

Mathematics – Global Exam – Mechanical Engineering (BMETE90AX23). Spring 2017

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ORAL EXAM

1. Functions of 1 real variable (domain, range, graph, even, odd, etc.). Exponential, logarithm, hyperbolic functions and their inverses. Trigonometric functions and their inverses.
2. Definition of derivative of functions of 1 real variable. Rules of derivation. Table of derivatives.
3. Function of 1 real variable. Necessary, sufficient conditions for extrema. Inflection points. L'Hospital's rule. Asymptotes (horizontal, vertical, oblique).
4. Taylor, Maclaurin series. Definition. Maclaurin series of basic elementary functions.
5. Periodic functions. Trigonometric polynomials. Fourier series.
6. Indefinite integral of functions of 1 real variable. Methods of integration (elementary – table of integrals, by parts, by special substitutions).
7. Definite integral of functions of 1 real variable. Definition. Calculation of integrals by the Newton-Leibniz formula. Calculation of definite integrals by substitution, by integration by parts.
8. Applications of integration of functions of 1 real variable (area, arc length, center of gravity of homogeneous plates, volume – surface area of bodies of revolution).
9. Ordinary differential equations of the 1st order. Initial value problem. Theorem of existence and uniqueness of solutions. Integral curves, orthogonal trajectories.
10. Linear differential equations of the first order. Separable ordinary differential equations of the 1st order.
11. Autonomous differential equations of the 1st order. Trajectories.
12. Linear differential equations of the second order with constant coefficients.
13. Planar systems of autonomous linear differential equations. Phase portraits.
14. Scalar fields. Gradient. Necessary, sufficient conditions for extrema. Laplace operator.
15. Double, triple integrals. Cartesian, cylindrical, spherical coordinates. Applications.
16. Vector fields. Derivative tensor, nabla operator, divergence, rotation.
17. Line integrals. Definition, potential theory.
18. Surface integrals. Gauss-Ostrogradsky theorem.
19. Line, surface integrals. Stokes theorem.
20. *.

Literature:

Thomas' Calculus by Thomas, G.B. et al. Several editions, e.g. Addison-Wesley, (ISBN0321185587)