Mathematics
Code: M101
Contacts: 3L + 1T = 4
Credits: 4

Note 1: The whole syllabus has been divided into five modules.
Note 2: Structure of the question paper:
There will be three groups in the question paper.
In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered.
From Group B, three questions (each carrying 5 marks) are to be answered out of a set of questions covering all the three modules.
Three questions (each carrying 15 marks) are to be answered from Group C. Each question of Group C will have three parts covering not more than two topics (marked in bold italics face).
Sufficient questions should to be set covering all modules.

Module I [9L]

Matrix: Determinant of a square matrix, Minors and Co-factors, Laplace's method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, orthogonal matrix and its properties, Trace of a matrix.

Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by matrix inversion method, Consistency and inconsistency of a system of homogeneous and inhomogeneous linear simultaneous equations, Eigen values and eigen vectors of a square matrix (of order 2 or 3), Eigen values of AP^{TP}, kA, AP^{-1P}, Caley-Hamilton theorem and its applications.

Module II

Successive differentiation: Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only and its application, problems of the type of recurrence relations in derivatives of different orders and also to find $(y_n)_0$). [2L]

Mean Value Theorems & Expansion of Functions: Rolle's theorem and its application, Mean Value theorems –Lagrange & Cauchy and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions: $\sin x$, $\cos x$,e^x, $\log(1+x)$, $(a+x)^n$, n being an integer or a fraction (assuming that the remainder $R_n \to 0$ as $n \to \infty$ in each case). [5L]

Reduction formula: Reduction formulae both for indefinite and definite integrals of types $\int \sin^n x$, $\int \cos^n x$, $\int \sin^m x \cos^n x$, $\int \cos^m x \sin nx$, $\int dx/(x^2 + a^2)^n$, m, n are positive integers. [2L]

Module III

Calculus of Functions of Several Variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives and related problems, Homogeneous functions and Euler's theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of

functions and related problems, Concept of line integrals, Double and triple integrals. [9L]

Module IV

Infinite Series: Preliminary ideas of sequence, Infinite series and their convergence/ divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test and Raabe's test (statements and related problems on these tests), Alternating series, Leibnitz's Test (statement, definition) illustrated by simple example, Absolute convergence and Conditional convergence. [5L]

Module-V

Vector Algebra and Vector Calculus: Scalar and vector fields –definition and terminologies, dot and cross products, scalar and vector triple products and related problems, Equation of straight line, plane and sphere, Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics. Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Statements and applications). [8L]

Suggested Reference Books

1. Advanced Engineering Mathematics 8e by Erwin Kreyszig is published by Wiley India
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
3. Higher Engineering Mathematics: John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
4. Mathematics Handbook: for Science and Engineering, L. Rade and B. Westergren (5th edition, Indian Edition 2009, Springer)
5. Calculus: M. J. Strauss, G. L. Bradley and K. L. Smith (3rdP Edition, 1stP Indian Edition 2007, Pearson Education)
6. Engineering Mathematics: S. S. Sastry (PHI, 4thP Edition, 2008)
7. Advanced Engineering Mathematics, 3E: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.