**LESSON PLAN**

**ENGINEERING MATHEMATICS-II**

**(Numerical Methods, Multivariable Calculus & PDEs)**

**(Common to ALL Branches except CSE & IT)**

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| **S.NO** | **TOPIC** | **HOURS** | **REFERENCE** |
| 1 | **Unit-I: Numerical Methods-1**  Solving Nonlinear equatons: Algebraic and Transcendental equations, Intermediate value theorem (statement) | 1 | RB-2 |
| 2 | solution concepts, error  in solution, measure of accuracy, approximate and exact solutions | 1 |
| 3 | Methods of solving Algebraic and Transcendental equations:  Bisection method | 1 |
| 4 | Regula false (False position ) method | 1 |
| 5 | Newton- Raphson Iterative method | 1 |
| 6 | Finite differences : Forward, backward and shift operators, relations among operators, Interpolation : Interpolation and  extrapolation | 1 |
| 7 | Newton's forward and backward Interpolation formulae | **1** |
| 8 | Lagrange's interpolation formula | **1** |
|  | Fitting polynomials to the data by using Newton's and Lagrange's formulae | 1 |
| 9 | Inverse Interpolation by Lagrange's formula |  |
|  | **Total** | **10** |  |
| 10 | **Unit-II: Numerical Methods-2**  Numerical Integration : Newton-Cote’s quadrature formula, Trapezoidal Rule, | 2 | TB-1 |
| 11 | Simpson’s 1/3 Rule , Simpson’s 3/8 Rule | 1 |
|  | Boole’s Rule and Weddle’s Rule | 1 |
| 12 | Numerical solutions of Ordinary Differential Equations : Concept of initial value problem, Taylor series method, | **1** |
| 13 | Euler's method | 1 |
|  | Runge - Kutta method of fourth order | 1 |
| 14 | Predictor - Corrector method :  Milne's method to solve Initial Value Problems | 1 |
|  | **Total** | **8** |  |
| 15 | **Unit-III: Functions of Several Variables (Multivariable Calculus)**  Overview : Functions of two variables, Limit and continuity of functions of two variables, partial derivatives and geometrical meaning in case of functions of two variable |  | TB-2 |
| 16 | Functions of Several Variables : Partial differential coefficients if higher order, Total derivatives,  Chain rules for partial differentiation |  |
| 17 | partial differentiation of Implicit functions; Homogeneous Functions : Euler's theorem and its  verification |  |
| 18 | Jacobians : Jacobian, properties, chain rule for Jacobians, Functional dependence, Jacobians of implicit functions |  |
| 19 | Taylor's theorem of a function of two variables |  |
| 20 | Maxima and Minima : Maxima and minima of a function of two variables |  |
| 21 | constrained maxima  and minima, Lagrange's method of undetermined multipliers |  |
|  | **Total** | **10** |
| 22 | **Unit-IV: PDEs-First Order**  Formation of PDEs: Elimination of arbitrary constants |  |
| 23 | Elimination of arbitrary functions |  |
| 24 | Solution concepts of PDEs : Complete  solution / integral, particular integral, general integral and singular integral; PDEs solvable by direct integration |  |
| 25 | Linear PDEs of first  order (Lagrange's linear equation) : Method of grouping |  |
| 26 | method of multipliers |  |
| 27 | Nonlinear PDEs of first order : Solution methods of  solving PDEs in standard forms I, II |  |
| 28 | Nonlinear PDEs of first order : Solution methods of  solving PDEs in standard forms III, IV |  |
|  | **Total** | **10** |  |
| 29 | **Unit-V: PDEs Higher Order**  Homogeneous Linear Partial Differential Equations of second and higher order with constant coefficients: Symbolic form |  | RB-3 |
| 30 | Rules for finding complementary function |  |
| 31 | Rules for finding particular integral and working procedure to get complete solution |  |
| 32 | Solving Non homogeneous linear PDEs of second and higher order with constant coefficients; Method of separation of variables |  |
| 33 | concept of boundary value problem, solving PDEs by separating variables |  |
|  | **Total** | **10** |  |
|  | **Grand total** | **48** |  |

**TEXT BOOKS:**

TB1 B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

TB2 T.K.V. Iyengar et al, Mathematical Methods, S.Chand Publishers

**REFERENCE BOOKS:**

RB1 Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011

RB2 B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi,

11th Reprint, 2010.