

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BRANCH NAME: All Branches**  
**SUBJECT NAME: Mathematics 02**  
**SUBJECT CODE: 3110015**  
**1<sup>st</sup> Year (Semester 2)**

**Type of course: Basic Science Course**

**Prerequisite: Calculus, fourier series**

**Rationale: To compute line and surface integrals, solution techniques of higher order ordinary differential equations, fourier integral representation.**

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	2	0	5	70	30	0	0	100

Sr. No.	Content	Total Hrs	% Weightage
<b>01</b>	Vector Calculus: Parametrization of curves, Arc length of curve in space, Line Integrals, Vector fields and applications as Work, Circulation and Flux, Path independence, potential function, piecewise smooth, connected domain, simply connected domain, fundamental theorem of line integrals, Conservative fields, component test for conservative fields, exact differential forms, Div, Curl, Green's theorem in the plane (without proof), Parametrization of surfaces, surface integrals, Stoke's theorem (without proof), Divergence Theorem (without proof).	14	33 %
<b>02</b>	Laplace Transform and inverse Laplace transform, Linearity, First Shifting Theorem (s-Shifting), Transforms of Derivatives and Integrals, ODEs, Unit Step Function (Heaviside Function), Second Shifting Theorem (t-Shifting), Laplace transform of periodic functions, Short Impulses, Dirac's Delta Function, Convolution, Integral Equations, Differentiation and Integration of Transforms, ODEs with Variable Coefficients, Systems of ODEs.	07	22 %
<b>03</b>	Fourier Integral, Fourier Cosine Integral and Fourier Sine Integral.	02	
<b>04</b>	First order ordinary differential equations, Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	05	12 %
<b>05</b>	Ordinary differential equations of higher orders, Homogeneous Linear ODEs of Higher Order, Homogeneous Linear ODEs with Constant Coefficients, Euler-Cauchy Equations, Existence and Uniqueness of Solutions, Linear Dependence and Independence of Solutions, Wronskian, Nonhomogeneous ODEs, Method of Undetermined Coefficients, Solution by Variation of Parameters.	08	20 %
<b>06</b>	Series Solutions of ODEs, Special Functions, Power Series Method, Legendre's Equation, Legendre Polynomials, Frobenius Method, Bessel's Equation, Bessel functions of the first kind and their properties.	06	13%

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	14	14	14	14	7

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

### Reference Books:

- (1) Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons.
- (2) Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage.
- (3) Dennis G. Zill, 4th edition, Advanced Engineering Mathematics, 4th Edition, Jones and Bartlett Publishers.
- (4) Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014.
- (5) Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10e, Wiley, 2016.

### Course Outcome:

After learning the course the students should be able to:

1. parametrized the given curve
2. compute line integral
3. compute Work, Circulation and Flux by line integral
4. use fundamental theorem of line integrals
5. use Div, Curl
6. use Green's theorem in the plane
7. parametrized surfaces
8. compute surface integrals
9. use Stoke's theorem
10. use Divergence theorem
11. use formula of Laplace transform
12. use Unit step function, short impulses, Dirac's Delta function
13. use Laplace transform to solve ODE
14. express in fourier integral representation
15. express in fourier cosine integral and fourier sine integral
16. solve exact differential equation
17. solve first order linear differential equation
18. solve bernoulli's equation
19. solve some of first order and higher degree equations
20. solve homogeneous linear ODEs of higher order
21. solve Euler - Cauchy equation
22. check linear dependence and independence of solutions
23. evaluate wronskian
24. use method of undetermined coefficients
25. use method of solution by variation of parameters

26. solve ODE by power series method
27. solve legendre's equation
28. use legendre polynomials
29. use frobenius method
30. solve Bessel's equation
31. use bessel functions of the first kind and its properties

**List of Open Source Software/learning website:**

Scilab, MIT Opencourseware.