



GAUHATI UNIVERSITY
Department of Mathematics

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Based on feedbacks received from colleges, the correspondences of contents of the paper **MAT-HC-1016** with the prescribed books are rectified.

Sd/
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SEMESTER-I

MAT-HC-1016: Calculus (including practical)

Total marks: 150 (Theory: 80 Internal Assessment: 20, Practical 50)
4 Lectures 2 Practical, Credits 6 (4+2) *Each unit carry equal credit*

UNIT 1: Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b} \sin x$, $e^{ax+b} \cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hopital's rule, applications in business, economics and life sciences.

[1]: Chapter 4 (Sections 4.3-4.7).

[2]: Chapter 6 (Section 6.1-6.8), Chapter 10 (Section 10.1-10.6).

UNIT 2: Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x \, dx$, $\int \cos^n x \, dx$, $\int \tan^n x \, dx$, $\int \sec^n x \, dx$, $\int (\log x)^n \, dx$, $\int \sin^n x \cos^m x \, dx$, volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

[1]: Chapter 9 (Sections 9.4).

[2]: Chapter 7 (Sections 7.1-7.5), Chapter 5 (Section 5.1-5.5 (excluding arc length by numerical methods))

UNIT 3: Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.

[1] Chapter 9 (Section 9.3), Chapter 10

Practical / Lab work to be performed on a computer:

List of the practical to be done using Matlab / Mathematica / Maple / Scilab / Maxima etc.

- (i). Plotting the graphs of the following functions: ax , $[x]$ (greatest integer function),

$$\sqrt{ax+b}, |ax+b|, c \pm |ax+b|, x^{\pm n}, x^{1/n}, n \in \mathbb{Z}$$

$$|x|/x, \sin(1/x), x \sin(1/x), \text{ and } e^{\pm 1/x} \text{ for } x \neq 0.$$

$$e^{ax+b}, \log(ax+b), 1/(ax+b), \sin(ax+b), \cos(ax+b), |\sin(ax+b)|, |\cos(ax+b)|.$$

Observe and discuss the effect of changes in the real constants a , b and c on the graphs.

- (ii). Plotting the graphs of polynomial of degree 4 and 5, the graphs of their first and second derivatives, and analysis of these graphs in context of the concepts covered in Unit 1.

- (iii). Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid.
- (iv). Tracing of conic in cartesian coordinates.
- (v). Obtaining surface of revolution of curves.
- (vi). Graph of hyperbolic functions.
- (vii). Computation of limit, Differentiation, Integration and sketching of vector-valued functions.
- (viii). Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form.
- (ix). Find numbers between two real numbers and plotting of finite and infinite subset of \mathbb{R}

Text Books:

1. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. H. Anton, I. Bivens and S. Davis, Calculus (10th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2011.

Note: The chapters/sections mentioned may vary depending on the number of editions of the books. To know about the availability of the books, HOD's of colleges can contact at: rkdgau@gauhati.ac.in