CURRICULUM
FOR
B.A./B.SC.(PROGRAM)
IN
MATHEMATICS

Under Choice Based Credit System

(CBCS)

Effective from the academic session 2016-2017

KAZI NAZRUL UNIVERSITY

ASANSOL-713 340

WEST BENGAL

Department of "Mathematics", Kazi Nazrul University, Asansol

Curriculum for B.A./B.Sc. Program in Mathematics [Choice Based Credit System]

Semester-I

Sr. No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			credit
				L	T	P	
1	Unit 1: Differential Calculus I Unit 2: Integral Calculus I & Ordinary Differential Equation I	Core Course-I		5	1	0	6
2	DSC 2A [other discipline]	Core Course-II					6
3	DSC 3A [other discipline]	Core Course-III					6
4	EVS	AECC		4			4
							Total Credit =22

Semester-II

Sr. No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			credit
				L	T	P	
1	Unit 1: Differential Calculus II Unit 2: Integral Calculus II & Ordinary Differential Equation II	Core Course-IV		5	1	0	6
2	DSC 2B [other discipline]	Core Course-V					6
3	DSC 3B [other discipline]	Core Course-VI					6
4	English/MIL	AECC					2
							Total Credit =20

Semester-III

Sr. No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			credit
				L	T	P	
1	Unit 1: Classical Algebra Unit 2: Abstract & Linear Algebra	Core Course-VII		5	1	0	6
2	DSC 2C [other discipline]	Core Course-VIII					6
3	DSC 3C [other discipline]	Core Course-IX					6
4	Skill enhancement Course	SEC-I					2
							Total Credit =20

Semester-IV

Sr. No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			credit
				L	T	P	
1	Geometry & Vector Analysis	Core Course X		5	1	0	6
2	DSC 2C [other discipline]	Core Course-XI					6
3	DSC 3D [other discipline]	Core Course-XII					6
4	Skill enhancement Course	SEC-2					2
							Total Credit =20

Semester-V

Sr. No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			credit
				L	T	P	
1	Skill enhancement Course	SEC-3					2
2	Discipline Specific Elective-1	DSE -1A					4/5
	Lab / Tutorial	DSE-1A					2/1
3	Discipline Specific Elective-2	DSE -2A					4/5
	Lab / Tutorial	DSE-2A					2/1
4	Discipline Specific Elective-3 (Theory)	DSE -3A					4/5
	Lab / Tutorial	DSE-3A					2/1
							Total Credit =20

Semester-VI

Sr. No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			credit
				L	T	P	
1	Skill enhancement Course	SEC-4					2
2	Discipline Specific Elective-4 (Theory)	DSE -1B					4/5
	Lab / Tutorial	DSE-1B					2/1
3	Discipline Specific Elective-5 (Theory)	DSE -2B					4/5
	Lab / Tutorial	DSE-2B					2/1
4	Discipline Specific Elective-6 (Theory)	DSE -3B					4/5
	Lab / Tutorial	DSE-3B					2/1
							Total Credit =20

Total Credit: 122

SEMESTER I

CORE COURSE-I

Unit-1: Differential Calculus-I, Unit-2: Integral Calculus I & Ordinary Differential Equation I

Total Marks: 50 (10 marks reserved for internal assessment) **Credit: 6**

Unit I: Differential Calculus I (20 Marks)

Rational and Irrational numbers, Linear continuum, Functions, limit of functions, Algebra of limits, Continuous functions, Properties of continuous functions, Monotone functions, Inverse function.

Derivative and its applications, Successive differentiation, Leibnitz's theorem, Rolle's theorem, Mean value theorem of Lagrange and of Cauchy with geometrical interpretations. Taylor's theorem and Maclaurin's theorem with remainder in Lagrange's and Cauchy's form and application of mean value theorem, Darboux's theorem. Series expansion of $\sin x, \cos x, \log(1+x), (1+x)^n, a^x$ with domain of convergence.

