RK UNIVERSITY

# SYLLABUS

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| **Course Title** | **Engineering Mathematics – III** |
| **Course Code** | MA302 |
| **Course Credit** | Lecture : 3 |
| | Practical : 0 |
| | Tutorial : 1 |
| | Total : 4 |

## Course Learning Outcomes

After Successful completion of the above course, students will be able to:

- Formulate and **solve** differential equations.
- **Illustrate** Fourier series and Laplace transform through practical applications.
- **Solve** boundary value problems.
- A**pply** applications of Partial Differential Equation (PDE) in two dimensional heat problems.
- **Solve** initial value problems using Laplace transform.

## Detailed Syllabus

| Sr. No. | Contents | Hours Allotted |
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| | **SECTION – 1** | |
| 1. | **Higher order Ordinary Differential Equation:** Linear differential equations of second and higher order, Superposition principle, Initial value problems, Linear dependence and independence of functions- Wronskians, Abel-Liouville formula, Method of obtaining general solution of non homogeneous linear differential equation with constant coefficients, Method of obtaining Particular Integral – Shorter methods for finding P. I. for special form of R(x), Method of undetermined coefficients, Method of variation of parameter, Linear ODEs of higher order with variable coefficients, Cauchy-Euler equation, Legendre's Linear differential equation with variable coefficients and its | 12 |

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| | applications. | |
| 2. | **Partial Differential Equation**<br>Introduction, Basic concepts and definitions, Formation of partial differential equation, Discussion about solutions of P.D.Es, Partial differential equation of first order, Linear partial differential equation of first order, Nonlinear partial differential equation of first order, Method of separation of variables, Classification of partial equations of mathematical physics and their origins(vibrating strings, vibrating membranes heat conduction in solids etc.,).Solving PDEs via the method of separation of variables. The Laplace operator in cylindrical and spherical polar coordinates. Brief discussion of Fourier Bessel series. Solution via Fourier series/Fourier-Bessel series for rectangular and circular domains in $R^2$and spherical and cylindrical domains $R^3$ | 8 |
| 3. | **Series solution of ODEs:**<br>Ordinary differential equations with regular singular points and the method of Frobenious and Power series. Illustrative examples as the equations of Legendre. | 6 |
| | **SECTION – 2** | |
| 5. | **Laplace Transforms**<br>Definition of Laplace transforms, Laplace transforms of elementary functions, Inverse Laplace transforms, First shifting theorem, Laplace transform of $d^n y/dx^n$ and $t^n y(t)$, Convolution theorem, Use of Laplace transform for solving IVP for ODEs and systems of ODEs Heaviside unit step function and Seco….nd shifting theorem. Applications of Laplace transforms. | 10 |
| 6. | **Fourier Series**<br>Basic formulae in Fourier series, Theorem of existence of Fourier series, Fourier series for discontinuous function, Fourier series of even and odd functions, Half range Fourier series, Parseval's formula (statement only) and Bessel's inequality with examples. Applications of Fourier | 8 |

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| | series | |
| 7. | **Fourier Transforms**<br>Fourier transforms and its basic properties. Fourier transform of the Gaussian and the Fourier inversion theorem (statement only). Riemann Lebesgue lemma for Fourier series and Fourier transforms (statement only). | 4 |
| 8. | **Legendre and Bessel's functions**<br>Legendre polynomial, Rodrigue's formula, generating function of the Legendre polynomial and their orthogonality, Recurrence relation for $\mathbf{P_n(x)}$ . Bessel's equation and Bessel's function of first kind only. Basic properties of $\mathbf{J_n(x)}$, the recurrence relation $\mathbf{J_n(x)}$ and Integral representation of $\mathbf{J_n(x)}$. | 8 |

**Instructional Method and Pedagogy:**

- Lectures will be conducted with the usage of Black-board and Chalk-duster, OHP etc.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/ will be conducted.
- The course includes tutorials, where students have an opportunity to practice the examples for the concepts being taught in lectures.

**Reference Books:**

1. Higher Engineering Mathematics by Erwin Kreyzig, Wiley India Publications – 8th edition.
2. Differential equations by Dr. R.C. Shah, Books India Publications – 5th edition
3. Elementary Differential Equations, by W. E. Boyce and R. Di Prima and John Wiley 2005, 8th edition.
4. Fourier series and boundary value problems, R. V. Churchill and J. W. Brown, McGraw-Hill (2006) 7th edition.
5. Calculus , Volume-2, T. M. Apostol, Wiley Eastern , 1980 2nd Edition.
6. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers Co. Ltd., New Delhi – 39th edition.
7. Calculus by Thomas George, B. weir Maurice, D. Hass Joel Giordano Frank, Prajapati Jyotindra, Pearson Education, Delhi – 1st edition.