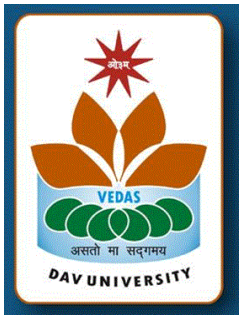
DAV UNIVERSITY JALANDHAR



Course Scheme & Syllabus

For

B.Sc. (Hons.) Mathematics
(Program ID-29)

1st TO 6th SEMESTER

Examinations 2013–2014 Session Onwards

Syllabi Applicable For Admissions in 2013

Scheme of B.Sc. (Hons.)

B.Sc. (Hons.) Mathematics

Semester 1

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH101	CALCULUS-I	4	1	0	4	25	25	25	25	100
2	MTH102	ALGEBRA	4	1	0	4	25	25	25	25	100
3	MTH103	ANALYSIS-I	4	1	0	4	25	25	25	25	100
4	PHY153	OPTICS & LASERS	4	0	0	4	25	25	25	25	100
5	PHY154	OPTICS LAB	0	0	3	2	-	-	-	-	50
6	EVS102	ENVIRONMENT EDUCATION	3	0	0	2	25	25	25	25	50
7	SGS102	GENERAL KNOWLEDGE & CURRENT AFFAIRS	2	0	0	2	25	25	25	25	50
8	ENG151	BASIC COMMUNICATION SKILLS	4	0	0	3	25	25	25	25	75
9	ENG152	BASIC COMMUNICATION SKILLS LABORATORY	0	0	2	1	-	-	-	-	25
			25	**3**	**5**	**26**					**650**

A: Continuous Assessment: Based on Objective Type & Subjective Type Test
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of B.Sc. (Hons.)

B.Sc. (Hons.) Mathematics

Semester 2

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH104	COORDINATE GEOMETERY	4	1	0	4	25	25	25	25	100
2	MTH105	CALCULUS-II	4	1	0	4	25	25	25	25	100
3	MTH106	ANALYSIS-II	4	1	0	4	25	25	25	25	100
4	PHY155	MODERN PHYSICS	4	0	0	4	25	25	25	25	100
5	PHY156	MODERN PHYSICS LAB	0	0	3	2	-	-	-	-	50
6	CHE155	SPECTROSCOPY	4	0	0	4	25	25	25	25	100
7	CHE156	CHEMISTRY LAB	0	0	3	2	-	-	-	-	50
8	SGS101	HUMAN VALUES & ETHICS	2	0	0	2	25	25	25	25	50
9	EVS103	ROAD SAFETY AND LEGAL AWARENESS	2	0	0	2	25	25	25	25	50
			24	**3**	**6**	**28**					**700**

A: Continuous Assessment: Based on Objective Type & Subjective Type Test
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of B.Sc. (Hons.)

B.Sc. (Hons.) Mathematics

Semester 3

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH201	ORDINARY DIFFERENTIAL EQUATIONS	4	1	0	4	25	25	25	25	100
2	MTH202	ABSTRACT ALGEBRA	4	1	0	4	25	25	25	25	100
3	MTH203	VECTOR CALCULUS	4	1	0	4	25	25	25	25	100
4	PHY253	ELECTRICITY MAGNETISM AND ELECTRONICS	4	0	0	4	25	25	25	25	100
5	PHY254	EM AND ELECTRONICS LAB	0	0	3	2	-	-	-	-	50
6	CHE253	INORGANIC CHEMISTRY	4	0	0	4	25	25	25	25	100
7	CHE254	INORGANIC CHEMISTRY LAB	0	0	3	2	-	-	-	-	50
8	CSA251	PRINCIPLES OF COMPUTER SCIENCE	4	0	0	4	25	25	25	25	100
			24	**3**	**6**	**28**					**700**

A: Continuous Assessment: Based on Objective Type & Subjective Type Test
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of B.Sc. (Hons.)

B.Sc. (Hons.) Mathematics

Semester 4

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH204	PARTIAL DIFFERENTIAL EQUATIONS	4	1	0	4	25	25	25	25	100
2	MTH205	LINEAR ALGEBRA	4	1	0	4	25	25	25	25	100
3	MTH206	NUMBER THEORY	4	1	0	4	25	25	25	25	100
4	MTH207	PROBABILITY AND STATISTICS	4	1	0	4	25	25	25	25	100
5	ENG180	ENGLISH	4	0	0	4	25	25	25	25	100
6	CSA255	PROGRAMMING IN C	4	0	0	3	25	25	25	25	75
7	CSA256	PROGRAMMING IN C, LABORATORY	0	0	2	1	-	-	-	-	25
8	SGS 104	STENOGRAPHY	3	0	0	0					0
9	SGS 105	STENOGRAPHY LAB	0	0	1	0					0
			27	**4**	**3**	**24**					**600**

A: Continuous Assessment: Based on Objective Type & Subjective Type Test
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of B.Sc. (Hons.)

B.Sc. (Hons.) Mathematics

Semester 5

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH301	MECHANICS	4	1	0	4	25	25	25	25	100
2	MTH302	ANALYTICAL SOLID GEOMETRY	4	1	0	4	25	25	25	25	100
3	MTH303	PROBABILISTIC METHODS	4	1	0	4	25	25	25	25	100
4	CHE353	PHYSICAL CHEMISTRY	4	0	0	4	25	25	25	25	100
5	CHE354	PHYSICAL CHEMISTRY LAB	0	0	3	2	-	-	-	-	50
6	PHY353	MECHANICS & WAVES	4	0	0	4	25	25	25	25	100
7	PHY354	MECHANICS & WAVES LAB	0	0	3	2	-	-	-	-	50
8	MTH304	COMPUTATIONAL LAB	0	0	4	2	-	-	-	-	50
			20	**3**	**10**	**26**					**650**

A: Continuous Assessment: Based on Objective Type & Subjective Type Test
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of B.Sc. (Hons.)

B.Sc. (Hons.) Mathematics

Semester 6

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH305	LINEAR PROGRAMMING AND OPTIMIZATION	4	1	0	4	25	25	25	25	100
2	MTH306	NUMERICAL METHODS	4	0	0	3	25	25	25	25	75
3	MTH307	NUMERICAL METHODS WITH C/C++	0	0	2	1	-	-	-	-	25
4	MTH308	DISCRETE MATHEMATICS	4	1	0	4	25	25	25	25	100
5	MTH309	SPECIAL FUNCTIONS AND INTEGRAL TRANSFORMS	4	1	0	4	25	25	25	25	100
6	MTH310	MAT LAB	0	0	4	2	-	-	-	-	50
7	CHE153	ORGANIC CHEMISTRY	4	0	0	4	25	25	25	25	100
8	CHE154	CHEMISTRY LAB-IV	0	0	3	2	-	-	-	-	50
			20	**3**	**9**	**24**					**600**

A: Continuous Assessment: Based on Objective Type & Subjective Type Test
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Instruction for candidates (Theory Paper)

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

* Wherever specific instructions are required these are given at the starting of that particular subject/paper

Instruction for candidates (Practical Paper)

- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test**.**

Course Title: Calculus-I
Paper Code: MTH 101

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
Calculus is one of the major branches of mathematics that finds application in almost all the Fields of science. This course is an introduction to calculus. Students will be introduced to the concepts of limits, derivatives, integrals and infinite series.