Determination of maxima and minima, Indeterminate forms.

Unit 2: Integral Calculus I & Ordinary Differential Equation I (30 Marks)

Definite integral as limit of a sum, its geometrical interpretation, Fundamental theorem of integral calculus, Reduction formula, Evaluation of definite integral viz: $\int_0^{\pi/2} sin^n x dx, \int_0^{\pi/2} cos^n x dx, \int_0^{\pi/2} sin^m x cos^n x dx,$ (m, n being positive integers).

First order and first degree ordinary differential equation: Existence and uniqueness theorem of solution, Exact differential equation, Integrating factor, First order linear differential equation, Equation reducible to linear form. Trajectories, orthogonal trajectories.

References:

1. B.C. Das and B.N.Mukherjee, *Differential Calculus*, U. N. Dhur and Sons Pvt.Ltd.
2. B.C. Das and B.N.Mukherjee, *Integral Calculus*, U. N. Dhur and Sons Pvt.Ltd.
3. *Calculus: Differentiation and Integration*, ICFAI University Press, Pearson.
4. Richard R.Goldberg, *Methods of Real Analysis*, Oxford and IBH, 2012.
5. Shanti Naryayn and P. K. Mittal, *Differential Calculus*, S Chand.
6. Daniel A.Murray, *Introductory Course in Differential Equations*, Orient Logman.
7. K.C.Maity and R.K.Ghosh, *Differential Calculus*, Books and Allied (P) Ltd.,.
8. K.C.Maity and R.K.Ghosh, *Integral Calculus*, Books and Allied (P) Ltd.
9. J.G.Chakraborty and P.R.Ghosh, *Differential Equation*, U. N. Dhur and Sons Pvt. Ltd.,
10. R.K.Ghosh and K.C.Maity, *An introduction to Differential Equation*, New Central Book Agency (P) Ltd.

SEMESTER II

CORE COURSE-IV

Unit-1: Differential Calculus-II, Unit-2: Integral Calculus II&Ordinary Differential Equation II

Total Marks: 50 (10 marks reserved for internal assessment) **Credit: 6**

Unit I: Differential Calculus II (20 Marks)

Sequence and its convergence, Cauchy's Criteria of convergence. Tests of convergence, Infinite series of constant terms, comparison test, D'Alembert's ratio test, Cauchy's root test, Raabe's test, Logarithmic test, Gauss' test. Alternating series, Leibnitz's test for alternating series (proofs are not required).

Functions of several variables, repeated and simultaneous limits, continuity, partial derivatives, total differentials, directional derivatives. Euler's theorem on homogeneous functions of two and three variables.

Rectilinear asymptotes, Envelopes, Curvature, Radius of curvature, tangent and normal, pedal equation of a curve.

Unit 2: Integral Calculus II & Ordinary Differential Equation II (30 Marks)

Idea of improper integrals and test of convergence of the following improper integrals (proofs are not required).

$$\int_0^1 \frac{dx}{x^\mu}, \int_a^\infty f(x)dx, \int_a^\infty \frac{f(x)dx}{(x-a)^\mu}$$

Beta and Gamma functions (only simple properties and examples). [12 hours lecture]

Quadratures, Rectification of curves, Volume and surface of solids of revolutions, Pappus theorem (statement only), Centre of gravity of simple bodies such as Rod; Rectangular Area, Rectangular Parallelepiped, Circular Arc, Circular Ring and Disc.

Equation of first order but not of first degree: Equations solvable for $p = \frac{dy}{dx}$, Equations solvable for x, Equations solvable for y, Clairaut's form of equation, singular solution, Equations reducible to Clairaut's form .

Higher order linear differential equations with constant coefficients: Both homogeneous and non-homogeneous forms.

Simultaneous differential equation of first order.

