Khalsa College Amritsar
(An Autonomous College)
Syllabus for
B.A. /B.Sc. (Semester System) (12+3 System of Education)
Session 2017-18
SEMESTER–I
MATHEMATICS
M-101
PAPER–I: ALGEBRA

Time: 3 Hours **Marks: 40**

Instructions for the Paper Setters:

1. 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 student will attempt five questions in all selecting at least two questions from each section
3. Teaching time for Mathematics would be six periods per week for each paper.

Section–A

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.

Section–B

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, Descarte's rule of signs, Newton's Method of divisors, Solution of cubic equations by Cardan method, Solution of biquadratic equations by Descarte'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: Text Book of Matrix.
6.M.K. Singal and Asha Rani Singal; Algebra, R Chand & Company, Delhi.
7 Rajinder pal kaur:Algebra ,First World publication Ludhiana.

Chairman, BoS in Mathematics

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B.A. /B.Sc. (Semester System) (12+3 System of Education)
Session 2017-18
SEMESTER–I
MATHEMATICS
M-102
PAPER–II: CALCULUS AND TRIGONOMETRY

Time: 3 Hours   **Marks: 40**

Instructions for the Paper Setters:
1. Syllabus of this paper is split into two Parts: Section–A and Section–B. Five questions will be set from each Section.
2. The student will attempt five questions in all selecting at least two questions from each section.
3. Teaching time for Mathematics would be six periods per week for each paper.

Section–A

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 continuities, Differentiation of hyperbolic functions, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's theorem with various forms of remainders, Indeterminate forms.

Section-B

De–Moivre's Theorem and its applications, circular and hyperbolic functions and their inverses. Exponential and Logarithmic function of a 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.

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Session 2017-18
SEMESTER–II
MATHEMATICS
M-201
PAPER–I: CALCULUS AND DIFFERENTIAL EQUATIONS

Time: 3 Hours   **Marks: 40**

Instructions for the Paper Setters:
1. Syllabus of this paper is split into two Parts: Section–A and Section–B. Five questions will
   be set from each Section.
2. The student will attempt five questions in all selecting at least two questions from each Section.
3. Teaching time for Mathematics would be six periods per week for each paper.

SECTION–A
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.

SECTION– B
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. Codington: 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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Session 2017-18
SEMESTER–II
MATHEMATICS
M-202
PAPER–II: CALCULUS

Time: 3 Hours   **Marks: 40**

Instructions for the Paper Setters:
1. Syllabus of this paper is split into two Parts: Section–A and Section–B. Five questions will be set from each Section.
2. The student will attempt five questions in all selecting at least two questions from each section.
3. Teaching time for Mathematics would be six periods per week for each paper.

SECTION–A
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.

SECTION–B
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.: Integral Calculus. Sultan Chand & Sons.
2. Kreyszig, E.: Advanced Engineering Mathematics.
3. Narayan S.: Differential Calculus, Sultan Chand & Sons.

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Session 2017-18
SEMESTER–III
MATHEMATICS
M-301
PAPER–I: ANALYSIS AND PLANE GEOMETRY

Time: 3 Hours **Marks: 40**

Instructions for paper setters:

1. 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 student 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.

Section-A

Sequences in real numbers: Basic concepts of bounded, convergent, divergent and oscillatory sequences, behavior of monotonic sequences, algebra of limits, Sandwich Theorem and its applications, Cauchy's first Theorem on limits and Cauchy's second Theorem on limits with applications, Cesaro's Theorem and Cauchy- Stolze Theorem with applications, peak points of a sequence.

Subsequence: Definition and behavior, subsequential limit, Bolzano Weierstrass Theorem.

Cauchy's sequence: Definition, Cauchy's convergence criterion, Cantor's Intersection Theorem.

Infinite Series: Basic concepts, behaviour and sum. Comparison tests, Cauchy's integral tests, Ratio tests, Cauchy's root test, Raabe's test, logarithmic test, De-Morgan's and Bertrand's tests, Kummer's test, Cauchy Condensation test, Gauss test, Alternating series, Leibnitz's test. Absolute and conditional convergence.

Section-B

Transformation of axes, shifting of origin and rotation of axes in a plane, Reduction of the second degree equation into standard forms by transformation of co-ordinates. The invariants. Identifications of curves represented by second degree equation (including pair of lines).Pole and polar, pair of tangents at a point, chord of contact, equation of the chord in terms of midpoint and diameter of a conic. Parabola, ellipse and hyperbola and their properties.

Polar Co-ordinates: Polar co-ordinates of a point, relation between rectangular cartesian and polar co-ordinates, polar equations of straight line, circle and conic.

Books Recommended:

1. Malik, S.C.: Mathematical Analysis, Wiley Eastern Ltd. (1991).
2. Apostal, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics (1974).
3. Shanti Narayan and P.K.Mittal, Real Analysis, S.Chand& Co.
4. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry.
5. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London.

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Syllabus for
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Session 2017-18
SEMESTER–III
MATHEMATICS
M-302
PAPER–II: SOLID GEOMETRY

Time: 3 Hours   **Marks: 40**

Instructions for paper setters:

1. 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 student 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.

