(12.) (28)

Scheme of Examination of B.A./B.Sc. I in the subject of Mathematics (w.e.f. 2017-2018)

Semester 1st

Paper Code	Title of Paper	Allocation of Periods	Maximum Marks						Credits
			External Marks		Internal Marks		Total		
			B.A.	B.Sc.	B.A.	B.Sc.	B.A.	B.Sc.	
MAT 101 A	Algebra	6 periods/4½ hours per week	27	40	7	10	100	150	4½
MAT 101 B	Calculus	6 periods/4½ hours per week	27	40	7	10			4½
MAT 101 C	Solid Geometry	6 periods/4½ hours per week	26	40	6	10			4½

225
D-12

B.A./B.Sc. 1st Year (1st Semester)
Algebra (MAT 101A)

Max. Marks: B.A. -27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of five sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

01/03/2018

(12 VX - 19)

Section – II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices.

Section – III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Section – IV

Nature of the roots of an equation Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Books Recommended :

1. H.S. Hall and S.R. Knight : Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan : A Text Books of Matrices.
3. Chandrika Prasad: Text Book on Algebra and Theory of equations, Pothishala Private Ltd., Allahabad.
4. Khurosh: Higher Algebra (Mir Publication).

01/03/2019

B.A./B.Sc. 1st Year (1st Semester)
Calculus (MAT 101B)

Max. Marks: B.A.-27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of five sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt one question from each section. Section-V will contain four short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be compulsory.

Section – I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Section – II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential Polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Section – III

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Section – IV

Quardrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorem of Pappu's and Guilden.

Books Recommended :

1. Shanti Narayan: Differential and Integral Calculus.
2. Murray R. Spiegel: Theory and Problems of Advanced Calculus. Schaum's Outline series, Schaum Publishing Co., New York.
3. N. Piskunov : Differential and integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad : Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad : Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

01/03/2019

B.A./B.Sc. 1st Year (1st Semester)
Solid Geometry (MAT 101C)

Max. Marks: B.A.-26
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of five sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 6 marks) without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

Section – II

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, Radical plane of two spheres. Co-axal system of spheres.

Section – III

Cones: Right circular cone, enveloping cone and reciprocal cone.
Cylinder: Right circular cylinder and enveloping cylinder.

Section – IV

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.
Paraboloids: Circular section, Plane sections of conicoids.
Reduction of second degree.

Books Recommended:

1. R.J.T. Bill: Elementary Treatise on Coordinary Geometry of three Dimensions, MacMillan India Ltd. 1994
2. P.K. Jain and Khalil Ahmad: A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.
3. Shanti Narayan: Solid Geometry, S. Chand and Company.

01/03/2019

*Approved by 19th Academic Council held in 14-09-2017 for implementation from the Academic session 2017-18.

Scheme of Examination of B.A./B.Sc. in the subject of Mathematics (w.e.f. 2017-2018)

Semester 2nd

Paper Code	Title of Paper	Allocation of Periods	Maximum Marks						Credits
			External Marks		Internal Marks		Total		
			B.A.	B.Sc.	B.A.	B.Sc.	B.A.	B.Sc.	
MAT 102 A	Number Theory and Trigonometry	6 periods/ 4 ½ hours per week	27	40	7	10	100	150	4 ½
MAT 102 B	Ordinary Differential Equations	6 periods/ 4 ½ hours per week	27	40	7	10			4 ½
MAT 102 C	Vector Calculus	6 periods/ 4 ½ hours per week	26	40	6	10			4 ½

01/03/2019

B.A./B.Sc. 1st Year (2nd Semester)
Number Theory and Trigonometry (MAT 102A)

Max. Marks: B.A.-27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Divisibility, G.C.D.(greatest common divisors), L.C.M.(least common multiple) Primes, Fundamental Theorem of Arithemetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophanatine equations in two variables.

Section – II

Complete residue system and reduced residue system modulo m. Euler's ϕ function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function [x]. The number of divisors and the sum of divisors of a natural number n (The functions d(n) and σ (n)). Moebius function and Moebius inversion formula.

Section - III

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Section – IV

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Books Recommended :

1. S.L. Loney : Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla : Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Ivan Niven and H.S. Zuckerman. An Introduction to the Theory of Numbers.
4. G.F. Andrew : Number Theory.
5. D.M. Burton: Elementary Number Theory.

01/03/2019

3821

B.A./B.Sc. 1st Year (2nd Semester)
Ordinary Differential Equations (MAT 102B)

Max. Marks: B.A-27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x,y,p. Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Section – II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous. Linear ordinary differential equations.

