

**DEPARTMENT OF MATHEMATICS,
UNIVERSITY OF KARACHI,
Course Outline
MATH 401: GEOMETRY**

Course contents:

PLANE CURVES: Curves in Cartesian plane, parametric representation, polar coordinates, tangents and normals, polar equation of a conic, Pedal equation, Change of axes, general equation of second degree. Extreme values, singular points, asymptotes, curve tracing, length of arc, intrinsic equation, curvature, areas in rectangular and polar coordinates.

ANALYTIC GEOMETRY IN THREE DIMENSIONS: Direction cosine and direction ratios, equations of a line, angle between two lines, distance of a point from a line, shortest distance between two lines, equation of a plane, angle between planes, area of a triangle and volume of tetrahedron, spherical and cylindrical polar coordinates, surfaces, intercepts, traces, symmetry, quadric surfaces, sphere, surface of revolution, ruled surfaces.

DIFFERENTIAL GEOMETRY: Simple arcs and curves in three dimension and their parametric representation, the arc length, the natural Parameterization, contacts (of order up to two) of curves and a surface, osculating plane, Frenet trihedron and Frenet formulae, curvature and torsion of curves, surfaces in space, curvilinear coordinates, implicit equation of surface, tangent plane, curves on surfaces and tangent vector, angle between curves on a surface, first and second fundamental forms on a surface.

MULTIVARIATE CALCULUS: Partial derivatives, geometrical meaning, equation of tangent plane and normal to surfaces, chain rule, approximation with the help of differentials, homogeneous functions, Euler's theorem, evaluation of simple double and triple integrals, volume and surface areas of solids of revolutions.

Books Recommended:

1. Dineen S., Multivariate calculus and geometry, Springer, 2nd edition, 2014.
2. Walschap G., Multivariable calculus and differential geometry, Walter de Gruyter GmbH & Co KG, 2015.
3. Simmons, George F. Calculus with Analytic Geometry. 2nd edition, 1996.
4. Larson R., Edwards B. H., Multivariable calculus, Cengage Learning, 2013.
5. Lax P. D., Terrell M.S., Multivariable calculus with applications, Springer, 2017.
6. Thomas F., Calculus, Addison Wesley Publishing Company, 11th edition, 2005.
7. Anton H., Bevens I., Davis S., Calculus Early Transcendentals, 10th edition, 2015.
8. Hughes-Hallett, Gleason, McCallum, et al, Calculus Single and Multivariable, 7th edition.