UNIT-A **14 HOURS**
Differential Calculus: Limit (ε-δ definition), Continuity, Discontinuity, properties of continuous functions. Differentiability, Successive differentiation and Leibnitz theorem. Chain rule of differentiation, Mean value theorems, Taylor's and Maclaurin theorems.

UNIT-B **15 HOURS**
Asymptotes in Cartesian coordinates, Intersection of curves, Asymptotes in Cartesian and Polar coordinates. Test for concavity and convexity, Points of Inflexion, Multiple points, Cusps, nodes & conjugate points. Curve sketching in Cartesian and Polar coordinates.

UNIT-C **13 HOURS**
Integral Calculus: Integration of functions. Riemann sum and definite integrals. Properties, Area and the Mean value theorem, the fundamental theorem of Integral calculus.

UNIT-D **14 HOURS**
Applications of definite integrals to find: Lengths of plane curves, Areas between curves, Areas of surfaces of revolution, Finding volumes by slicing, Volumes of solids of Revolution-Disks and Washers, Cylindrical Shells.

Reference Books:

Thomas, George B., and Finney, Ross L. *Calculus and Analytic Geometry* (9th Edition). Delhi: Addison Wesley, 2002.
2. Apostol, T. M., *Calculus-I* (2nd Edition). Delhi: Wiley, 1969

Course Title: Algebra
Course Code: MTH-102

L	T	P	Credits	Marks
4	1	0	4	100

Objectives:

This paper emphasizes on Matrix and Trigonometry algebra. It includes the topics like Matrices, hyperbolic trigonometric functions and polynomials. Last section is devoted to the study of polynomials and nature of roots of polynomials.

Unit –A **15 HOURS**

De-Moivre's Theorem and Its Applications: Directed complex numbers, geometrical representation of addition and subtraction of directed complex numbers, De Moivre's theorem and its applications, expansion of trigonometric functions. Direct and inverse circular and hyperbolic functions. Logarithm of a complex quantity. Gregory's series. Summation of series. Infinite products.

Unit –B **13 HOURS**

Mappings. Equivalence relations and partitions. Congruence modulo.

Matrices: Algebra of Matrices, symmetric, skews symmetric, Orthogonal, Hermitian skew Hermitian and Unitary matrices. Elementary operations on matrices, Inverse of a matrix, Guass Jordan Method, Linear Independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of row and column ranks.

Unit –C **15 HOURS**

Eigen values, Eigen vectors and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix. Diagonalization of a matrix, Quadratic forms and Canonical Forms of Matrices, Application of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations.

Unit –D **15 HOURS**

Roots of Polynomials: Polynomials, Euclid's Algorithm, Synthetic division, Greatest common divisor, unique factorization of polynomials over a field F of numbers (statement only), Fundamental theorem of Algebra (statement only). Reducible and Irreducible polynomials. Relationship between roots and the coefficients, Fundamental theorem of symmetric polynomials (without proof), Evaluation of symmetric functions of roots. Roots of polynomials with integral coefficients. Descartes rule of sign, Strum's theorem (Statement only), Complex roots. Relations between the roots and coefficients of general polynomial equation in one variable, Transformation of equation, Solution of cubic and bi-quadratic equations. Cardan's method of a cubic. Discriminant and nature of roots of a real cubic. Trigonometric solutions of a real cubic with real root. Descarte's and Ferrari's method for solving bi-quadratic equations.

Reference Books:

1. Herstein, I. N, *Topics in Algebra* (2nd edition). Delhi: Wiley, 1975.
2. Barbeau, E.J., *Polynomials.* Germany: Springer Verlag, 2003.
3. Bhattacharya, P. B., Jain, S. K., and Nagpaul S.R., *First Course in Linear Algebra*. Delhi: Wiley Eastern, 1983
4. Jain, R. K., and Iyengar, S.R.K., *Advanced Engineering Mathematics* (2nd edition). Delhi: Narosa Publishing House, 2003.
5. Dickson, Leonard E., *First Course in The Theory of Equations*. New York: John Wiley & Sons, 1922

Course Title: Analysis-I
Paper Code: MTH 103

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: The aim of this course is to make the students learn fundamental concepts of real analysis.

UNIT-A **14 HOURS**

Real number system: Intuitive idea of numbers. Mathematical operations revisited with their properties.

Field Axioms: Concept of ordered field. Bounded set, L.U.B. (supremum) and G.L.B.(infimum) of a set. Properties of L.U.B. and G.L.B. Least upper bound axiom or completeness axiom. Characterization of IR as a complete ordered field. Definition of an Archimedean ordered field. Archimedean property of IR. Q is Archimedean ordered field but not ordered complete.

UNIT-B **14 HOURS**

Sets in IR: Intervals. Neighbourhood of a point. Interior point. Open set. Union, Intersection of open sets. Every open set can be expressed as disjoint union of open intervals.
Limit point and isolated point of a set. Criteria for L.U.B. and G.L.B. of a bounded set to be limit point of the set. Bolzano-Weierstrass theorem on limit point. Definition of derived set. Derived set of a bounded set is contained in the closed interval [inf A, sup A]. Closed set. Complement of open set and closed set. Union and intersection of closed sets as a consequence. No nonempty proper subset of IR is both open & closed.
Dense set in IR as a set having non-empty intersection with every open interval. Q and IR - Q are dense in IR.

UNIT-C **15 HOURS**

Sequences of real numbers: Definition of a sequence as function from IN to IR. Bounded sequence. Convergence (formalization of the concept of limit as an operation in IR) and non-convergence. Examples. Every convergent sequence is bounded and limit is unique. Algebra of limits.
Relation between the limit point of a set and the limit of a convergent sequence of distinct elements. Monotone sequence and their convergence. Sandwich rule. Nested Interval Theorem. Limit of some important sequences. Cauchy's First and Second Limit theorems. Subsequence. Sub sequential limits. Lim sup upper (limit) and liminf (lower limit) of a sequence using inequalities. Every sequence has a bounded subsequence. Bolzano-Weierstrass theorem. Cauchy's general principle of convergence.

UNIT-D **13 HOURS**

Definition of infinite series, sequence of partial sums, convergence of infinite series, Cauchy criterion, absolute and conditional convergence, convergence via boundedness of sequence of partial sums.

Tests of convergence: Comparison test, Limit comparison test, Ratio test, Cauchy's nth root test. Integral test.Alternating series. Leibnitz test.

Reference Books:

1. Bartle, R. G., and Sherbert, D. R., *Introduction to Real Analysis* (Third Edition). Delhi: Wiley India Pvt. Ltd., 2002.
2. Apostol, T.M., *Mathematical Analysis.* Delhi: Norosa Publishing House, 1985.
3. Goldberg, R.R., *Real Analysis*. New Delhi: Oxford & IBH Publishing Co., 1970.
4. Lang, S., *Undergraduate Analysis*. New York: Springer-Verlag, 1983.
5. Rudin, Walter, *Principles of Mathematical Analysis* (3rd Edition). New Delhi: McGraw-Hill Inc., 1976.
6. Narayan, Shanti, *A Course of Mathematical Analysis.* New Delhi: S. Chand & Co., 2005.
7. Ross, K. A., *Elementary Analysis: The Theory of Calculus* (Undergraduate Texts in Mathematics). London: Springer (SIE), Indian reprint, 2004.

