Syllabus for the Academic Year : 2020 - 2021

Department: Mathematics **Semester: I**

Subject Name: Calculus and Linear Algebra

Subject Code: BS-MA101 **L-T-P-C: 3-1-0-4**

Course Objectives : The purpose of this course is to make students to

1	Master the basic tools of differential and integral calculus.
2	Study the differential equations and its applications.
3	Study the infinite series.
4	Study the elementary linear algebra and become skilled for solving problems arising in science and Engineering.

Course Outcomes

CO1	Understand the concepts of calculus, differential equations, infinite series and linear algebra.
CO2	Analyze the first order linear differential equations and infinite series using standard methods.
CO3	Apply the concepts of calculus, differential equations and matrix method to Engineering problems.
CO4	Demonstrate the matrix method and Jacobians using alternative tools.

UNIT	Description	Hours
I	**Differential Calculus :** Review of elementary calculus, polar curves- angle between the radius vector and tangent, angle between two curves, Length of the perpendicular from pole to the tangent. Curvature and radius of curvature-Cartesian and polar forms (without proof)-problems.	10
II	**Linear Algebra:** Rank of the matrix, Echelon form. Solution of system of linear equations by Gauss-Elimination method, Gauss-Jordan method and Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's Power method. Diagonalization of a square matrix of order two.	12
III	**Partial differentiation:** Definition of Partial differentiation, Total derivatives - differentiation of composite functions. Jacobians, Maxima and Minima for a function of two variables, Method of Lagrange's multipliers with one subsidiary condition.	10
IV	**Infinite Series**- Convergence and divergence of positive infinite series- P-series test, Comparison test, Cauchy's root test and D'Alembert's ratio test, Raabe's test(without proof)- problems. **Series:** Taylor's and Maclaurin's series expansions for one variable(Statement only)-problems.	10
V	**Ordinary Differential Equations (ODE):** Review of Differential equation, Bernoulli's differential equation. Exact differential equation and reducible to Exact differential equation of the Types: $(t)\frac{M_y - N_x}{N} = g(x)(tt)\frac{N_x - M_y}{M} = h(y)$. Application of ODE's-Orthogonal trajectories, Newton's law of cooling, flow of electricity, law of decay and growth.	10

Text Books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 43rd Edition Khanna Publications,2015.ISBN:9788174091956

2. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 10th Edition JonWiley&Sons,2015. ISBN:9780470913611

Reference Book:

1. "Advanced Engineering Mathematics", C. Ray Wylie, Louis C. Barrett, McGraw-Hill Book Co., New York, 6th Edition. 1995, ISBN:9780071135436.

2. "A Text Book of Engineering Mathematics"**,** N.P.Bali and Manish Goyal, Laxmi Publishers, 7th Edition Lakshmi Publishers,2010, ISBN:9788131808030.

3. "Higher Engineering Mathematics", B.V.Ramana, Tata McGraw-Hill, 1st Edition, TataMcGraw-Hill, 2006, ISBN:9780070634190

4. "Calculus and Analytical Geometry", Thomas G. B and Finney R. L**,** Pearson, 9th Ed. 2012.ISBN:0201400154.

Syllabus for the Academic Year – 2020 - 2021

Department: Mathematics **Semester: II**

Subject Name: Advanced Calculus and Numerical Methods

Subject Code: BS-MA201 **L-T-P-C: 3-1-0-4**

Course Objectives : The purpose of this course is to make students to

1	Concrete foundation of Integral calculus, vector calculus.
2	Study the differential equations of Higher order and its applications.
3	Study the partial differential equations and its applications.
4	Study the numerical methods enabling them to acquire the knowledge of these mathematical tools.

Course Outcomes: On completion of this course, students are able to:

CO1	Understand the concept of second and higher differential equations,vector calculus, partial differential equations and integral calculus.
CO2	Analysis of the improper integrals, Beta and Gamma functions and vector calculus.
CO3	Apply the concepts of differential equations, numerical methods and calculus to solve the Engineering problems.
CO4	Demonstrate the differential equations, partial differential equations and numerical methods using alternate tools.

UNIT	Description	Hours
I	**Differential Equations of higher order:** Linear Differential Equations with constant coefficients-Inverse differential operators, Particular Integrals of $e^{ax}, sinax, cosax, x^m, e^{ax}sinax$ and $e^{ax}cosax$, method of variation of parameters, Cauchy's and Legendre's differential equations. Applications to oscillation of simple pendulum, oscillation of spring and L-C-R circuits.	10
II	**Numerical Methods:** Finite differences. Interpolation and extrapolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae (all formulae without proof)- problems. Solution of polynomial and transcendental equations-Newton-Raphson and Regula-Falsi method (only formulae)- problems.	10
III	**Partial Differential Equations:** Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of Lagrange's linear PDE, Method of separation of variables. Solution of one dimensional heat and wave equations by the method of separation of variables.	12
IV	**Integral Calculus:** Multiple Integrals- Evaluation of double and triple integrals. Evaluation of double integrals by changing the order of integration and changing into polar co-ordinates. Applications: Area(polar curves) and volume. **Beta and Gamma functions:** Definitions, Relation between beta and gamma functions - problems.	10
V	**Vector Calculus:** **Vector Differentiation**: Scalar and vector fields. Gradient, directional derivative, curl and divergence-physical interpretation, solenoidal and irrotational vector fields -problems. Vector identities (without proof)-problems. **Vector Integration**: Statement and problems on Green's theorem, Gauss divergence theorem and Stokes theorem(without proof)-problems. Applications to work done by a force and flux.	10

Text Books:

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2. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 10th Edition JonWiley&Sons,2015. ISBN:9780470913611

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3. "Higher Engineering Mathematics", B.V.Ramana, Tata McGraw-Hill, 1st Edition, TataMcGraw-Hill, 2006, ISBN:9780070634190

4. "Calculus and Analytical Geometry", Thomas G. B and Finney R. L**,** Pearson, 9th Ed. 2012.ISBN:0201400154.