**Course outcomes**

6. Tracing of 3D curves, evaluation of multiple integrals by change of order of integration, change of variables.
7. Series solution and applications of partial differential equations.
8. Study of analytical functions, expansion of complex functions, zeros and singularities of functions, theory of residues, evaluation of contour integrals and conformal mappings.
9. Laplace transform and its applications in solving differential and integral equations.
10. Learning of theory and applications of Fuzzy mathematics.

## UNIT-I: SOLID GEOMETRY & MULTIPLE INTEGRALS                     (CO-1)

Formation of equations of cylinder and cone under the given geometrical conditions; Tracing of some quadric (or conicoid) three dimensional surfaces.
Evaluation of multiple integrals by change of order of integration, change of variables i.e. use of Jacobian and applications of multiple integrals in finding plane area, mass, centre of gravity, centre of pressure, moment of inertia, product of inertia, curved surface area and volume.

## UNIT-II: SERIES SOLUTION AND APPLICATIONS OF P.D.E.            (CO-2)

Ordinary point, regular singular point, series solutions of ordinary differential equations of second order, Frobenius method for the solution of O.D.E. with variable coefficients; Solutions of one-dimensional wave equation, one dimensional heat conduction equation and two-dimensional Laplace (cartesian and polar forms) equation using method of separation of variables.

## UNIT-III: COMPLEX ANALYSIS                                     (CO-3)

Analytical function, C-R equations in cartesian and polar forms, geometrical representation of $w = f(z)$; Determination of conjugate harmonic function, Milne – Thomson method and related problems; Evaluation of complex integrals using Cauchy's integral theorem, Cauchy's integral formula for the $n^{th}$ order derivative of an analytic function.
Taylor series, Maclaurin series and Laurent series expansions of functions, conformal mapping, sufficient condition for conformality of $w = f(z)$, some standard transformations; Zeros, singularities and residues of an analytic function; Application of Cauchy's residue theorem in solving contour integrals and evaluation of real definite integrals using residue method.

## UNIT-IV: LAPLACE TRANSFORM & ITS APPLICATIONS                  (CO-4)

Laplace and inverse Laplace transforms of some well-known elementary functions and Special functions, Change of scale property, First and second shifting theorems, Laplace transforms of Derivative, Integral, $t^n f(t)$, $f(t)/t$, Convolution theorem & Periodic function.
Applications of Laplace and inverse Laplace transform in finding the particular solutions of ordinary linear differential equations with constants and variables coefficients, system of differential equations, integral equation, Integro-differential equations, difference equations and, conversion of differential equations into integral equations & vice versa.

## UNIT-V: FUZZY MATHEMATICS                                      (CO-5)

Introduction to Fuzzy logic, Fuzzy sets and membership functions, Fuzzy number and Fuzzy arithmetic, operations on Fuzzy sets, Fuzzy relations, Pattern classification based on Fuzzy relations, distance between Fuzzy sets, area perimeter, height, width of fuzzy subsets, and applications of Fuzzy logic.

**Text/ Reference Books**

6. A. B. Mathur and V.P. Jaggi; **Advanced Engineering Mathematics**, Khanna Publishers, 2nd edition, 2001.
7. B.S. Grewal; **Higher Engineering Mathematics**, Khanna Publishers, 44th edition, 2017.
8. B. V. Ramana: **Higher Engineering Mathematics,** McGraw Hill Education India, 26th edition 2016.
9. R. K. Jain and S. R. K. Iyengar: **Advanced Engineering Mathematics,** Narosa, 5th Edition, 2018.
10. H. K. Dass; **Advanced Engineering Mathematics**, S. Chand Publishing, 22nd edition, 2018.
11. Timothy J. Ross; **Fuzzy Logic with Engineering Applications**, Wiley; 2nd edition, 2004.