Course Title: Coordinate Geometry
Course Code: MTH- 104

L	T	P	Credits	Marks
4	1	0	4	100

Objectives:
Geometry is one of the fundamental areas of Mathematics. The course is designed to lay a strong foundation of two dimensional and three dimensional coordinate Geometry.

Unit –A **14 HOURS**
Conic Sections. General equation of second degree, Pair of lines, Parabola, Tangent, normal. Equation of parabola in standard and parametric form, Pole and polar and their properties.

Unit –B **14 HOURS**
Equation of Ellipse and Hyperbola in standard and parametric forms, Tangent, normal, pole and polar. Conjugate diameters, Asymptotes, Conjugate hyperbola and rectangular hyperbola.

UNIT-C **14 HOURS**
Polar equation of a conic, polar equation of tangent, normal, polar and asymptotes, General equation of second degree, Tracing of parabola, Ellipse and hyperbola.

UNIT-D **14 HOURS**
Equation of sphere, Tangent plane, Plane of contact and polar plane, Intersection of two spheres, radical plane, Coaxial spheres, Conjugate systems.

Reference Books:

1. Loney, S. L., *The elements of coordinate geometry*. New Delhi: Surjeet Publications, 2004.
2. Jain, P.K., and Ahmed, Khalil, *A text book of Analytical Geometry of three dimensions*. Delhi: Wiley Eastern Ltd, 1999.
3. Narayan, Shanti and Mittal, P.K., *Analytical Solid Geometry* (17th Edition), New Delhi: S. Chand and Co., 2006

Course Title: Calculus-II
Paper Code: MTH 105

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
This course is in continuation of Calculus-I course. Here some advanced topics of calculus are included. This will help the students to understand the use of higher Calculus in various physical problems.

UNIT-A **15 HOURS**
Functions of Two Variables: Explicit and Implicit functions. Limit, Continuity, Differentiability. Partial differentiation, Function of functions, Change of variables, Euler's theorem on homogeneous functions, Taylor's theorem for function of two variables, Jacobians.

UNIT-B **13 HOURS**
Function of several variables, Envelops, Evolutes, Maxima, minima and saddle points of function of two variables. Lagrange's Multiplier method, Indeterminate forms.

UNIT-C **14 HOURS**
Power series, Exponential functions, Logarithmic functions, Trigonometric functions, Functional equations, Functions of bounded variations and Vector valued functions.

UNIT-D **15 HOURS**
Inverse function theorem. Implicit function theorem. Chain rule and its matrix form. Mean value theorem for differentiable functions, sufficient condition for differentiability and sufficient condition for the equality of mixed partial derivatives, higher order derivatives, Taylor Theorem for function of n-variables.

Reference Books:

1. Thomas, George B., and Finney, Ross L, *Calculus and Analytic Geometry* (9th Edition). Delhi: Addison Wesley, 1998.
2. Mallik, S. C., *Mathematical Analysis* (2nd edition). New Delhi: Wiley Eastern Ltd, 1992.
3. Klaumber, Gabriel, *Mathematical Analysis*. New York: Marcel Dekkar, 1975.
4. Kreyszig, Erwin, *Advanced Engineering Mathematics*. New Delhi: John Wiley & Sons, 1999.
5. Jain, R. K., and Iyengar, S.R.K. *Advanced Engineering Mathematics* (2nd edition). New Delhi: Narosa Publishing House, 2003.
6. Apostol, T. M., *Calculus-II* (2nd edition). New Delhi: Wiley, 1969.

Course Title: Analysis-II
Paper Code: MTH 106

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: The aim of this course is to make the students learn about the metric spaces, series of real terms and relationship between continuous functions, compactness and connectedness of metric spaces.

UNIT-A **15 HOURS**

Limits of functions, sequential criterion for limits, divergence criteria, review of limit theorems and one-sided limits, continuous functions, sequential criterion for continuity, discontinuity criterion, Dirichlet's nowhere continuous function (illustrations), combinations of continuous functions and compositions of continuous functions, continuous functions on intervals.

Boundedness theorem, the maximum-minimum theorem, location of roots theorem, Bolzano's intermediate value theorem, intermediate value property, preservation of interval property.

UNIT-B **14 HOURS**

Uniform continuity, uniform continuity theorem, differentiation, derivative, combinations of differentiable functions, Caratheodory theorem, chain rule, derivative of inverse functions, interior extremum theorem, intermediate value property for derivatives (Darboux's theorem), review of Rolle's theorem, mean value theorem, Cauchy's mean value theorem.

UNIT-C **14 HOURS**

Taylor's theorem with Lagrange and Cauchy form of remainders, binomial series theorem, Taylor series, Maclaurin series, expansions of exponential, logarithmic and trigonometric functions, convex functions, applications of mean value theorems and Taylor's theorem to monotone functions. Power series, radius of convergence, interval of convergence.

UNIT-D **13 HOURS**

The Riemann Integral: The Riemann Integral, Riemann Integrable functions, Integrability of continuous and monotonic functions. The Fundamental Theorem of Integral Calculus, Mean Value Theorem of Integral Calculus. Approximation Integration.

Reference books:

1. Bartle, R. G., and Sherbert, D. R., *Introduction to Real Analysis* (3rd edition). Delhi: Wiley India Pvt. Ltd., 2002.
2. Apostol, T.M., *Mathematical Analysis.* New Delhi: Narosa Publishing House, 1985.
3. Goldberg, R.R., *Real Analysis*. New Delhi: Oxford & IBH Publishing Co.,1970.
4. Lang, S., *Undergraduate Analysis*. New York : Springer-Verlag, 1983.
5. Rudin, Walter, *Principles of Mathematical Analysis* (3rd Edition). New Delhi: McGraw-Hill Inc., 1976.
6. Narayan, Shanti, *A Course of Mathematical Analysis.* New Delhi: S. Chand & Co., 1968.
7. Ross, K. A., *Elementary Analysis: The Theory of Calculus* (Undergraduate Texts in Mathematics). Springer (SIE), 2004.

Course Title: Ordinary Differential Equations
Paper Code: MTH 201

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives:
The objective of this course is to equip the students with knowledge of some advanced concepts related to differential equations and to understand some basic approach to mathematical oriented differential equations.

UNIT A **16 HOURS**
Formation of differential Equations, Solutions of differential equations, Solvable forms of differential equations of first order: Equations with separable variables, exact differential equations, Integrating factors, Linear equation of first order, simultaneous equations. Applications of first order differential equations.

UNIT B **14 HOURS**
Integral curves, Trajectories: Integrals of a differential equation, The direction field of a differential system, The isoclines of a direction field, Traj ectories, Singular points of a direction fields, Some elementary cases of the differential equation, The integral curves as trajectories.

