# Kerala Technological university KTU First year B.tech Syllabus for **MA101CALCULUS**

Course No. : MA101

Course Name: CALCULUS

L-T-P-Credits: 3-1-0-4

Year of Introduction: 2015

Course Objectives:

Students will be able to understand the fundamental concepts and methods in calculus and will be able to apply the same in various engineering and technological applications.

Syllabus:

Single Variable Calculus and Infinite series, Three dimensional spaces, Functions of several variables, Calculus of vector valued functions, Multiple integrals, and Vector integration.

Expected outcome:

Students shall be able to apply the knowledge of Calculus for solving problems in respective areas of specialization.

Text Book**:**

1. Anton, Bivens, Davis: Calculus, John Wiley and Sons.

References**:**

1. Advanced Calculus, Sengar and Singh, Cengage Learning.

2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India edition.

3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.

4. N. P. Bali, Manish Goyal, Engineering Mathematics, Lakshmy Publications

5. D. W. Jordan, P Smith. Mathematical Techniques, Oxford University Press.

6. A C Srivastava, P K Srivasthava, Engineering Mathematics Vol. 1, PHI Learning Private Limited.

Module 1 Contents

Single Variable Calculus and Infinite series (Book I –sec.6.1, 6.4, 6.5, 6.8, 9.3 to 9.9)

Introduction. Exponential and Logarithmic functions. Graphs and Applications involving exponential and Logarithmic functions. Hyperbolic functions and inverses-derivatives and integrals. Indeterminate forms. Basic ideas of infinite series and convergence. Convergence tests-comparison, ratio, root and integral tests (without proof). Geometric series and p-series. Alternating series, conditional and absolute convergence, Leibnitz test. Maclaurins series-Taylor series - radius of convergence. (Sketching, plotting and interpretation of Exponential, Logarithmic and Hyperbolic functions using suitable software. Demonstration of convergence of series by mathematical software)

Module 2 Contents

Three dimensional space (Book I –sec.11.1, 11.7, 11.8)

Rectangular coordinates in three space-graphs in three space, cylindrical surfaces – Quadric surfaces, Traces of surfaces – the quadric surfaces –Technique for graphing quadric surfaces-Translation – reflection –technique for identifying

quadric surfaces, cylindrical and spherical coordinates-constant surfaces-converting coordinates-equations of surfaces in cylindrical and spherical coordinates.

Module 3 Contents

Functions of more than one variable (Book I –sec. 13.1 to 13.5 and 13.8)

Introduction- Functions of two or more variables – graphs of functions of two variables- level curves and surfaces –graphing functions of two variables using technology, Limits and continuity - Partial derivatives–Partial derivatives of functions of more than two variables - higher order partial derivatives - differentiability, differentials and local linearity -the chain rule – Maxima and Minima of functions of two variables - extreme value theorem (without proof)-relative extrema. (Sketching, plotting and interpretation of functions of two variables, level curves and surfaces using mathematical software)

Module 4 Contents

Calculus of vector valued functions (Book I-12.1-12.6, 13.6,13.7, 14.9)

Introduction to vector valued functions- parametric curves in 3-D space-parametric curves generated with technology –Parametricequations for intersection of surfaces -limits and continuity – derivatives - tangent lines – derivative of dot and cross product-definite integrals of vector valued functions-change of parameter-arclength-unit tangent-normal-binormal-curvature-motion along a curve –velocity-acceleration and speed – Normal and tangential components of acceleration. Directional derivatives and gradients-tangent planesand normal vectors-Lagrange multiplier method – extremum problem with constraint (vector approach).

Module 5 Contents

Multiple integrals (Book I-sec. 14.1, 14.2, 14.3, 14.5, 14.6, 14.7)

Double integrals- Evaluation of double integrals – Double integrals in non-rectangular coordinates- reversing the order of integration-area calculated as a double integral- Double integrals in polar coordinates- triple integrals-volume calculated as a triple integral-
triple integrals in cylindrical and spherical coordinates-
converting triple integrals from rectangular to cylindrical coordinates - converting triple integrals from rectangular to spherical coordinates- change of variables in multiple integrals- Jacobians (applications only).

Module 6 Contents

Vector integration (Book I sec. 15.1, 15.2, 15.3, 15.4, 15.5, 15.7, 15.8)

Vector field- graphical representation of vector fields – gradient fields – conservative fields and potential functions – divergence and curl - the $\nabla$ operator- the Laplacian $\nabla 2$, line integrals - work as a line integral-independence of path-conservative vector field - Green's Theorem (without proof- only for simply connected region in plane),surface integrals – Divergence Theorem
(without proof) , Stokes' Theorem (without proof)