

Code	Subject Name	L	T	P
BSCT 102	Engineering Mathematics - II	3	1	0

Common to all B.Tech. branches except B.Tech. Biotechnology and B.Tech. Agricultural Engineering. (Effective from the Session : 2018 – 2019)

### OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

### Unit 1: First order ordinary differential equations: 6 hours

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for  $p$ , equations solvable for  $y$ , equations solvable for  $x$  and Clairaut's type.

### Unit 2: Ordinary differential equations of higher orders: 8 hours

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

### Unit 3: Multivariable Calculus (Integration): 10 hours

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes (without proof) simple applications involving cubes, sphere and rectangular parallelepipeds.

### Unit 4: Complex Variable – Differentiation: 8 hours

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

### Module 5: Complex Variable – Integration: 8 hours

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof);

Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. 3. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. U.S. Rana, Engineering Mathematics for Second Semester, Anand Publications, 2008
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.