Section A

Intersection of three planes: Condition for three planes to intersect in a point, along a line, and to form a prism. Change of axes, shift of origin and rotation of axes(in three dimensions).

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.

Cylinder: Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic cylinder in standard forms.

Section B

Cone: 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.

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

Books Recommended:

1. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
2. Kreyszig, E.: Advanced Engineering Mathematics.

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Syllabus for
B.A./B.Sc. (Semester System) (12+3 System of Education)
Session 2017-18
SEMESTER–IV
MATHEMATICS
M-401
PAPER–I: MECHANICS AND NUMERICAL METHODS- I

Time: 3 Hours   **Marks: 40**
Instructions for paper setters:
1. 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 student 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.
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Section-A
Forces acting at a point: Basic concepts, composition and resolution of forces acting at a point(parallelogram law, polygon law), Lami's Theorem, λ-μ Theorem. Resultant of a number of coplanar forces acting at a point, parallel forces.
Moments: Basic concept, Varignon's Theorem of moments, Generalized Theorem of moments. Moment of a force about a line.
Couples: Concept, Resultant of Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple. Resultant of a system of forces acting on a rigid body. **Friction:** Concept, Laws of friction, Equilibrium of a particle on a rough plane. Problems of friction on ladders, beams, hollow spheres and vertical circles.
Centre of Gravity (C.G.): Basic concepts of C.G, C.G. of a number of particles arranged in a line and in a plane, C.G. of a uniform lamina (parallelogram, triangular, trapezium, and quadrilateral only). C.G of a uniform rod, a tetrahedron, a solid hemisphere, a hollow hemisphere, a solid cone and a hollow cone. C.G. of a combined body and a remainder body. C.G. of a uniform circular arc, a uniform sector and a uniform segment.

Section B
Errors: Error generation, propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Iteration method, Newton's Method, Generalized Newton's Method, Method of false position, Muller's method and rate of convergence of these methods. **Solution of system of linear equations:** Direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative Method, Jacobi's Method, Gauss Seidel Method. **Finite Differences:** Forward, Backward, Central, Divided differences. Shift operator, relationship between the operators and detection of errors by use of difference operator

Books Recommended:
1. S.L. Loney: Statics, Macmillan and Company, London
2. Scarborough: Numerical Mathematical Analysis (6th edition).
3. S.S. Sastry: Introductory Methods of Numerical Analysis, 2003 (3rd Edition), PrenticeHall of India.
4. R.S. Salaria: Computer Oriented Numerical Methods, 2007, Khanna Book Co.(P) Ltd.
5. A. Maritava Gupta and Subash Ch. Bose: Introduction to Numerical Analysis.

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Session 2017-18
SEMESTER–IV
MATHEMATICS
M-402
PAPER–II: ADVANCED CALCULUS

Time: 3 Hours   **Marks: 40**

Instructions for paper setters:

1. 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 student 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.

Section–A

Limit and Continuity of functions of two variables. Partial derivatives, 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 and applications. Taylor's Theorem for functions of two variables with applications. Envelopes and Evolutes.

Section–B

Jacobians. Maxima-minima and saddle points of functions of two variables. Lagrange's undetermined multiplier method. Double and Triple Integrals, Change of variables in double and triple integrals. Change of order of integration in double integrals. Applications of double and triple integrals for evaluation of area. Volume, Centre of Gravity and Moment of Inertia.

Books Recommended:

1. Narayan, S.: Principles of Mathematical Analysis, Sultan Chand & Sons.
2. Kreyszig, E.: Advanced Engineering Mathematics.
3. S.C.Malik and SavitaArora: Mathematical Analysis, Wiley Eastern.

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Syllabus for
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Session 2017-18
SEMESTER–V
MATHEMATICS
M-501
PAPER–I: MECHANICS AND NUMERICAL METHODS-II

Time: 3 Hours   **Marks: 40**

Instructions for paper setters:
1. 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 student 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.

Section–A
Basic concepts, rectilinear motion in a starlight 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.

Section–B
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 Practice 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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Session 2017-18
SEMESTER–V
MATHEMATICS
M-502
PAPER–II: ANALYSIS AND VECTOR CALCULUS

Time: 3 Hours   **Marks: 40**

Instructions for paper setters:
1. 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 student 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.
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Section–A

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.

Section–B

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. Apostal, 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.
6. Spiegal, M.R.: Introduction to Vector Calculus and Tensor.
7. Spiegal, M.R.: Vector Analysis.
8. Sharma Publication.: Statics and Vector Calculus.

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Session 2017-18
SEMESTER–VI
MATHEMATICS
M-601
PAPER–I: LINEAR ALGEBRA

Time: 3 Hours   **Marks: 40**

Instructions for paper setters:
1. 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 student 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.

Section–A

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.

Section–B

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

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.

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SEMESTER–VI
Session 2017-18
MATHEMATICS
M-602
PAPER–II: NUMBER THEORY

Time: 3 Hours **Marks: 40**

Instructions for paper setters:
1. 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 student 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.

Section–A

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.

Section–B

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 in Chapters 2-5, 7-12).
2. Niven and Zuckerman: An Introduction to Number Theory.

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