

Khalsa College Amritsar

(An Autonomous College)



Faculty of Mathematical Sciences

Syllabus for

B.A. /B.Sc. Semester I-VI

Session 2018-19

Khalsa College Amritsar

(An Autonomous College)

Syllabus for

B.A. /B.Sc. (Semester System) (12+3 System of Education)

Session 2018-19

SEMESTER-I

MATHEMATICS

M-101

PAPER-I: ALGEBRA

Time: 3 Hours

Marks: 37

Internal Assessment: 13

Instructions for the Paper Setters:

1. The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit), Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from section-B & C. Each question carries 6 marks.
4. Teaching time for this paper would be six periods per week for each paper.

Unit-I

Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks, Nullity of a matrix, Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field.

Unit-II

Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Matrix Congruence of skew-symmetric matrices. Reduction in the real field. Classification of real quadratic forms in variables. Definite, semi-definite and indefinite real quadratic forms. Characteristic properties of definite, semi-definite and indefinite forms. Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equations and symmetric function of roots, Descartes's rule of signs, Newton's Method of divisors, Solution of cubic equations by Cardan method, Solution of biquadratic equations by Descartes's and Ferrari's Methods.

Books Recommended:

1. K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
2. H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
3. Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
4. S.L. Loney: Plane Trigonometry Part-II, Macmillan and Company, London.
5. Shanti Narayan and P.K.Mittal: Text Book of Matrices, S.Chand & Company, Delhi.
6. M.K. Singal and Asha Rani Singal; Algebra, R Chand & Company, Delhi.
7. Rajinder Pal Kaur: Algebra, First World publication Ludhiana.

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Syllabus for

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Session 2018-19

SEMESTER-I

MATHEMATICS

M-102

PAPER-II: CALCULUS AND TRIGONOMETRY

Time: 3 Hours

Marks: 37

Internal Assessment: 13

Instructions for the Paper Setters:

1. The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit), Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from section-B & C. Each question carries 6 marks.
4. Teaching time for this paper would be six periods per week for each paper.

Unit-I

Real number system and its properties, lub, glb of sets of real numbers, limit of a function, Basic properties of limits, Continuous functions and classification of discontinuities, Uniform continuity, Differentiation of hyperbolic functions, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's theorem with various forms of remainders, Indeterminate forms.

Unit-II

De-Moivre's Theorem and its applications, circular and hyperbolic functions and their inverses. Exponential and Logarithmic function of complex numbers, Expansion of trigonometric functions, Gregory's series, Summation of series.

Books Recommended:

1. N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow.
2. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
3. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999.
4. Shanti Narayan and P.K. Mittal: Differential Calculus, S Chand & Company.
5. Shanti Narayan and P.K. Mittal: Real Analysis, S Chand & Company.
6. Rajinder Pal Kaur: Calculus, First world Publication, Ludhiana.

Khalsa College Amritsar
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 Syllabus for
 B.A. /B.Sc. (Semester System) (12+3 System of Education)
Session 2018-19
SEMESTER-II
MATHEMATICS
M-201
PAPER-I: CALCULUS AND DIFFERENTIAL EQUATIONS

Time: 3 Hours

Marks: 37

Internal Assessment: 13

Instructions for the Paper Setters:

1. The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit), Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from section-B & C. Each question carries 6 marks.
4. Teaching time for this paper would be six periods per week for each paper.

Unit-I

Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple Points, Curvature, Tracing of Curves (Cartesian and Parametric coordinates only). Integration of hyperbolic functions. Reduction formulae. Definite integrals. Fundamental theorem of integral calculus. Quadrature, rectification.

Unit-II

Exact differential equations. First order and higher degree equations solvable for x, y, p . Clairaut's Form and singular solutions. Geometrical meaning of a differential equation. Orthogonal Trajectories. Linear differential equations with constant and variable coefficients. Variation of Parameters method, reduction method, series solutions of differential equations. Power series Method, Bessel and Legendre equations (only series solution).

Books Recommended:

1. D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
2. G.F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
3. E.A. Codrington: An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
4. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
5. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999.
6. Shanti Narayan and P.K. Mittal: Integral Calculus, S Chand & Company

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Syllabus for

B.A. /B.Sc. (Semester System) (12+3 System of Education)

Session 2018-19

SEMESTER-II

MATHEMATICS

M-202

PAPER-II: CALCULUS

Time: 3 Hours

Marks: 37

Internal Assessment: 13

Instructions for the Paper Setters:

1. The question paper will consist of three sections namely Section-A which will be from entire syllabus (equally distributed from each unit), Section-B from Unit-I and Section-C from Unit-II.
2. The Section-A will consist of seven compulsory questions, each of one mark.
3. The Section-B & C will consist of five questions each. Students are to attempt any five questions in total by selecting at least two questions from section-B & C. Each question carries 6 marks.
4. Teaching time for this paper would be six periods per week for each paper.

