



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CIVIL ENGINEERING

II Year - I Semester		L	T	P	C
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MATHEMATICS-III (Vector Calculus, Transforms and PDE) (BSC301) (Common to ALL branches of Second Year B.Tech.)					

Course Objectives:

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes: At the end of the course, the student will be able to

- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- apply the Laplace transform for solving differential equations (L3)
- find or compute the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- identify solution methods for partial differential equations that model physical processes (L3)

UNIT –I: Vector calculus:

(10 hrs)

Vector Differentiation: Gradient– Directional derivative – Divergence– Curl– Scalar Potential.

Vector Integration: Line integral – Work done – Area– Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and problems on above theorems.

UNIT –II: Laplace Transforms:

(10 hrs)

Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac’s delta function Periodic function – Inverse Laplace transforms– Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT –III: Fourier series and Fourier Transforms:

(10 hrs)

Fourier Series: Introduction– Periodic functions – Fourier series of periodic function –Dirichlet’s conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.



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Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties (article-22.5 in text book-1) – inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

UNIT –IV: PDE of first order: (8hrs)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT – V: Second order PDE and Applications: (10 hrs)

Second order PDE: Solutions of linear partial differential equations with constant coefficients –Non-homogeneous term of the type e^{ax+by} , $\sin(ax + by)$, $\cos(ax + by)$, $x^m y^n$.

Applications of PDE: Method of separation of Variables– Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Text Books:

1. **B. S. Grewal**, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia**, Engineering Mathematics, Oxford University Press.