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| **Course – 44 Title: Numerical Methods** |  |
| **Course No.: CCE 311 Credit : 3 Contact Hours: 3** | **Total Marks: 100** |

**11.1 Rationale:**

The aim of this course is to achieve the knowledge of different numerical methods for solving computer related problems.

**11.2 Objectives:**

1. *Numerical methods.* Understand the most common numerical methods used in engineering analysis, when to use each method, and how to implement basic methods in a structured manner using programming language.
2. *Numerical accuracy.* Estimate the amount of error inherent in different numerical methods.
3. *Numerical efficiency.* Assess the efficiency of a selected numerical method when more than one option is available to solve a certain class of problem.
4. *Numerical stability.* Understand the convergence properties and limitations of different numerical methods.

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| **11.3**  **Learning Outcomes** | **11.4**  **Course Content** | **11.5**  **Teaching Learning Strategy/** | **11.6 Assessment Strategy** |
| Define Numerical methods  Discuss application of different numerical method | Introduction | **Lecture** | **Assignment** |
| **Explain the** Solution of algebraic and transcendental equations, | Solution of algebraic and transcendental equations: Method of iteration, False position method, Newton-Rhapson method, | **Lecture**  **Discussion** | **Assignment**  **Exercise**  **Essay**  **Short answer** |
| Compute the solution of simultaneous linear equations | Solution of simultaneous linear equations: Cramer's rule, Iteration method, Gauss-Jordan Elimination method, Choleski's process, | **Lecture**  **Discussion** | **Assignment**  **Group Exercise**  **Multiple Choice** |
| Discuss different Interpolation method | Interpolation: Diagonal and horizontal differences, Differences of a polynomial, Newton's formula for forward and backward interpolation, Spline interpolation, | **Lecture**  **Assignment**  **Case studies** | **Assignment**  **Group Exercise**  **Multiple Choice**  **Essay** |
| Compute Integration | Integration: General quadrature formula, Trapezoidal rule, Simpson's rule, Weddle's rule, | **Lecture**  **Q/A**  **Assignment**  **Case studies** | **Assignment**  **Exercise**  **Short answer** |
| Explain the solution of ordinary differential equations | Solution of ordinary differential equations: Euler's method, Picard's method, Milne's method, Taylor's series method, Runge-Kutta method. | **Lecture**  **Q/A**  **Assignment**  Group Discussion | **Assignment**  **Exercise**  **Short answer**  **Essay** |
| Illustrate least squares approximation of functions | Least squares approximation of functions: Linear and polynomial regression, Fitting exponential and trigonometric functions. | **Lecture**  **Q/A**  **Assignment**  **Case studies** | **Assignment**  **Exercise**  **Short answer**  **Essay** |