References:

1. B.C. Das and B.N.Mukherjee, *Differential Calculus*, U. N. Dhur and Sons Pvt.Ltd.
2. B.C. Das and B.N.Mukherjee, *Integral Calculus*, U. N. Dhur and Sons Pvt.Ltd.
3. *Calculus: Differentiation and Integration* , ICFAI University Press, Pearson.
4. Richard R.Goldberg, *Methods of Real Analysis*, Oxford and IBH , 2012.
5. Shanti Naryayn and P. K. Mittal, *Differential Calculus*, S Chand.
6. Shanti Naryayn and P. K. Mittal, *Integral Calculus*, S Chand.
7. Daniel A.Murray, *Introductory Course in Differential Equations*, Orient Logman.
8. K.C.Maity and R.K.Ghosh, *Differential Calculus*, Books and Allied (P) Ltd.
9. K.C.Maity and R.K.Ghosh, *Integral Calculus*, Books and Allied (P) Ltd..
10. S. N. Mukhopadhyay and A. Layek – *Mathematical Analysis – Vol-I* , U. N. Dhar & Sons Pvt. Ltd.
11. S. N. Mukhopadhyay and S. Mitra – *Mathematical Analysis – Vol-II*, (U. N. Dhar & Sons. Pvt. Ltd.
12. J.G.Chakraborty and P.R.Ghosh, *Differential Equation*, U. N. Dhur and Sons Pvt. Ltd.
13. R.K.Ghosh and K.C.Maity, *An introduction to Differential Equation*, New Central Book Agency (P) Ltd.

SEMESTER III

CORE COURSE-VII

Unit-1: Classical Algebra, Unit-2: Abstract and Linear Algebra

Total Marks: 50 (10 marks reserved for internal assessment) **Credit: 6**

Unit 1: Classical Algebra (20 Marks)

Polynomials, Division Algorithm, Fundamental Theorem of Classical algebra (proof not required) and its consequences, Descarte's rule of signs – its applications, Relation between roots and co-efficients, symmetric functions of roots, transformation of polynomial equations, Cardan's solution of cubic equation. Complex numbers, De-Moivre's theorem, exponential, logarithm, sine and cosine of complex numbers.

Unit 2: Abstract & Linear Algebra (30 Marks)

Mapping – injective, surjective and bijective. Composition of two mappings, Inverse mapping. Binary composition, groupoids, semigroups, monoids, groups – simple examples, properties like uniqueness of identity and inverse element, law of cancellation and solution of the equation $ax = b$ and $ya = b$. Commutative property, subgroups, permutation, even and odd permutation, group of permutation, divisor of zeros, Rings, Integral domain, fields.

Solution of non-homogeneous system of three linear equations by matrix inversion method. Elementary row and column operations, rank of a matrix, row reduced echelon form and fully reduced normal form.

Vector spaces over reals, simple examples, Euclidean 3-space E^3, linear dependence and independence of a finite set of vectors, sub-spaces, definition and examples.

References:

1. S. K. Mapa, *Higher Algebra (Abstract and Linear),* Sarat Book House.
2. Promode Kumar Saikia, *Linear Algebra With Applications*, Pearson.
3. Burnside and Panton, *The Theory of Equations*, Hodges Figgis And Company.
4. U. M. Swamy & A. V. S. N. Murthy, *Algebra: Abstract and Modern*, Pearson.
5. Ghosh & Chakravorty, *Higher Algebra (Classical & Modern),* U. N. Dhur & Sons Pvt. Ltd.

SEMESTER IV

CORE COURSE-X

Geometry & Vector Analysis

Total Marks: 50 (10 marks reserved for internal assessment) **Credit: 6**

Geometry (40 Marks) & Vector Analysis (10 Marks)

Geometry (2- Dimension) (Marks - 10)

Transformation of rectangular axes, Invariants, Pair of straight lines, General equation of second degree –reduction to standard forms and classification. Polar coordinates, polar equation of a straight line, circle and conic.