UNIT C **13 HOURS**
Series solutions of differential equations-Power series methods, Bessel, Legendre and Hypergeometric equations, Bessel, Legendre and Hypergeometric functions and their properties-convergence, recurrence and generating relations. Orthognality of functions, Sturm-Lioville problem. Orthogonality of eigen-functions. Reality of eigenvalues. Orthognality of Bessel functions and Legendre polynomials.

UNIT D **14 HOURS**
Laplace Transform- Linearity of the Laplace transformation. Existence theorem for Laplace transform, Laplace transforms of derivatives and integrals. Shifting theorems. Differentiation and integration of transform. Convolution theorem, Solution of integral equations and systems of differential equations using the Laplace transformation.

Reference Books:

1. Langer, Rudolph E., *A First Course in Ordinary Differential Equations*. New Delhi: John Wiley & Sons, 1954.
2. Ross, S.L., *Differential* Equations (3rd edition). Delhi: Wiley, 2012.
3. Siddiqi, A.H., and Manchanda P., *A First Course in Differential Equation with Applications*. New Delhi: Macmillan India Ltd., 2006.
4. Codington, E.A., *An Introduction to Ordinary Differential Equation*. New York: Dover Publications, 1989.
5. Simmons, G.F., *Differential Equation with Application and Historical Notes* (2nd edition). New Delhi: Tata Mcgraw Hill, 2003.
6. Braun, M., *Differential Equations and their Applications* (4th edition). New York: Springer Verlag, 1993.
7. Jain, R. K., and Iyengar, S.R.K, *Advanced Engineering Mathematics* (2nd Edition). New Delhi: Narosa Publishing House, 2003.

Course Title: Abstract Algebra
Paper Code: MTH 202

L	T	P	Credits	Marks
4	1	0	4	100

Objective:

This is a basic course in Group Theory, Ring Theory and Field, which are an integral part of Algebra. These have applications in almost all major branches of science.

UNIT-A **15 HOURS**

Group Theory: Symmetries of plane figures, The Dihedral Group, Definitions, examples and properties of groups, Order of an element, Cyclic groups, connection with primitive roots, Subgroups, Cosets. Lagrange's Theorem, Subgroups of a cyclic group, Subgroup generated by a subset, Conjugacy, Normal subgroups, Quotient groups, Homomorphisms, and isomorphism theorems.

UNIT-B **13 HOURS**

Group-Automorphism and inner automorphism, Automorphism groups and their computations. Conjugacy relation. Normalizer and centre, Counting principle and the class equation of a finite group

UNIT-C **14 HOURS**

Center of group of prime order. Abelianizing a group and its universal property. Group actions, stabilizers and orbits. Finite groups, Commutator subgroups.

UNIT-D **15 HOURS**

Ring theory-Rings, Ideal and quotient Rings. Ring Homomorphism and basic isomorphism theorems. Prime and maximal ideals. Fields of quotients of an integral domain. Principal ideal domains. Euclidean rings, Division algorithm.

Reference Books:

1. Herstein, I.N., *Topics in Algebra* (2^{nd} edition). New Delhi: Vikas Publishing House, 1976.
2. Bhatacharya, P.B., Jain, S.K, and Nagpaul, S.R., *Basic Abstract Algebra* (2^{nd} edition). New Delhi: Cambridge University Press (Indian Edition), 1977.
3. Gallian, Joseph A., *Contemporary Abstract Algebra* (4^{th} edition). New Delhi: Narosa Publishing House, 1998.
4. Singh, Surjeet, and Zameeruddin, Quzi, *Modern Algebra* (7^{th} edition). New Delhi: Vikas Publishing House, 1993.

Course Title: Vector Calculus
Paper Code: MTH 203

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
The aim of this course is to make the students acquire facility and confidence in the use of vectors and vector calculus so that they may employ the same in an effective manner.

UNIT-A **13 HOURS**

Vector Algebra: Vectors in the plane. Operations with vectors. Cartesian Co-ordinates and vectors in spaces. Scalar and vector product of three vectors. Product of four vectors. Reciprocal vectors. Lines and planes in space, Cylinders and Quadric surfaces. Cylindrical and Spherical co-ordinates.

UNIT-B **13 HOURS**

Vector Calculus: Scalar-valued functions over the plane and the space. Vector function of a scalar variable: Curves and Paths. Vector fields.

UNIT-C **15 HOURS**

Vector differentiation: Differentiation of vectors**, Directional** derivatives, the tangent plane, total differential, Del, Gradient, Divergence and Curl, their physical interpretations. Formulae involving Del applied to point functions and their products.

UNIT-D **16 HOURS**

Vector integration: Path, line, surface, and volume integrals. Line integrals of linear differential forms, integration of total differentials, conservative fields, conditions for line integrals to depend only on the endpoints, the fundamental theorem on exact differentials. Theorems of Green, Gauss, Stokes, and problems based on these.

Reference Books:

1. Davis, H. F., and Snider, A. D., *Introduction to Vector Analysis* (6th edition). New Delhi: McGraw-Hill Inc., 1991.
2. Narayan, S., and Mittal, P. K., *A Text Book of Vector Analysis* (5th edition). New Delhi: S. Chand & Co. Ltd., 2013.
3. Spiegal, Murray R., *Vector Analysis*, New Delhi: Schaum Publishing Company, 1959.
4. Saran N., and Nigam, S.N., *Introduction to Vector Analysis*. Allahabad: Pothishala Pvt. Ltd.

Course Title: Partial Differential Equations
Paper Code: MTH 204

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective

The objective of this course is to equip the students with knowledge of some advanced concepts related to partial differential equations and to understand some basic approach to mathematical oriented PDEs.

UNIT A **15 HOURS**

Partial differential equations of the first order: Partial differential equations, solution of Partial differential equations in three variables. Partial differential equations of the first order. Cauchy's Problem for first order equations, Linear Partial differential equations of the first order, Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces.

UNIT B **14 HOURS**

Partial differential equations of the first order: Nonlinear Partial differential equations of the first order, compatible system of first order equations, Charpit method, Jacobi Method, Cauchy's method of characteristics.

UNIT C **13 HOURS**

Partial differential equations of second and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients.

UNIT D **13 HOURS**

Dirichlet and Neumann boundary conditions. Laplace, Diffusion and Wave equations and their solutions in Cartesian, Spherical polar and cylindrical polar coordinates by Separation of Variables.

Reference Books:

1. Evans, L. C, *Partial Differential Equations* (Graduate Studies in Mathematics). New York: American Mathematical Society, (1998).
2. McOwen, Robert C., *Partial Differential Equations methods and applications* (2nd edition), Noida: Pearson Education Inc., 2003.
3. Weinbergerger H.F., *A first course in Partial Differential Equations with complex variables and transform methods.* New York: Dover Publications Inc., 1995.

Course Title: Linear Algebra
Paper Code: MTH 205

L	T	P	Credits	Marks
4	1	0	4	100

Objective:

The concepts and techniques from linear algebra are of fundamental importance in many scientific disciplines. The main objective is to introduce basic notions in linear algebra that are often used in mathematics and other sciences. The emphasis will be to combine the abstract concepts with examples in order to intensify the understanding of the subject.

