem

$$I[y(x), z(x)] = \int_0^1 (y'^2 + z'^2 - 4xz' - 4z)dx,$$

when $y(0) = z(0) = 0$, $y(1) = z(1) = 1$ and $\int_0^1 (y'^2 - xy' - z'^2)\,dx = 2$.   5