Geometry (3-Dimension) (Marks-30) Rectangular Cartesian coordinates. Transformation of axes.

Equations of a plane and a straight line, Shortest distance between two skew lines.

Sphere, Cone, Cylinder, Ellipsoid, Hyperboloid and Paraboloid referred to principal axes. Tangent planes and normals.

Vector Analysis (10 Marks)

Definition of vector, Resolution of vectors into components along three directions. Scalar and vector products of two and three vectors. Applications to geometry and mechanics**.**

Continuity and differentiability of vector-valued function of one variable. Velocity and acceleration. Vector-valued functions of two and three variables, Gradient of scalar function, Divergence, curl and their properties.

References:

1. Loney, *Co-ordinate Geometry*, Reem Publication Pvt. Ltd.
2. R. J. T. Bell, *An Elementary Treatise on Co-ordinate Geometry*, Macmillan & Co. Ltd.
3. N. Dutta & R. N. Jana, *Analytical Geometry and Vector Algebra*, Shreedhar Prakashani,
4. B. Spain, *Vector Analysis*, D.Van Nostrand Company Ltd.
5. L. Brand, *Vector Analysis*, Dover Publications Inc.
6. Shanti Narayan**,** *A Text Book of Vector Analysis*, 19th Edn, S.Chand publishing.
7. M. Spiegel, S.Lipschutz , D. Spellman, *Vector Analysis*, McGraw-Hill.

SEMESTER V

DSE-1A

(Choose any one from the following)

Marks distribution for each topic is as follows

Total Marks: 50 (10 marks reserved for internal assessment) **Credit: 6**

i) Mechanics

[**Prerequisite:** Basic concepts of Dynamics: Motion in a straight line with uniform acceleration, Vertical motion under gravity, Momentum of a body, Newton's laws of motion, Reaction on the lift when a body is carried on a lift moving with an acceleration, Work, Power and Energy, Impulse and Impulsive forces].

Rectilinear motion: Motion under repulsive force (i) proportional to distance (ii) inversely proportional to square of the distance, Motion under attractive force inversely proportional to square of the distance, Motion under gravitational acceleration.

Simple Harmonic Motion: Simple harmonic motion, Compounding of two simple harmonic motions of the same period, Elastic string and spiral string, Hook's law, Particle attached to a horizontal elastic string, Particle attached to a vertical elastic string, Forced vibrations, Damped harmonic oscillations, Damped forced oscillations.

Two dimensional motion: Angular velocity and angular acceleration, Relation between angular and linear velocity, Radial and transverse components of velocity and acceleration,

Velocity and acceleration components referred to rotating axes, Tangential and normal components of velocity and acceleration, Motion of a projectile under gravity (supposed constant).

Central orbits: Motion in a plane under central forces, Central orbit in polar and pedal forms, Rate of description of sectorial area, Different forms of velocity at a point in a central orbit, Apse, apse line, apsidal distance, apsidal angle, Law of force when the centre of force and the central orbit are known, Differential equation and classifications of paths under central accelerations, Stability of circular orbits, Conditions for stability of circular orbits under central force (general case).

Planetary motion: Newton's law of gravitation, Kepler's laws of planetary motion, Modification of Kepler's third law, Escape velocity, Time to describe a given arc of an orbit.

Motion in a resisting medium & Constrained motion: Motion of a heavy particle on a smooth curve in a vertical plane, Motion under gravity with resistance proportional to some integral power of velocity, Motion of a projectile in a resisting mediumTerminal velocity, Motion of a particle in a plane under different laws of resistance, Motion on a smooth cycloid in a vertical plane, Motion of a particle along a rough curve (circle, cycloid).