UNIT-A **13 HOURS**
Systems of linear equations, matrices, rank, Gaussian elimination. Determinants and their properties, Cramer's Rule.

UNIT-B **13 HOURS**
Vector spaces, subspaces, linear spans, linear dependence and independence, bases and dimension. The null space and the column space of a matrix and their dimension.

UNIT-C **14 HOURS**
Linear transformations, representation of linear transformations by matrices, change of basis, rank-nullity theorem, Applications to difference equations and Markov chains.

UNIT-D **15 HOURS**
Eigen values and eigenvectors, characteristic polynomials, minimal polynomials, Cayley-Hamilton Theorem, triangulation, diagonalization Inner product, length, orthogonally, orthogonal projections, Gram-Schmidt orthonormalization process Least square problems, inner product spaces and their applications. Diagonalization of symmetric matrices and quadratic forms.

Reference Books :

1. Lipschutz, Seymour, and Lipson, Marc, *Schaum's Outline of Linear Algebra* (4th edition). Delhi: Tata McGraw-Hill, 2008.
2. Hoffman K., and Kunze, R., *Linear Algebra* (2nd edition). Noida: Pearson, 1971.
3. Artin, M., *Algebra* (2nd edition). Noida: Pearson, 2010.
4. S. Lang: Linear Algebra, Undergraduate Texts in Mathematics, Springer Verlag, New York, 1989.
5. Lax, P., *Linear Algebra*. New York: John Wiley & Sons, 1997.
6. Herstein, I. N., *Topics in Algebra.* New Delhi: Wiley Eastern Ltd., 1975.
7. Dutta, K.B., *Matrix and Linear Algebra.* New Delhi: Prentice Hall of India Pvt. Ltd, 2000.
8. Luther, I.S., and Passi, I.B.S., *Algebra Vol. I – Groups.* New Delhi: Narosa Publishing House, 2004.

Course Title: Number Theory
Course Code: MTH-206

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
The aim of this course is to teach the students about the basics of Elementary Number Theory starting with primes, congruence's, quadratic residues, primitive roots, arithmetic functions.

Unit-A **14 HOURS**
Divisibility: Definition, properties, division algorithm, greatest integer function The Euclidean Algorithm, Primes and their properties, Infinitude of primes, The Fundamental Theorem of Arithmetic, The Prime Number Theorem (statement only).

Unit-B **14 HOURS**
Congruences: Definition and properties, Linear congruence's in one variable, Simultaneous linear congruences Euler's phi function, Fermat's Theorem, Euler's Theorem, Wilson's Theorem, Solutions of Congruences, The Chinese Remainder Theorem, Multiplicative property of Euler's phi function, Primitive Roots.

Unit-C **14 HOURS**
Quadratic residues: Quadratic residues and non-residues, The Legendre symbol: Definition and basic properties, Euler's Criterion, Gauss' Lemma The law of quadratic reciprocity.

Unit-D **14 HOURS**
Linear Diophantine equation, The order of an integer. Continued fractions Groups and Arithmetic. What is a group? Numbers modulo n. The group of unit's moduli p. Primitive roots: Definition and properties.

Reference Books:

1. Burton, David M., *Elementary Number Theory* (6th edition). New Delhi: Tata McGraw Hill, 2006.
2. Niven, I. and Zuckeman, H.S., *Introduction to Number Theory* (5^{th} edition). Delhi: Wiley Eastern, 1991.
3. Apostal, T.N., *Introduction to Analytic Number Theory* (5^{th} edition). New York: Springer Verlag, 1998.
4. Hardy, and Wright, *An Introduction to the theory of Numbers* (6th edition). New York: Oxford Univ. Press, 2008

Course Title: Probability and Statistics
Paper Code: MTH 207

L	T	P	Credits	Marks
4	1	0	4	100

Objective: The course is designed to develop greater skill and understanding of statistics and probability. To develop strategies to calculate the number of possible outcomes for various events. To explore properties of probability distributions.

UNIT-A **15 HOURS**

Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, equally likely and independent events, Definition of probability—classical, relative frequency, statistical and axiomatic approach, Addition and multiplication laws of probability, Boole's inequality.

UNIT-B **13 HOURS**

Baye's theorem and its applications. Random Variable and Probability Functions: Definition and properties of random variables, discrete and continuous random variable, probability mass and density functions, distribution function.

UNIT-C **12 HOURS**

Concepts of bivariate random variable: joint, marginal and conditional distributions. Mathematical Expectation: Definition and its properties –moments, measures of location, dispersion, skewness and kurtosis.

UNIT-D **15 HOURS**

Linear Regression: Concept of regression, principle of least squares and fitting of straight line, derivation of two lines of regression, properties of regression coefficients, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values. Angle between two lines of regression. Difference between correlation and regression. Curvilinear Regression: Fitting of second degree parabola, power curve of the type $Y=ax^b$, exponential curves of the types $Y=ab^x$ and $Y=ae^{bx}$

Reference Books:

1. Gupta, S.C., and Kapoor, V.K., *Fundamentals of Mathematical Statistics*. New Delhi: S. Chand & Sons, 2002.
2. Mood, A.M., Graybill, F.A., and Boes, D.C., *Introduction to the theory of Statistics*. Delhi: McGraw Hill, 1974.
3. Baisnab, and Jas M., *Elements of Probability and statistics*. Delhi: Tata McGraw Hill, 2004.
4. Meyer, P.L., *Introductory Probability and Statistical Applications.* Delhi: Addison-Wesley Publishing Company, 1970.

Course Title: Mechanics
Paper Code: MTH 301

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective:
The objective of this paper is to make students understand the Theoretical Principles of Mechanics and to clarify the physical foundations of dynamics. Syllabus of this paper is split into two-parts- Statics (UNITS-A, B) and Dynamics (UNITS- C, D).

UNIT-A **13 HOURS**
Preliminary concepts, Force Systems -parallel, coplanar, collinear, concurrent, equivalent force systems, Composition and Resolution of forces- parallelogram law, triangle law, $\lambda - \mu$ theorem, Lami's theorem, m-n theorem, equilibrium of forces acting on a particle, moment of force, sign of moment, Varignon's theorem of moments, moment of couple, equilibrium conditions for coplanar forces..

UNIT-B **12 HOURS**
Virtual work, principle of virtual work for forces acting on a particle and for forces acting at different points, definition and nature of friction, laws of friction, equilibrium of a particle on a rough plane, basic concepts of centre of gravity (C.G.)

UNIT-C **12 HOURS**
Velocity and acceleration of a particle, radial and transverse components of velocity and acceleration, Newton's laws of motion, motion of a particle under constant and variable acceleration, motion under gravity- motion of a body projected vertically upward, motion along a smooth inclined plane, constrained motion along a smooth inclined plane, simple harmonic motion, central force motion.

UNIT-D **13 HOURS**
Linear momentum, angular momentum, conservation of momentum, work, energy, power, conservative forces-potential energy, Earth's gravitational field, impulsive forces, constrained particle motion- simple pendulum, Kepler's laws of motion and two-body system.

