**SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY**

AUTONOMOUS

Accredited by National Board of Accreditation, AICTE, New Delhi

Accredited by NAAC with “A” Grade-3.32/4.00 CGPA,

Recognised under 2(f)&2(B) of UGC Act 1956,Approved by AICTE,

Permanently Affiliated to JNTUK, Kakinada

SEETHARAMPURAM, NARSAPURAM-534 280, W.G.DT.,

**B Tech II SEMESTER**

**DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS**

 **(FOR CSE & IT)**

**SYLLABUS (R19)**

**Course Objectives:**

1. To enlighten the learners in the concept of differential equations and vector calculus.
2. 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.

**Unit I: Ordinary Differential Equations of First Order and First Degree:**

Linear differential equations – Bernoulli’s equations – Exact equations and equations reducible to exact form.

Applications: Newton’s Law of cooling – Law of natural growth and decay – Orthogonal trajectories

**Learning Outcomes:**

 At the end of this unit, the student will be able to

* solve first order differential equations by appropriate method (K3)
* apply to geometrical and real world problems (K3)

**Unit II: Linear differential equations of higher order:**

Solutions of Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e*ax*, sin ax, cos ax, polynomials in xn, e*ax* V(x) and xnV(x) – Method of Variation of parameters.

Applications: LCR circuit

**Learning Outcomes:**

At the end of this unit, the student will be able to

* identify the essential characteristics of linear differential equations with constant coefficients (K3)
* solve the linear differential equations with constant coefficients by appropriate method (K3)

**Unit –III: Partial Differential Equations of First Order**:

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.

**Learning Outcomes:**

At the end of this unit, the student will be able to

* apply a range of techniques to find solutions of standard PDEs (K3)
* outline the  basic properties of standard PDEs  (K2)

**Unit IV: Numerical Solution of Equations and Interpolation**

**Numerical Solution of Equations:** Solution of algebraic and transcendental equations - Bisection Method, Method of False Position, Newton-Raphson Method, useful deduction from Newton-Raphson Method.

**Interpolation-** Finite differences, Differences of a polynomial, relation between operators, Newton’s interpolation formulae, and interpolation with unequal intervals- Newton’s divided difference formula, Lagrange’s formula.

**Learning Outcomes:**

After the completion of this unit student will be able to

* find approximate roots of an equation by using different numerical methods ( K3 )
* explain various discrete operators and find the relation among operatos ( K2 )
* apply Newton’s forward and backward formulas for equal and unequal intervals ( K3 )

**Unit V: Numerical Integration and Numerical Methods for Ordinary Differential Equations**

**Numerical Integration –** Trapezoidal rule, Simpson’s $\frac{1}{3}$ rule and Simpson’s $\frac{3}{8}$ rule.

**Numerical Methods for Ordinary Differential Equations -** Taylor’s series, Euler’s and modified Euler’s methods, Runge-kutta method of fourth order for solving first order equations.

Learning Outcomes:

After the completion of this unit student will be able to

* find integral of a function by using different numerical methods ( K3 )
* solve ordinary differential equations by using different numerical schemes ( K3 )

**Textbooks:**

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna publishers, 2012.

**References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

**Course Outcomes:**

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

1. solve the  differential equations related to various engineering fields (K3)
2. identify solution methods  for partial differential equations that model physical processes (K3)
3. evaluate the approximate roots of polynomial and transcendental equations by different algorithms(K3)
4. solve integration and ordinary differential equations by various numerical techniques.(K3)