Unit-I

Limit and Continuity of functions of two variables, Partial differentiation, Change of variables, Partial derivatives and differentiability of real-valued functions of two variables, Schwartz's and Young's Theorem, Statements of Inverse and implicit function theorems and applications, Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Envelopes. Evolutes, Maxima, Minima and saddle points of functions of two Variables, Lagrange's undetermined multiplier method.

Unit-II

Double and Triple Integrals, Change of variables. Applications to evaluation of Areas, Volumes, Surfaces of solid of revolution, Change of order of integration in double integrals.

Books Recommended:

1. Narayan, S. & Mittal, P.K. : Integral Calculus, S. Chand & Co.
2. Kreyszig, E.: Advanced Engineering Mathematics.
3. Narayan S. & Mittal, P.K. : Differential Calculus, S. Chand & Co.

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Syllabus for

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Session 2018-19

SEMESTER-III

MATHEMATICS

M-301

PAPER-I: ANALYSIS

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests. Cauchy's integral tests. Ratio tests. Cauchy's root test. Raabe's test, Logarithmic test. Demorgan's and Bertrand's tests. Kummer's test, Cauchy Condensation test, Gauss test, Alternating series. Leibnitz's test, absolute and conditional convergence.

Unit-II

Partitions, Upper and lower sums. Upper and lower integrals, Riemann integrability. Conditions of existence of Riemann integrability of continuous functions and of monotone functions. Algebra of integrable functions. Improper integrals and statements of their conditions of existence. Test of the convergence of improper integral, beta and gamma functions.

Books Recommended:

1. Malik, S.C & Arora, Savita.: Mathematical Analysis, Wiley Eastern Ltd. (1991).
2. Apostol, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics (1974).
3. Narayan, S & Mittal, P.K.: Integral Calculus, S. Chand & Co.

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Session 2018-19

SEMESTER-III

MATHEMATICS

M-302

PAPER-II: ANALYTICAL GEOMETRY

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

Transformation of axes, shifting of origin, Rotation of axes, The invariants, Joint equation of pair of straight lines, equations of bisectors, Parabola and its properties. Tangents and normals, Pole and polar, pair of tangents at a point, Chord of contact, equation of the chord in terms of mid point and diameter of conic.

Unit-II

Ellipse and hyperbola with their properties. Tangents and normals, Pole and polar. Pair of tangents at a point, Chord of contact, Identifications of curves represented by second degree equation (including pair of lines). Intersection of three planes, condition for three planes to intersect in a point or along a line or to form a prism. Change of axes, Shift of origin, rotation of axes. Sphere, Section of a sphere by a plane, spheres of a given circle. Intersection of a line and a sphere. Tangent line, tangent plane, power of a point w.r.t. a sphere, radical planes.

Books Recommended:

1. Gorakh Prasad and H.C. Gupta: Text Book on Coordinate Geometry.
2. S.L. Loney: The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S. & Mittal, P.K.: Analytical Solid Geometry, S. Chand & Co.
4. Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons.
5. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry.

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SEMESTER-IV

MATHEMATICS

M-401

PAPER-I: STATICS AND VECTOR CALCULUS

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

Composition and resolution of forces (parallelogram law, triangle law, polygon law, Lami's Theorem, $(\lambda - \mu)$ theorem). Resultant of a number of coplanar forces, parallel forces. Moments, Varignon's theorem of moments, Couples, Resultant of two Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple. Equilibrium of coplanar forces. Friction, Laws of friction, Equilibrium of a particle on a rough plane. Centre of Gravity: Centre of gravity of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.

Unit-II

Vector differentiation, Gradient, divergence and curl operators, line integrals, Vector identity, Vector integration, Theorems of Gauss, Green, Stokes and problems based on these.

Books Recommended:

1. S.L. Loney: Statics, Macmillan and Company, London.
2. R.S. Verma: A Text Book on Statics, Optical Pvt. Ltd., Allahabad.
3. Spiegel, M.R.: Introduction to Vector Calculus and Tensor.
4. Spiegel, M.R.: Vector Analysis.

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Syllabus for
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Session 2018-19

SEMESTER-IV

MATHEMATICS

M-402

PAPER-II: SOLID GEOMETRY

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

Cylinder as surface generated by a line moving parallel to a fixed line and through a fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms, Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z . Cone as a surface generated by a line passing through a fixed curve and a fixed point outside the plane of the curve, right circular and elliptic cones.

Unit-II

Equation of surface of revolution obtained by rotating the curve $f(x,y)=0$ about the z -axis in the form of $f(x^2+y^2,z)=0$. Equation of ellipsoid, hyperboloid and paraboloid in standard forms. Surfaces represented by general equation of 2nd degree $S = 0$. Tangent lines, tangent planes and Normal plane.

Books Recommended:

1. Narayan, S. & Mittal, P.K. : Analytical Solid Geometry, S. Chand & Co.
2. Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons.

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SEMESTER-V

MATHEMATICS

M-501

PAPER-I: MECHANICS AND NUMERICAL METHODS-II

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.
4. Use of scientific and non-programmable calculator is allowed.