References

1. S. L. Loney, *An Elementary Treatise On the Dynamics of a Particle and a Rigid Body*, Cambridge University Press.
2. J. L. Synge and B. A. Griffith, *Principles of Mechanics*, McGraw-Hill.
3. A. S. Ramsey, *Dynamics (Part I & II)*, Cambridge University Press.
4. F. Chorlton, *A Text Book of Dynamics*, E. Horwood.
5. S. Ganguly and S. Saha, *Analytical Dynamics of a Particle*, New Central Book Agency (P) Ltd.
6. N. Dutta and R. N. Jana, *Dynamics of a Particle*, Shreedhar Prakashani, 4th Edition.
7. M.D. Raisinghania, *Dynamics*, S. Chand & Company Ltd.

ii) Probability & Statistics:

[**Prerequisite:** Concept of mathematical probility, addition and multiplication theorem of probability. Independent event, total probability, Bayes' theorem, Bernoulli trials, Binomial distribution].

Generalised addition and multiplication rule of probability continuity theory, Boole's inequality, Bonferroni's inequality; Poisson trials and Poisson law of probability, Multinomial law; Random variables, Discrete and continuous distribution functions: Poisson, Geometric, Negative Binomial, exponential, Hypergeometric, Uniforn, Normal, Gamma, Beta, Cauchy distributions,

Transformation of random variables; Discrete and continuous distribution in two dimension, Marginal distribution, Bivariate Uniform distribution, Bivariate Normal distribution, Transformation of two dimensional random variables, Conditional distribution, Mathematical expectation in one and two variables, Moments, Measures of skewness and kurtosis, Moment generating function, Characteristic function, Uniqueness of characteristic function (statement

only) Conditional expectation, covariance, co-relation coefficient, Regression curves, and -distribution, convergence in probability, convergence in law, Tchebycheff's inequality, Bernoulli's limit theorem, Law of large numbers, Concept of asymptotically normal distribution, De-Moivre-Laplace limit theorem, Central limit theorem in case of equal components.

Statistics: Method of least square, curve fitting (straight line, parabola and exponential curves).

Sampling theory, simple random sampling, sampling distribution of the statistic χ^2, t and F-distribution of the statistic.

Theory of estimation, point estimation, unbiasedness, minimum variance, consistency, efficiency, sufficiently, maximum likelihood method; Interval estimation –confidence interval, approximate confidence interval. Testing of hypothesis, Neyman-Pearson lemma, Likelihood ratio testing, application to Normal(m, σ)-population, Pearsonian χ^2 -test for goodness of fit. Theory of errors.

References:

1. S. Ross – *First Course in Probability*, Pearson Education.
2. W.Feller – An *Introduction to Probability* Theory and its Applications, Vol –I , Wiley.
3. W.Feller – An *Introduction to Probability* Theory and its Applications, Vol –II , Wiley.
4. R. V. Hogg, J. W.Mekenard and A.T. Craig, *Introduction to Mathematical Statistics*, Pearson Education.
5. A.Gupta, *Groundwork of Mathematical Probability & Statistics*, Academic publishers.
6. Banerjee, De & Sen, *Mathematical Probability*, U. N. Dhur & Sons Pvt. Ltd.

SEMESTER VI

DSE-1B

(Choose any one from the following)

Marks distribution for each topic is as follows

Total Marks: 50 (10 marks reserved for internal assessment) **Credit: 6**

i) Linear Programming Problems:

[Prerequisite: General introduction to optimization problem, Definition of L.P.P., Mathematical formulation of the problem, Canonical & Standard form of L.P.P., Basic solutions, feasible, basic feasible & optimal solutions].

Reduction of a feasible solution to basic feasible solution.

Hyperplanes, Convex sets and their properties, Convex functions, Extreme points, Convex feasible region, Convex polyhedron, Polytope, Supporting hyperplane, Separating hyperplane.

Fundamental theorem of L.P.P., Replacement of a basis vector, Improved basic feasible solutions, Unbounded solution, Condition of optimality, Simplex method, Simplex algorithm, Artificial variable technique (Big M method, Two phase method), Inversion of a matrix by Simplex method, Solution of simultaneous equations by Simplex method.