Reference Books :

1. Chorlton, F., *Text book of Dynamics*. CBS Publishers, Reprint 2002
2. S.L. Loney, *The elements of statics and dynamics*, 5th edition, Cambridge University Press, 1947.
3. Goldstein, H., Poole, C. and Safko, J., *Classical Mechanics*. Addison Wesley (2002)
4. Grantmacher, F., *Lecture in analytical Mechanics*. Mir Publication,1975
5. Synge, J. L., Griffth, B. A., *Principles of mechanics*, 2nd edition, Mc-Graw Hill Book Comapny, 1947

DAV UNIVERSITY, JALANDHAR

Course Title: ANALYTICAL SOLID GEOMETRY

L	T	P	Credits	Marks
4	1	0	4	100

Paper Code: MTH 302

Objective:

The course is an introductory course on Analytical Solid Geometry so as to enable the reader to understand further deeper topics in Differential Geometry etc.

Unit –I 12 HOURS

Equations of parabola, ellipse, hyperbola and their properties, Cartesian equation and vector equation of a line, shortest distance between two lines, Cartesian and vector equation of a plane, Angle between (i) two lines, (ii) two planes, (iii) a line and a plane, Distance of a point from a plane.

Unit –II 13 HOURS

Equation of a sphere and its properties, Equation of a cone, Intersection of cone with a plane and a line, Enveloping cone, Right circular cone, Cylinder: Definition, Equation of cylinder, Enveloping and right circular cylinders.

Unit –III 12 HOURS

Equations of central conicoids, Tangent plane, Normal, Plane of contact and polar plane, Enveloping cone and enveloping cylinder, Conjugate diameters and diametral planes, Equations of paraboloids and its simple properties.

Unit –IV 13 HOURS

Plane section of central conicoid, Axes of non-central plane sections, Circular sections, Sections of paraboloids, Circular sections of paraboloids, Condition for a line to be a generator of the conicoid.

Reference Books

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005
2. Jain, P.K, and A, Khalil, *A text book of Analytical Geometry of three dimensions*, Wiley Eastern Ltd, 1999.
3. S. Narayan and P.K. Mittal, *Analytical Solid Geometry,* S. Chand & Company Pvt. Ltd., 2008.
4. Dipak Chatterjee, *Analytical Solid Geometry,* PHI Learning, 2003.
5. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.

Course Title: Probabilistic Methods
Paper Code: MTH 303

L	T	P	Credits	Marks
4	1	0	4	100

Objective: Course is designed to equip the students how to collect, organize, display, and analyze data and also to explore properties of probability distributions.

UNIT-A **14 HOURS**

Random Variables: Concept, cumulative distribution function, discrete and continuous random Variables, expectations, mean, variance, moment generating function Generating Functions: Moment generating function and cumulating generating function along with their properties and uses.Tchebychev's inequality, Convergence in probability, Weak and strong laws of large numbers.

UNIT-B **13 HOURS**

Bernoulli, binomial, Poisson, geometric and hyper-geometric distributions with their properties. Normal distribution with its properties.

UNIT-C **13 HOURS**

Uniform, gamma, beta (first and second kinds) and exponential distributions with their properties. Central Limit Theorem (Statement only) and its applications.

UNIT-D **15 HOURS**

Bivariate random variables: Joint distribution, joint and conditional distributions, the correlation coefficient. Functions of random variables: Sum of random variables, the law of large numbers and central limit theorem, the approximation of distributions. Uncertainty, information and entropy, conditional entropy, solution of certain logical problems by calculating information

Reference Books:

1. Gupta, S.C. and Kapoor, V.K., *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons, 2002.
2. Baisnab and Jas, M., *Element of Probability and statistics*. New Delhi: Tata McGraw Hill.
3. Meyer, P.L., *Introductory Probability and Statistical Applications*. New Delhi: Addison-Wesley Publishing Company, 1970

Course Title: Linear Programming and Optimization
Course Code: MTH-305

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
The aim of this course is to make the students acquire facility and confidence in the use of optimization techniques, so that they may employ the same in an effective manner.

UNIT-A **13 HOURS**
Definition, scope, methodology and applications of OR. Types of OR models. Concept of optimization, Linear Programming: Introduction, Formulation of a Linear Programming Problem (LPP), Requirements for an LPP, Advantages and limitations of LP. Graphical solution: Multiple, unbounded and infeasible solutions.

UNIT-B **15 HOURS**
Principle of simplex method: standard form, basic solution, basic feasible solution. Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution, multiple solutions and unbounded solution and degeneracy. Two Phase and Big-M methods. Duality in LPP, primal-dual relationship.

UNIT-C **13 HOURS**
Transportation Problem: Methods for finding basic feasible solution of a transportation Problem, Modified distribution method for finding the optimum solution, Unbalanced and degenerate transportation problems, transshipment problem, maximization in a transportation problem.

UNIT-D **13 HOURS**
Assignment Problem: Solution by Hungarian method, Unbalanced assignment problem, Maximization in an assignment problem, Crew assignment and Travelling salesman problem.

Reference Books:

1. Taha, H.A., *Operations Research-An Introduction* (Macmillan Publishing Company Inc., 2006
2. Kanti Swarup, Gupta, P.K. & Man Mohan: *Operations Research*, Sultan Chand & Sons, New Delhi, 2001
3. Sharma, J.K., *Mathematical Model in Operations Research*, Tata McGraw Hill.
4. Gupta, P.K. and Hira, D.S., *Operations Research*, S. Chand & Co.
5. Hadley, G., *Linear Programming*, Narosa Publishing House, 1987.

Course Title: Numerical Methods

Paper Code: MTH 306

L	T	P	Credits	Marks
4	0	0	3	75

Objective

The aim of this course is to teach the applications of various numerical techniques for a variety of problems occurring in daily life. At the end of the course, the students will be able to understand the basic concepts in Numerical Analysis of differential equations.

UNIT-A **15 HOURS**

Approximate numbers, Significant figures, rounding off numbers. Error Absolute, Relative and percentage.

Operators: Forward, Backward and Shift (Definitions and some relations among them).

Non-Linear Equations: Bisection, Regula-Falsi, Secant, Newton-Raphson, Muller, Chebshev and General Iteration Methods and their convergence, Aitken Method for acceleration of the

Convergence, Methods for multiple roots, Newton-Raphson and General iteration Methods for System of Non-Linear Equations, Methods for Complex roots and Methods for finding roots of Polynomial Equations.

UNIT-B **14 HOURS**

Systems of Simultaneous Linear Equations: Direct methods: Gauss elimination method, Gauss Jordon method, Matrix inversion method; Iterative methods: Jacobi method and Gauss-Seidel method, Successive over relaxation iterative method, iterative method to determine A^{-1}, Eigen values problem: Power method for finding largest/smallest Eigen value.

UNIT-C **13 HOURS**

Lagrange's interpolation, Newton Interpolation, Finite Difference Operators, Piecewise and Spline Interpolation, Interpolating Polynomials using Finite Differences and Hermite Interpolation. Least square approximation, Uniform approximation, Rational approximation Numerical Differentiation, Error in Numerical Differentiation, Cubic Spline method, Maximum and Minimum values of a tabulated function.

