"Differential and Integral Methods"
(before 2016)

1. Real-valued functions, the domain, the range, graphs, shifting graphs, increasing and decreasing, inverse functions, composite functions.
2. Elementary functions: linear and quadratic, polynomials, power, exponential, logarithmic, trigonometric, hyperbolic, absolute value, integer.
3. Informal definition of limit of functions, continuous functions. Number e as a limit, the limit of Sin(x) divided by x. Continuity of a function using sequences and using epsilon-delta, one-sided limits and continuity, the intermediate value theorem, inverse function and its continuity. Existence of extremum. Continuity of elementary functions.
4. Derivative as a tangent slope and a velocity, tangent and normal lines to functions. Calculating derivatives of polynomials, negative powers, Sin(x), Cos(x). Differentiation rules, derivative of tan(x) and inverse functions.
5. The chain rule, derivative of rational powers, derivatives of sinh(x), cosh(x), tanh(x), arcsinh(x), arccosh(x), arctanh(x). Derivative of a in power x using the chain rule. Parametrizations of plain curves and their derivatives.
6. Rolle theorem, the intermediate value theorems of Lagrange and Cauchy.
8. Complex numbers, Euler's formula, complex representation of trigonometric functions.
10. Applications of integrals: area between curves, the length of curves, volumes of solids of revolution, moments and centers of mass.


12. Double and triple integrals, iterated integrals.


14. Surface area and surface integrals. Theorems of Stokes and Gauss.

Books:

"Calculus 1b"
(after 2016)

COURSE DESCRIPTION
We are going to investigate real-valued functions of a single variable. That includes, in particular, limits, differentiation and integration of the functions, investigation of their extremum, approximation of the functions by polynomials. But, first, we start with numerical sequences and series and conclude the course with sequences and series of functions of a single variable.

COURSE TOPICS

- Real-valued functions, increasing and decreasing functions, inverse functions, composition of functions. Elementary functions: linear and quadratic, polynomials,
power, exponential, logarithmic, trigonometric and their inverse, hyperbolic, absolute value, floor function. Informal definition of limit of functions and continuity - using sequences and epsilon-delta, one-sided limits and continuity. The intermediate value theorem, Weierstrass theorem.

- Uniform continuity. The squeeze theorem. Number e as a limit, the limit of Sin(x) divided by x. Derivative as a tangent slope and a velocity, tangent and normal lines to functions. Calculating derivatives of polynomials, negative powers, Sin(x), Cos(x). Differentiation rules, derivative of tan(x) and inverse functions. The chain rule, derivative of rational powers, derivatives of sinh(x), cosh(x), tanh(x). Derivative of a in power x using the chain rule. The mean value theorems of Rolle and Langrange.


- Indefinite integral, integral formulas: substitutions, integral of rational functions, integration by parts. Definite integral and area. The fundamental theorem of calculus. Integrals which depend on a parameter and their derivative with respect to the parameter. Applications of integrals: area between curves, the length of curves, volumes of solids of revolution, moments and centers of mass. Improper integrals.

REQUIRED READING

ADDITIONAL READING
Any other book in calculus (for engineering faculties and higher) can be used.