

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
(Common to all Programmes)

Course Code	18MAT31	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transforms: Definition and Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function – problems.

Inverse Laplace Transforms: Inverse Laplace transform - problems, Convolution theorem to find the inverse Laplace transform (without proof) and problems, solution of linear differential equations using Laplace transform.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis, examples from engineering field.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.

Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform. Simple problems.

Module-4

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Range - Kutta method of fourth order, Milne's and Adam-Bashforth predictor and corrector method (No derivations of formulae), Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge -Kutta method and Milne's predictor and corrector method.(No derivations of formulae).

Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course Outcomes:

At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5: Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.

- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44 th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3 rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6 th Edition, 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4 th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11 th Edition, 2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018
Web links and Video Lectures:				
1. http://nptel.ac.in/courses.php?disciplineID=111				
2. http://www.class-central.com/subject/math(MOOCs)				
3. http://academicearth.org/				
4. VTU EDUSAT PROGRAMME - 20				