UNIT-D **14 HOURS**

Numerical Integration:, Numerical Integration: Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Boole's and Weddle's Rule, Integration using Cubic Splines, Romberg Integration, Newton Cotes formulae, Adaptive Quadrature, Gaussian Integration, Euler-Maclaurin Sum Formula, Numerical Integration of Singular and Fourier Integrals, Numerical Double Integration.

Numerical solutions to first order ordinary differential equations: Taylor's Series method, Picard's Method, Euler's and modified Euler's methods, Runge Kutta methods.

Reference Books:

1. Atkinson, K.E., *An Introduction to Numerical Analysis*, Wiley, 1989.
2. Eriksson, K., Estep, D., Hansbo, P. and Johnson, C., *Computational Differential Equations*, Cambridge Univ. Press, Cambridge, 1996.
3. Conte, S.D. and Carl De Boor, *Elementary Numerical Analysis, An Algorithmic Approach*, Tata McGraw Hill, New Delhi, 1981.
4. Jain, M.K., *Numerical Analysis for Scientists and Engineers*, S.B.W. Publishers, Delhi, 1971.

Course Title: Numerical Methods with C/C++
Course Code: MTH 307

L	T	P	C	Marks
0	0	2	1	25

List of Programs:

1. Write a program to solve a polynomial equation.
2. Write a program to find C(n, r).
3. Write a program to write a tridiagonal matrix.
4. Write a program to solve the system of linear equations
   a) using Gauss Elimination b) using LU Decomposition.
5. Write a program in Matlab to find the characteristic roots and the characteristic functions
6. WAP on Bisection and False Position Method.
7. WAP on polynomial interpolation.
8. WAP on Taylor Series method.
9. WAP on Runge-Kutta Methods
10. WAP on Finite Difference Methods
11. WAP on Numerical Integration.
12. WAP on Trapezoidal and Simpson's rule.
13. WAP on Gaussian Quadrature.
14. WAP on Spline Interpolation.
15. WAP on Hermite Interpolation.

Reference Books:

1. Atkinson, K.E., *An Introduction to Numerical Analysis*, Wiley, 1989.
2. Eriksson, K., Estep, D., Hansbo, P. and Johnson, C., *Computational Differential Equations*, Cambridge Univ. Press, Cambridge, 1996.
3. Golub, G.H. and Ortega, J.M., *Scientific Computing and Differential Equations: An Introduction to Numerical Methods*, Academic Press, 1992.
4. Conte S.D. and Carl De Boor, *Elementary Numerical Analysis, An Algorithmic Approach***,** Tata McGraw Hill, New Delhi, 1981.
5. Jain, M.K., *Numerical Analysis for Scientists and Engineers*, S.B.W. Publishers, Delhi, 1971.

Course Title: Discrete Mathematics
Course Code: MTH- 308

L	T	P	C	Marks
4	1	0	4	100

Objective:
The objective of this course is to acquaint the students with the basic concepts in Discrete Mathematics and Graph Theory. It also includes the topic like Mathematical Logic, Recursive relations, Boolean algebra and Lattice theory.

Unit-A **15 HOURS**
Set Theory: Sets and Subsets. **Relations**: Equivalence relations and partitions, Partial order relations, Hasse diagram. **Mathematical Logic:** Basic logical operations, conditional and bi-conditional statements, tautologies, contradiction, Quantifiers, prepositional, calculus. **Recurrence Relations:** Recursively Defined Sequences. Solving Recurrence Relations. The Characteristic Polynomial. Solving Recurrence Relations. Generating Functions.

Unit-B **15 HOURS**
Graphs and Planar Graphs: Basic Terminology, l types of Graphs. The Handshaking Theorem, Isomorphism of Graphs. Homeomorphic Graphs. Eulerianand Hamiltonian Graphs. Planar and Non Planar Graphs. Euler's formula. Graph Coloring. Adjacency and Incidence Matrices. **Trees**: Binary Trees. Tree Traversing: Preorder, Postorder and Inorder Traversals. Minimum Spanning Trees, Prim's and Kruskal's Alogrithm.

Unit –C **14 Hours**
Boolean algebra and Logic Gates: Introduction to Boolean algebra, laws of Boolean algebra, logic gates, universal logic gates, POS and SOP notations, Canonical logic forms. **Logic families:** Simplification of Boolean Functions: Laws of Boolean algebra and K-Maps, Tabulation Method.

Unit –D **14 Hours**
Lattice Theory: Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, lattices as ordered sets, lattices as algebraic structures, sublattices, products and homomorphisms Definition, examples and properties of modular and distributive lattices, bounded and complement lattices.

Reference Books:

1. Rosen, K. H., *Discrete Mathematics and its Applications*, 6th Edition, McGraw Hill, 2007.
2. Malik, D.S., and Sen, M.K., *Discrete Mathematical Structures: Theory and Applications*, Thomson, 2004.
3. Liu, C. L., *Elements of Discrete Mathematics***,** McGraw Hill, International Edition, Computer Science Series, 1986.
4. Trembley, J.P. and Manohar, R.P., *Discrete Mathematical Structures with Applications to Computer Science*, McGraw Hill.
5. Joshi, K. D., *Foundations of Discrete Mathematics*, Wiley, 1989.

Course Title: Special Functions & Integral Transforms
Paper Code: MTH 309

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: The objective of this course is to introduce the special function as a solution of specific differential equations and acquaint the students with their properties, Integral Transforms and their inverse have been introduced which help in solving the various initial and boundary value problems.

UNIT-A **13 HOURS**

Legendre Polynomials – Orthogonal property of Legendre polynomials, Recurrence relations, Rodrigue's formula, generating function, Orthogonal and Orthonormal functions, Fourier-Legendre series.

UNIT-B **14 HOURS**

Chebyshev Differential Equation, Chebyshev polynomials of first and second kind and relation between them, Generating function, orthogonal property, Recurrence formulae, Fourier Chebyshev Series. Bessel's functions. Strum-Liouville Problem – Orthogonality of Bessel functions, Reccurence formulae, Generating function, Fourier-Bessel Series.

UNIT-C **15 HOURS**

Laplace Transforms, Inverse Laplace transform, Solution of initial value problems using Laplace transforms, Translation theorems, Laplace transform of Dirac-Delta function, Differentiation and Integration of Laplace transform, Convolution theorems, Laplace transform of periodic functions, Laplace transform method to solve some ordinary differential equations.

UNIT-D **15 HOURS**

Review of Fourier series, Fourier integrals, Applications of Fourier series, Fourier transforms. 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.

Reference Books:

1. Jain, R. K. and Iyengar. S.R.K. *Advanced Engineering Mathematics.* Narosa Publishing House, 2004.
2. Rainville, E. D. *Special Functions.* New York: Macmillan, 1960.