Section – III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Section – IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators x (d/dx) or t (d/dt) etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Books Recommended :

1. D.A. Murray: Introductory Course in Differential Equations. Orient Longaman (India), 1967.
2. A. R. Forsyth : A Treatise on Differential Equations, Machmillan and Co. Ltd. London
3. E.A. Codington: Introduction to Differential Equations.
4. S.L.Ross: Differential Equations, John Wiley & Sons.
5. B.Rai & D.P. Chaudhary: Ordinary Differential Equations; Narosa Publishing House Pvt. Ltd.

01/03/19

3·25
PM-3

B.A./B.Sc. 1st Year (2nd Semester)
Vector Calculus (MAT 102C)

Max. Marks: B.A.-26
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 6 marks) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives.

Section – II

Gradient of a scalar point function, geometrical interpretation of grad Φ, character of gradient as a point function. Divergence and curl of vector point function, characters of Div. $\bar{f}$ and Curl $\bar{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Section – III

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Section – IV

Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

Books Recommended:

1. Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publishing Company, NewYork.
2. Murrary R. Spiegal : VectorAnalysis, Schaum Publisghing Company, New York.
3. N. Saran and S.N. Nigam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

01/03/2019

Scheme of Examination of B.A./B.Sc.
in the subject of Mathematics
(w.e.f. 2015-2016)

Semester 3rd

Paper Code	Title of Paper	Allocation of Periods	Maximum Marks						Credits
			External Marks		Internal Marks		Total Marks		
			B.A.	B.Sc.	B.A.	B.Sc.	B.A.	B.Sc.	
MAT 201 A	Advanced Calculus	6 periods/ 4½ hours per week	24	36	6	9	100	150	4½
MAT 201 B	Partial Differential Equations	6 periods/ 4½ hours per week	24	36	6	9			4½
MAT 201 C	Programming in C and Numerical Methods	6 periods/ 4½ hours per week	24	36	6	9			4½
MAP 201	Programming in C & Numerical Methods	2 hours per week per group	8	12	2	3			1

01/03/19

Semester 4th

Paper Code	Title of Paper	Allocation of Periods	Maximum Marks						Credits
			External Marks		Internal Marks		Total Marks		
			B.A.	B.Sc.	B.A.	B.Sc.	B.A.	B.Sc.	
MAT 202 A	Sequences and Series	6 periods/ 4½ hours per week	24	36	6	9	100	150	4½
MAT 202 B	Special Functions and Integral Transforms	6 periods/ 4½ hours per week	24	36	6	9			4½
MAT 202 C	Numerical Analysis	6 periods/ 4½ hours per week	24	36	6	9			4½
MAP 202	Methods of Numerical Analysis with C Language	2 hours per week per group	8	12	2	3			1

01/03/19

Semester 5th

Paper Code	Title of Paper	Allocation of Periods	Maximum Marks						Credits
			External Marks		Internal Marks		Total Marks		
			B.A.	B.Sc.	B.A.	B.Sc.	B.A.	B.Sc.	
MAT 301 A	Real Analysis	6 periods/ 4½ hours per week	27	40	7	10	100	150	4½
MAT 301 B	Groups and Rings	6 periods/ 4½ hours per week	27	40	7	10			4½
MAT 301 C	Statics	6 periods/ 4½ hours per week	26	40	6	10			4½

Semester 6th

Paper Code	Title of Paper	Allocation of Periods	Maximum Marks						Credits
			External Marks		Internal Marks		Total Marks		
			B.A.	B.Sc.	B.A.	B.Sc.	B.A.	B.Sc.	
MAT 302 A	Real and Complex Analysis	6 periods/ 4½ hours per week	27	40	7	10	100	150	4½
MAT 302 B	Linear Algebra	6 periods/ 4½ hours per week	27	40	7	10			4½
MAT 302 C	Dynamics	6 periods/ 4½ hours per week	26	40	6	10			4½

Note:-(i) The other conditions will remain the same as per relevant ordinance and rules and regulations of the University.

(ii) Each Practical group will be of 20 students.

01/03/2019

-12 2295
D-18

B.A./B.Sc. 2nd Year (3rd Semester)
Advanced Calculus (MAT 201A)

Max. Marks: B.A.-24
B.Sc.-36
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 7.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 4 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

Section – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Section – III

Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Section – IV

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Curvature in two dimensions. Locus of the centre of curvature. Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves.

Books Recommended:

1. C.E. Weatherburn: Differential Geometry of three dimensions, Radhe Publishing House, Calcutta.
2. Gabriel Klaumber: Mathematical analysis, Mrcel Dekkar, Inc., New York, 1975.
3. R.R. Goldberg: Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970.
4. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
5. S.C. Malik: Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan: A Course in Mathemtical Analysis, S.Chand and company, New Delhi.

