B. E. Common to all Programmes
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>18MAT31</th>
<th>CIE Marks</th>
<th>40</th>
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<tbody>
<tr>
<td>Teaching Hours/Week (L: T:P)</td>
<td>(2:2:0)</td>
<td>SEE Marks</td>
<td>60</td>
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<tr>
<td>Credits</td>
<td>03</td>
<td>Exam Hours</td>
<td>03</td>
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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 Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.

Inverse Laplace Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

Module-2

Fourier Series: Periodic functions, Dirichlet’s condition. Fourier series of periodic functions period \( \frac{2\pi}{2} \) and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Module-3


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 and applications to solve difference equations.

Module-4


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 externals 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.
- Each full question will have sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title of the Book</th>
<th>Name of the Author/s</th>
<th>Name of the Publisher</th>
<th>Edition and Year</th>
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<tbody>
<tr>
<td><strong>Textbooks</strong></td>
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<td><strong>Reference Books</strong></td>
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<tr>
<td>5</td>
<td>Advanced Engineering Mathematics</td>
<td>Chandrika Prasad and Reena Garg</td>
<td>Khanna Publishing</td>
<td>2018</td>
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**Web links and Video Lectures:**
1. [http://nptel.ac.in/courses.php?disciplineID=111](http://nptel.ac.in/courses.php?disciplineID=111)
2. [http://www.class-central.com/subject/math(MOOCs)](http://www.class-central.com/subject/math(MOOCs))
4. VTU EDUSAT PROGRAMME - 20
Advanced mathematics for engineering and science. Modern engineering mathematics is mostly teamwork. It usually combines analytic work in the process of modeling and the use of computer algebra and numerics in the process of solution, followed by critical evaluation of results. Kreyszig introduces engineers and computer scientists to advanced math topics as they relate to practical problems. The material is arranged into seven independent parts: ODE; Linear Algebra, Vector Calculus; Fourier Analysis and Partial Differential Equations; Complex Analysis; Numerical methods; Optimization, graphs; and Probability and Statistics.