

MAJOR (MJ)

MATPMJ101: Calculus, Geometry & Ordinary Differential Equations

Credits 04, Full Marks: 75

MATPMJ101T: Calculus, Geometry & Ordinary Differential Equations

Credits 04, Full Marks: 75

Course contents:

UNIT-1 (Differential Calculus):

Higher order derivatives, Leibnitz rule, and its applications to problems of type $e^{ax+b} \sin x$, $e^{ax+b} \cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, Hyperbolic functions; Concavity and inflection points; Curvature; Envelopes; Asymptotes; Curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves; L'Hospital's rule; Applications in business, economics, and life sciences.

UNIT-2 (Integral Calculus):

Reduction formulae, derivations, and illustrations of reduction formulae of the type $\int \sin^n x \, dx$, $\int \cos^n x \, dx$, $\int \tan^n x \, dx$, $\int \sec^n x \, dx$, $\int (\log x)^n \, dx$, $\int \sin nx \sin mx \, dx$; Parametric equations; Parameterizing a curve; Arc length of a curve, arc length of parametric curves; area under a curve; area and volume of surface of revolution,

UNIT-3 (Geometry):

Geometry 2D

Reflection properties of conics, rotation of axes, and second-degree equations; Classification of conics using the discriminant, canonical form of a conic; Polar equations of conics.

Geometry 3D

Recapitulation of the coordinate system, Plane and Straight Line, Tangent and Normal; Spheres; Cylindrical surfaces; Central conicoids; Paraboloids; Plane sections of conoids; Generating lines; Classification of quadrics

UNIT-4 (Ordinary Differential Equations):

General, Particular, Explicit, Implicit, and Singular solutions of a Differential equation; First order but not first-degree differential equation; Exact differential equations and integrating factors, and equations reducible to this form; Linear equation; Bernoulli equation and special integrating factors and transformations.

SKILL ENHANCEMENT COURSE (SEC)

MATPSEC01: MATLAB-1

Credits 03, Full Marks: 50

MATPSEC01P: MATLAB--1

Credits 03, Full Marks: 50

Course Outline:

MATLAB interface, data types, variables, Flow control statements, arrays: creating, indexing, operations, Matrix creating, indexing, operations, Input and output function, Mathematical library functions, user-defined function: anonymous function.

Plotting of two-dimensional functions, Graph plotting, Graph formatting (title, axis, line styles, colors, etc.), multiple plots, matrix plots, polar plots, 3D plotting (line, surface, mesh, and contour) of three-dimensional functions.

- I. Find the sum, product, max, min of a list of number in an array, in a sub-array without library function.
- II. Find a sub-matrix of the given matrix.
- III. Find the column sum, product, max, min of the given matrix without library function.
- IV. Find the row sum, product, max, min of the given matrix without library function.
- V. Define any transcendental function and then find and show the table of its functional values.
- VI. Plotting of graph of functions e^{ax+b} , $\log(ax + b)$, $\log \frac{1}{ax + b}$, $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.
- VII. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
- VIII. Sketching parametric curves (eg. trochoid, cycloid, epicycloids, hypocycloid).
- IX. Tracing of conics in cartesian coordinates/ polar coordinates.
- X. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using cartesian coordinates.