01/03/2019

13 - 2293
D-18

B.A./B.Sc. 2nd Year (3rd Semester)
Partial Differential Equations (MAT 201B)

Max. Marks: B.A.-24
B.Sc.-36
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 7.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 4 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

Section – II

Linear partial differential equations of second and higher orders, Linear and non-linear homogeneous and non-homogeneous equations with constant co-efficients, Partial differential equation with variable co-efficients reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Equations reducible to linear equations with constant co-efficients.

Section – III

Classification of linear partial differential equations of second order, Hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order.

Section – IV

Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Books Recommended:

1. D.A.Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967
2. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
3. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.
4. Ian N.Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
5. J.N. Sharma & Kehar Singh : Partial Differential Equations.

01/03/2019

-14-

B.A./B.Sc. 2nd Year (3rd Semester)
Programming in C and Numerical Methods (MAT 201C)
Part-A (Theory)

Max. Marks: B.A.-24
B.Sc.-36
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 7.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 4 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**. The students are allowed to use **simple calculator**.

Section – I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions.

Section – II

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

Section – III

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions.

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods.

Section – IV

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition Method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Books Recommended:

1. B.W. Kernighan and D.M. Ritchie : The C Programming Language, 2nd Edition
2. V. Rajaraman : Programming in C, Prentice Hall of India, 1994
3. Byron S. Gottfried : Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1999.
4. M.K. Jain, S.R.K.Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
5. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
6. Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd.
7. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.
8. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.
9. Babu Ram: Numerical Methods, Pearson Publication.
10. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.

01/03/2019

B.A./B.Sc. 2nd Year (3rd Semester)
Part-B(Practical)
Programming in C & Numerical Methods (MAP 201)

Max. Marks

	External	Internal
B.A.	8	2
B.Sc.	12	3

Time: 2 Hours

There will be a separate practical paper which will consist of simple programs in C and implementation of Numerical Methods studied in the theory paper MAT 201C (Part-A).

List of Practicals:

1. Program to convert a decimal number to its binary equivalent.
2. Program to generate first n prime numbers.
3. Program to calculate compound interest.
4. Program for pattern matching of two strings.
5. Program to solve a quadratic equation.
6. Program to generate first n Fibonacci terms using recursion.
7. Program to find the GCD of two integers and use it to find the GCD of three integers using functions.
8. Program to find transpose of a Matrix.
9. Program to find roots of an equation by Bisection Method.
10. Program to find roots of an equation by Regula-Falsi Method.
11. Program to find roots of an equation by Newton-Raphson Method.

01/03/2019

B.A./B.Sc. 2nd Year (4th Semester)
Sequences and Series (MAT 202A)

Max. Marks: B.A.-24
B.Sc.-36
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 7.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 4 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weierstrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

Section – II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits.
Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

Section – III

Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

Section – IV

Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem. Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series (definitions and examples only). Convergence and absolute convergence of infinite products (definitions and examples only).

Books Recommended:

1. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
3. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
5. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York

01/03/2019

B.A./B.Sc. 2nd Year (4th Semester)
Special Functions and Integral Transforms (MAT 202B)

Max. Marks: B.A.-24
B.Sc.-36
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 7.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 4 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

Section – II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

Section – III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

Section – IV

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

Books Recommended:

1. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
2. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry.
4. W.W. Bell : Special Functions for Scientists & Engineers.
5. I.N. Sneddon: the use of integral transform, McGraw Hill, 1972.
6. Murray R. Spiegel: Laplace transform, Schaum's Series.

01/03/2019

B.A./B.Sc. 2nd Year (4th Semester)
Numerical Analysis (MAT 202C)
Part-A (Theory)

Max. Marks: B.A.-24
B.Sc.- 36
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 7.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 4 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**. The students are allowed to use **simple calculator**.

Section-I

Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite's Formula.

Section-II

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula.

Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution: Mean, Variance and Fitting.

Section-III

Numerical Differentiation: Derivative of a function using interpolation formulae as studied in Sections–I & II.

Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method, QR method, Lanczos method.

Section-IV

Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one-third and three-eight rule, Chebychev formula, Gauss Quadrature formula.

Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta methods. Multiple step methods, Predictor-corrector method, Modified Euler's method, Milne-Simpson's method.

Books Recommended:

1. Babu Ram: Numerical Methods, Pearson Publication.
2. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.
3. M.K. Jain, S.R.K.Iyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
4. M.K. Jain, S.R.K. Iyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
5. C.E. Froberg : Introduction to Numerical Analysis (2nd Edition).
6. Melvin J. Maaron : Numerical Analysis-A Practical Approach, Macmillan Publishing Co., Inc., New York.
7. R.Y. Rubnistein : Simulation and the Monte Carlo Methods, John Wiley, 1981.