Unit-I

Basic concepts, rectilinear motion in a straight line with uniform acceleration, Newton's laws of motion. Motion of two particles connected by a string. Motion along a smooth inclined plane. Variable acceleration. Simple Harmonic Motion. Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles. Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum. Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.

Unit-II

Interpolation with divided difference, Newton's formula, Lagrangian Method, Finite difference interpolation, Gauss formula, Stirling formula, Bessel's formula, Error Estimation Extrapolation. Numerical differentiation, Method based on interpolation. Numerical Integration, Trapezoidal rule, Simpson's rule, Weddle rule, Romberg Integration, Gaussian integration method, Gaussian Legendre integration. Double numerical integration. Numerical solution of ordinary differential equations, Equations of first and second order, System of simultaneous equations, Milne's Method, Runge-Kutta Method. Predictor- Corrector Methods.

Books Recommended:

1. S.R.Gupta, A text book of Dynamics
2. F. Chorlton, Dynamics.
3. S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Cambridge University Press, 1956.
4. Scarborough: Numerical Mathematical Analysis (6th edition).
5. S.S. Sastry: Introductory Methods of Numerical Analysis, 2003 (3rd Edition), Prentice Hall of India.
6. R.S. Salaria: Computer Oriented Numerical Methods, 2007, Khanna Book Co. Publishing Co. (P) Ltd.
7. A. Maritava Gupta and Subash Ch. Bose: Introduction to Numerical Analysis.
8. Sharma publication: Dynamics.

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SEMESTER-V

MATHEMATICS

M-502

PAPER-II: ANALYSIS AND VECTOR CALCULUS

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

Partitions, Upper and lower sums. Upper and lower integrals, Riemann integrability. Conditions of existence of Riemann integrability of continuous functions and of monotone functions. Algebra of integrable functions. Inequalities involving integrals. Improper integrals and statements of their conditions of existence. Test of the convergence of improper integrals.

Unit-II

Vector differentiation, Gradient, divergence and curl operators, line integrals, Vector identity, Vector integration, Theorems of Gauss, Green, Stokes and problems based on these.

Books Recommended:

1. Malik, S.C.: Mathematical Analysis, Wiley Eastern Ltd. (1991).
2. Apostol, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics (1974).
3. Narayan, S.: Vector Calculus, Sultan Chand & Sons.
4. Narayan, S.: Mathematical Analysis Sultan Chand & Sons.
5. Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons.
6. Spiegel, M.R.: Introduction to Vector Calculus and Tensor.
7. Spiegel, M.R.: Vector Analysis.
8. Sharma Publication.: Statics and Vector Calculus.

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SEMESTER-VI

MATHEMATICS

M-601

PAPER-I: LINEAR ALGEBRA

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

Definition of groups, rings and fields with illustrations. Definition of a vector space, subspaces with examples. Direct sum of subspaces. Linear span, Linear dependence, Linear independence of vectors. Linear combination of vectors, Basis of a vector space, Finitely generated vector spaces. Existence theorem for basis. Invariance of the number of elements of the basis set. Dimension of sum of two subspaces. Quotient space and its dimension.

Unit-II

Linear transformations. Algebra of linear transformations. Rank- Nullity theorem, Isomorphism and Isomorphic spaces, Matrix of a linear transformation. Changes of basis, Linear operators.

Books Recommended:

1. K.Hoffman & R. Kunze, Linear Algebra, 2nd Edition, Prentice Hall, New Jersey, 1971.
2. V. Krishnamurthy, V. P. Mainra and J.L. Arora, An Introduction to Linear Algebra, East West Press.
3. Shanti Narayan & P.K. Mittal, A Text Book of Matrices, 10th Edition (2002), S. Chand & Co.
4. Surjit Singh: Linear Algebra, Vikas Publishing House.
5. Surjit Singh and Quazizamirzudin- Modern Algebra, Vikas Publishing House.

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Syllabus for

B.A./B.Sc. (Semester System) (12+3 System of Education)

SEMESTER-VI

Session 2018-19

MATHEMATICS

M-602

PAPER-II: NUMBER THEORY

Time: 3 Hours

Marks: 40

Internal Assessment: 10

Instructions for the Paper Setters:

1. The syllabus of this paper is split into two parts, Section-A and Section-B. Five questions will be set from each section. Each question will carry eight marks.
2. The students will attempt five questions in all, selecting at least two questions from each section.
3. Teaching time for this paper would be six periods per week.

Unit-I

The division algorithm, The greatest common divisor, least common multiple, The Euclidean Algorithm, The Diophantine equation $ax + by = c$, Prime numbers and their distribution, The fundamental theorem of arithmetic, Basic properties of congruences, Linear congruences, Special divisibility tests.

Unit-II

Chinese remainder theorem, The Fermat's theorem, Wilson's theorem, τ , μ and σ functions, Mobius Inversion formula, Greatest integer function, Euler's Phi function, Euler's theorem, some properties of the Phi Function.

Books Recommended:

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
(Scope as in Chapters 2-5, 7-12).
2. Evan Niven and Herbert S. Zuckerman: An Introduction to Number Theory, Wiley Eastern.