KING ABDULAZIZ UNIVERSITY
DEPARTMENT OF MATHEMATICS
Syllabus For M.Sc. Entrance Exam
(1434/2013)

Calculus and Analytic Geometry:
Functions (domain, range, trigonometric functions, inverse functions, exponential functions, logarithmic functions, limits, continuity, derivatives, monotonic functions, concavity, L'Hospital's Rule). Integrations and applications (methods of integrations, improper integrals, areas, volumes, arc lengths). Sequences and series (various tests, alternating series, power series). Vectors and the geometry of space (dot and cross products, lines and planes). Vector functions (derivatives and integrals of vector functions, arc length curvature). Partial derivatives (functions of several variables, limits, continuity, tangent planes, directional derivative, gradient vector, extreme values, Lagrange multipliers). Multiple integrals (double integrals, triple integrals, change of variables).

References:

1. James Stewart, Calculus: Early Transcendentals, 7th Edition, 2011.
2. H. Anton, C. Bivens, S. Davis, Calculus, 10th Edition, 2012

Linear Algebra:
Vector spaces, subspaces, linear independence, bases and dimensions. Linear transformations, kernel and range. Matrices, determinants, inverse of a square matrix, systems of linear equations, conditions of solvability, Cramer's rule. Matrix of a linear transformation. Eigenvalues, eigenvectors.

Reference:

1. H. Anton, "Elementary Linear Algebra ", 10th Edition, 2010.
2. R.Larson, R. Edwards, "Elementary Linear Algebra ", 3rd Edition.

Abstract Algebra:
Groups, subgroups, cyclic groups, and permutations groups. Cosets and Lagrange s theorem**.** Normal subgroups and quotient groups. Group homomorphisms and isomorphism, three fundamental isomorphism theorems of groups. The three Sylow's theorems (without proofs, only applications to determine groups of small orders). Rings & subrings with elementary properties and examples (rings of integer modulo *n*, rings of matrices, polynomial rings), zero-divisors, units, idempotents, nilpotents, integral domains, field of fractions of an integral domain. Ideals, factor rings, homomorphisms between rings, three fundamental isomorphism theorems of rings.

References:

1. J.B. Fraleigh, A First Course in Abstract Algebra, 7th Edition, 2003.
2. Joseph A. Gallian, Contemporary Abstract Algebra, 7th Edition, 2010.
3. C.C. Pinter, A Book of Abstract Algebra, Dover, 2nd Edition 2012.

Mathematical Analysis (Real & Complex):

The real and complex number systems, convergent sequences, Cauchy sequences, compact sets, connected sets, continuity, uniform continuity, mean value theorems. Polar form and roots of a complex number, Cauchy's theorem, Cauchy's integral formula, classification of singularities, residues.

References:

1. R.G. Bartle, D.R. Sherbert, Introduction to Real Analysis, 3rd Edition, 2011.
2. W. Rudin, Principles of Mathematical Analysis, 3rd Edition 1976.
3. D.G. Zill, P. Shanahan, A First Course in Complex Analysis, 2006.

Topology:

Topology and topological spaces, open and closed sets, closure and interior of sets, dense sets and separable spaces. Separation Axioms: T_0, T_1, T_2, regular, T_3, normal and T_4 spaces.

Reference:

1. P. Long, An Introduction to General Topology, 1971.
2. James Munkers, Topology, 2nd Edition, 2000.

Differential Equations:

First-order ordinary differential equations, higher order linear ordinary differential equations, separation of variables and partial differential equations. Solving initial value problems & boundary value problems using Laplace transform.

References:

1. H. J. Ricardo, A Modern Introduction to Differential Equations, 2009.
2. Dennis Zill, A First Course in Differential Equations with Modeling Applications, 10th Edition, 2013.
3. R. H. Rand, Lecture Notes on PDE's:Separation of Variables and Orthogonality, http://audiophile.tam.cornell.edu/randpdf/PDE15.pdf

Numerical Analysis:

Numerical solution of nonlinear equations, Newton's method and secant method. Numerical solution of linear systems, Gauss elimination method. Interpolation: Lagrange interpolating polynomials. Differentiation and Integration: How to approximate the first and second derivatives, how to approximate the integrals using trapezoidal and Simpson's rules**,** two points Gaussian quadrature. Numerical solution of ordinary differential equations: Euler method, Runge Kutta method of order 4.

Rference:

1. R. Burden**,** J. Faires, Numerical Analysis, 9th Edition, 2011.
2. C.F. Gerald, P.O. Wheatley, Applied Numerical Analysis, 7th Edition, 2003.

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