01/03/2019

B.A./B.Sc. 2nd Year (4th Semester)
Part-B(Practical)
Methods of Numerical Analysis with C Language (MAP 202)

Max. Marks

	External	Internal
B.A.	8	2
B.Sc.	12	3

Time: 2 Hours

There will be a separate practical paper which will consist of implementation of numerical methods, studied in the theory paper MAT 202C (Part-A), in 'C' Programming Language.

List of Practicals:

1. Program for interpolation by Newton-Forward method.
2. Program for interpolation by Newton-Backward method.
3. Program for interpolation by Lagrange's method.
4. Program for Numerical integration by Trapezoidal Rule.
5. Program for Numerical integration by Simpson's 1/3 Rule.
6. Program for Numerical integration by Simpson's 3/8 Rule.
7. Program to execute Euler's method.
8. Program to execute Euler's modified method.
9. Program to execute Runge-Kutta method of fourth order.
10. Program to execute Milne Simpson method.

01/03/2019

B.A/B.Sc. 3rd Year (5th Semester)
Real Analysis (MAT 301A)

Max. Marks: B.A.-27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Riemann integral, Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Section – II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and integrability of an integral of a function of a parameter.

Section – III

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category theorem, contraction Principle.

Section – IV

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness , components, continuity in relation with connectedness.

Book s Recommended:

1. P.K. Jain and Khalil Ahmad: Metric Spaces, 2nd Ed., Narosa, 2004
2. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
3. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970
4. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
5. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi
6. E.T. Copson, Metric Spaces, Cambridge University Press, 1968.
7. G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw Hill, 1963.

01/03/2019

B.A./B.Sc. 3rd Year (5th Semester)
Groups and Rings (MAT 301B)

Max. Marks: B.A.-27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem and its consequences, Normal subgroups, Quotient groups.

Section – II

Homomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.

Section – III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

Section – IV

Euclidean rings. Principal ideal domains. Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion of irreducibility.

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal: Basic Abstract Algebra (2nd edition).
3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House.
5. J.B. Gallian: Abstract Algebra, Narosa Publishing House.

01/03/2019

B.A./B.Sc. 3rd Year (5th Semester)
Statics (MAT 302C)

Max. Marks: B.A.-26
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 6 marks) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Composition and resolution of forces. Parallel forces. Moments and Couples.

Section – II

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

Section – III

Virtual work. Forces in three dimensions. Poinsots central axis.

Section – IV

Wrenches. Null lines and planes. Stable and unstable equilibrium.

Books Recommended:

1. S.L. Loney: Statics, Macmillan Company, London.
2. R.S. Verma: A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.

01/12/2019

B.A./B.Sc. 3rd Year (6th Semester)
Real and Complex Analysis (MAT 302A)

Max. Marks: B.A.-27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

Section – II

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions, Half range series, Change of Intervals.

Section – III

Extended Complex Plane, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions.

Section – IV

Mappings by elementary functions: Translation, rotation, Magnification and Inversion. Conformal Mappings, Mobius transformations. Fixed points, Cross Ratio, Inverse Points.

Books Recommended:

1. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970.
3. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
4. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
5. R.V. Churchill & J.W. Brown: Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990
6. Shanti Narayan : Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

P Kumar 01/03/2019

B.A./B.Sc. 3rd Year (6th Semester)
Linear Algebra (MAT 302B)

Max. Marks: 27
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5.5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 5 and 6 marks for B.A. and B.Sc. respectively) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Section – II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vector spaces, Vector space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimensional vector spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem.

Section – III

Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

Section – IV

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations.

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal: Basic Abstract Algebra (2nd edition).
3. Vivek Sahai and Vikas Bist : Linear Algebra, Narosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Narosa Publishing House.
5. Gilbert: Linear Algebra.

01/03/2019

B.A./B.Sc. 3rd Year (6th Semester)
Dynamics (MAT 302C)

Max. Marks: B.A.-26
B.Sc.-40
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (*I-IV*) will contain two questions (each carrying 5 and 8.5 marks for B.A. and B.Sc. respectively) and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **four** short answer type questions (carrying total 6 marks) without any internal choice covering the entire syllabus and shall be **compulsory**.

Section – I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

Section – II

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.

Section – III

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.

Section – IV

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems.

Books Recommended:

1. S.L.Loney : An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956
2. F. Chorlton : Dynamics, CBS Publishers, New Delhi
3. A.S. Ramsey: Dynamics Part-1&2, CBS Publisher & Distributors.

01/03/2019