Duality in L.P.P.: Concept of duality, Fundamental properties of duality, Fundamental theorem of duality, Duality & Simplex method, Dual simplex method and algorithm.

Transportation Problem (T.P.): Mathematical formulation, Existence of feasible solution, Loops and their properties, Initial basic feasible solutions (different methods, like North West corner, Row minima, Column minima, Matrix minima & Vogel's Approximation method), Optimal solutions, Degeneracy in T.P., Unbalanced T.P., Special cases in T.P.

Assignment Problem (A.P.): Mathematical formulation, Solution methods of A.P., Hungerian method, Restrictions on assignments, maximization problem, unbalanced assignment problem, Traveling salesman (salesperson) problem.

Theory of Games: Introduction, Two person zero-sum games, Minimax and Maximin priciples, Minimax and Saddle point theorems, Pure and Mixed Strategies games without saddle points, Minimax (Maximin) criterion, Dominance rules, Solution methods of games without saddle point : Algebraic method, Graphical method and Linear Programming method, Symmetric game.

References:

1. G. Hadley, *Linear Programming*, Addison – Wesley.
2. R. Bronson and G. Naadimuthu, *Schaum's Outline of Operations Research,* Schaum's Outline.
3. A. K. Bhunia and L. Sahoo, *Advanced Operations Research, Asian Books Pvt. Ltd.*
4. J.G. Chakravorty and P.R. Ghosh, *Linear Programming and Game Theory*, Moulik Library.
5. J. K. Sharma, *Operations Research – Theory and Applications*, Macmillan.
6. H. A. Taha, *Operations Research – An Introduction,* Prentice-Hall
7.

ii) Numerical Methods & Computer Programming:

Numerical Methods (Marks: 30):

Approximate numbers, significant figures, rounding off numbers. Errors - absolute, relative and percentage. General formula for errors. Errors in arithmetic operations. Ordinary and divided differences. Propagation of error in difference table. Newton's forward and backward

interpolation formulae. Newton's divided difference formula. Lagrange interpolation formula. Errors in interpolation formulae. Problems related to interpolations. Numerical integration - Newton- Cotes' formula. Trapezoidal rule and Simpson's 1/3 rule - their inherent error and geometrical significance. Solution of system of linear equations - Gauss Elimination Method , Gauss - Seidel Method, condition of convergence (statement only).
Solution of first order o.d.e. - Picard's method and Euler's method. Solution for real roots of algebraic and transcendental equations - Regula Falsi Method , Fixed point iteration method and Newton - Raphson Method - their convergences (statement only).

Computer Programming (Marks: 20):

Functional units of a computer. Common Hardware components. Computer software. Concept of Computer Languages - Machine language and High level languages . Operating system. Compiler and Interpreter. Concept of Algorithm and Flowchart - their basic features and differences . Flowcharts of some common problems. Binary decimal, octal and hexadecimal number systems and their conversions. Programming Language C: C-Character set, Keywords, Basic data types, Numeric constants and variables operators, Expressions, Assignment statements, I/0 – Statements. Control Statements: Decision making and Looping statements in C, Break continue and goto statements, Example of simple programs. C programs of ---

1) Evaluation of finite series
2) Factorial of an integer
3) Fibonacci sequence
4) Testing of prime numbers
5) Largest and smallest of n given numbers
6) Arrangement of numbers in ascending/descending order
7) Roots of a quadratic equation with real coefficients
8) HCF and LCM of two positive integers

References:

1. F. B. Hildebrand, *Introduction to Numerical Analysis*, McGraw-Hill.
2. C. F. Gerald and P. O. Wheatley, *Applied Numerical Analysis,* Pearson.
3. J. B. Scarborough, *Numerical Mathematical Analysis*, Oxford and IBH Publishing.
4. B. Dasgupta, Applied *Mathematical Methods,* Pearson.
5. S. S. Sastry, *Introductory Methods of Numerical Analysis,* PHI.
6. A. Gupta and S. C. Bose , *Introduction to Numerical Analysis,* Academic Press
7. G. Hadley, *Linear Programming,* Addison.
8. J. K. Sharma, *Operations Research - Theory and Applications,* Macmilian.
9. J.G. Chakraborty & P. R. Ghosh, *Linear Programming and Game Theory,* Moulik Library.
10. E. Balagurusamy, *Programming in Ansi C,* Tata McGraw-Hill Education.

SKILL ENHANCEMENT COURSES

1. Mathematical study on local weather conditions. (Marks: 50, credit: 2)
(Marks distribution: written submission: 35, viva: 15)

Students are required to collect data from the local weather office. Then the collected data have to be analysed by means of charts, graphs and other statistical tools to make a report on the local weather conditions. The report has to be submitted at the time of examination.

2. Object oriented programming in C++. (Marks: 50, credit: 2)
(Marks distribution: Written submission: 35, viva: 15)

Programming paradigms, characteristics of objected programming languages, brief history of C^{++}, structure of C^{++} program, differences between C and C^{++}, basic C^{++} operators, comments, working with variables, enumeration, arrays and pointer.

Objects, classes, constructor and destructors, friend function, inline function, encapsulation, data abstraction, inheritance, polymorphism, dynamic binding, operator overloading, method overloading, overloading arithmetic operator and comparison operators.

Template class in C^{++}, copy constructor, subscript and function call operator, concept of namespace and exception handling.

References:

1. A. R. Venugopal, Rajkumar and T. Ravishanker, Mastering C^{++}, TMH.
2. S.B. Lippman and J. Lajoie, C^{++} Primer, Addison Wesley.
3. D. Parasons, Object Oriented Programming with C^{++}, BPB pub.
4. E. Balaguruswami, Object Oriented Programming in C^{++}, Tata McGraHill.

3. Mathematical study on environmental pollutions. (Marks: 50, credit: 2)
(Marks distribution: written submission: 35, viva: 15).

Students are required to collect data either by himself/herself or from the local bodies. Then the collected data have to be analysed by means of charts, graphs and other statistical tools to make a report on the local environmental pollution. The report has to be submitted at the time of examination.

4. Use of Latex. (Marks: 50, credit: 2)
(Marks distribution: Written submission: 35, viva: 15)

Introduction: TEX, LATEX, Software installation, Latex compilation

Text, Symbols and Commands: Command names and arguments, Environments, Declarations, Lengths, Special characters, Character set and Fonts, Type size, Sectioning and Paragraphs

Document Layout and Organization: Document classes (article, report, book, letter, beamer, slides), Page style options, Parts of the document, Table of contents

Packages: Geometry, Hyperref, amsmath, amssymb, algorithms

Displayed Text: Changing font, Centering and indenting, Lists, Theorem like declarations, Tabular stops, Arrays, Boxes, Tables, Footnotes and marginal notes, Page numbering, Comments within text

Mathematical Formulas: Mathematical environments, Mathematical symbols, Single equations, Blocks of mathematical formula, Multiline equation, Mutiple equations, Spacing in Math mode, Theorem, Lemmas, Fine-tuning mathematics

Graphics Inclusion and color: The graphics packages, Adding color

User Customizations: Counters, Lengths, User defined commands and environments

Document management: Processing parts of a document, In-text references, Bibliographies, Indexing, Fancy headers, Keyword index

Application to: Trigonometric formulas, Statistical data chart, Mathematical formulas, writing articles/research papers etc.

References:

5. Leslie Lamport, *LATEX: A document preparation system*, Addison-Wesley Publishing Company, 1986.
6. Donald Knuth, *The TEXbook*, Addison-Wesley Publishing Company, 1984.
7. Helmut Kopka and Patrick W. Daly, *A Guide to LATEX and Electronic Publishing*, Wesley Publishing Company, 2004.