Course Title: MATLAB
Paper Code: MTH 310

L	T	P	Credits	Marks
0	0	4	2	50

Course Objectives

The objective of this course is to teach the basics of computer and computer programming so that one can develop the computer program in MATLAB at their own. For the purpose of learning programming skill, some Numerical methods which are extremely useful in scientific research are included. This is all Laboratory work.

UNIT A **14 HOURS**

Starting and Quitting MATLAB, Basic Operations of MATLAB: Input/output data, The Colon Operator ,Graphics, Types of files, mathematical functions, operations on vectors and matrices, random number generators. Error computation: absolute/relative, avoiding large errors.

UNIT B **14 HOURS**

Expressions **,** Variables, Numbers, Operators, Functions, Examples of Expressions, About Matrices, Entering Matrices, sum, transpose, the magic Function Types of matrices, Eigen values and Eigen vectors, computing inverse of matrices

UNIT C **13 HOURS**

Looping statements: if, else, and elseif, for, while, switch and case, break , return, Developing algorithms using nested loops, Sorting and Searching, Tracing a program/algorithm step-by-step, Commands for Parsing Input and Output, User Input and Screen Output, Evaluation, Debugging

UNIT D **15 HOURS**

Plotting Process, Graph Components, Figure Tools, Arranging Graphs within a Figure, Selecting Plot Types. Plotting Two Variables, Changing the Appearance, Adding More Data to the Graph, Changing the Type of Graph, Modifying the Graph Data Source, Working with Images.

Reference Books:

1. Chapman, S. *MATLAB Programming for Engineers*, *4th Edition*, Cengage Learning, Engineering, 1120 Birchmount Rd, Toronto, ON, M1K5G4, Canada. 2008.
2. Duffy, D.G. *Advanced engineering mathematics with MATLAB*, Boca Raton, FL: CRC Press, 2003.
3. Register, A.H. *A guide to MATALB object-oriented programming*, Boca Raton, FL: CRC Press, 2007.
4. Kalechman, M. *Practical MATALB applications for engineers*, Boca Raton, FL: CRC Press, 2009.
5. Poularikis, A.D. *Discrete random signal processing and filtering primer with MATLAB*, Boca Raton, FL: CRC Press, 2009.

Course Title: Matrices and Infinite series
Paper Code: MTH 155

L	T	P	Credits	Marks
4	0	0	4	100

Objective:
This Course is a requirement for majors in other sciences because study of matrices and infinite series provides a basis for advanced studies not only in Mathematics but also in other branches like engineering, physics and computers etc.

UNIT-A **12HOURS**
Vector Spaces and Linear Algebra: Matrices – basic definitions and Operations, Determinants for linear algebraic equations, Cramer's rule, Gauss elimination, orthogonal matrices, Hermitian matrices, unitary matrices.

UNIT-B **15HOURS**
Cayley-Hamilton Theorem. Characteristic roots and characteristic vectors of a square matrix. Nature of roots of different types of matrices. Minimal polynomial of a matrix. Similarity of matrices, similarity reduction to a diagonal form, diagonalizable matrix, Spectral decomposition of Hermitian matrix.

UNIT-C **13HOURS**
Linear transformations. Rank and Nullity of a linear transformation, Inverse of a Linear Transformation. Rank and Nullity Theorem and its consequences. Matrix of a linear transformation with respect to a given basis

UNIT-D **14HOURS**
Infinite Series: Sequence, Infinite series, Fundamental concepts, Geometric series, Convergence tests (Comparison test, D'Alembert's ration test, Logarithmic test, Cauchy's root test, Cauchy's integral test etc.), Alternating series, Absolute convergence of a series, algebra of series, power series, Taylor series.

Reference Books:

1. Narayan, Shanti and Mittal P. K. *A textbook of Matrices*. New Delhi: S. Chand & Co., 2010.
2. Boas, M.L. *Mathematical Methods in the Physical Sciences*. New Delhi: Wiley, 2002.
3. Pipes, L.A. and Harvill L.R. *Applied Mathematics for Engineers and Physicists*. New Delhi: McGraw- Hill, 1971.
4. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009.

Course Title: Calculus & Geometry
Paper Code: MTH-156

L	T	P	Credits	Marks
4	0	0	4	100

Objective:
The objective of the course is to equip the students with the knowledge of basic concepts of partial derivatives, multiple integration and their applications in geometry.

UNIT-A **14 HOURS**
Coordinate Geometry: Polar & Cartesian co-ordinates in plane, different forms of straight lines. Angle between two straight lines. Conditions of parallelism and perpendicularity. Standard equations of circle, parabola, ellipse and hyperbola (without proof) and simple problems.

UNIT-B **14 HOURS**
Solid Geometry: Sphere, Cone, Cylinder, Equation of paraboloid, ellipsoid and hyperboloid in standard forms. Simple properties of these surfaces. Equation of tangent planes to the above surfaces.

UNIT-C **13 HOURS**
Functions of two and more variables: Vector-valued function and space curves. Arc length and unit tangent vector. Limit and continuity of multivariable function. Partial derivatives. Directional derivatives, gradient vectors and tangent planes.

UNIT-D **14 HOURS**
Multiple Integrals and Integral in vector fields: Double and triple integrals. Fubini's Theorem Without proof, Change of order of integration in double integrals, volume of a region in space, Triple integrals in spherical and cylindrical coordinates, substitution in multiple integrals. Line integrals vector fields. Path independence and surface integrals. Divergence and Stoke's theorem (Applications only).

Reference Books:

1. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.
2. Mohindru, J. P. and Gupta, Usha and Dogra A. S., *New Pattern Vector Algebra and Geometry*. International Publishers, New Edition, 2004.
3. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009

Course Title: Differential Equations and Fourier series
Paper Code: MTH-255

L	T	P	Credits	Marks
4	0	0	4	100

Objective:
The objective of the course is to enable the students to understand the basic concepts related to ordinary differential, partial differential equations and Fourier series and their applications.

UNIT-A **14 HOURS**
Ordinary Differential Equations: Exact First Order Differential Equations, Linear second order equations. Homogeneous equation with constant coefficients, Characteristic equation and their roots. Non-homogeneous equations of second order. Particular integrals, method of variation of parameters.

UNIT-B **14 HOURS**
Solution in series of second order linear differential equations with variable coefficients (in particular, solutions of Legendre's and Bessel's equations.) Bessel functions, Legendre functions, their recurrence and orthogonal relations, Gamma and Beta functions.

UNIT-C **15 HOURS**
Fourier Series and Partial Differential Equations: Fourier Series; Periodic functions. Fourier series and Fourier coefficients. Functions having arbitrary period. Sine and Cosine series. Half-range expansions. Exponential and complex form of Fourier series. Differentiation and integration of Fourier series. Fourier integrals.

UNIT-D **13 HOURS**
Formation of first and second order partial differential equations and their classification, solution of first order equation, Lagrange's equation. Solution of Laplace, diffusion and wave equations by method of separation of variables. D'Alembert's solution of wave equation.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995

Course Title: Integral Transforms and Complex Analysis
Paper Code: MTH-351

L	T	P	Credits	Marks
4	0	0	4	100

Objective:

To acquaint the students with the application of Laplace transforms to solve ordinary differential equations. Moreover, basics of Complex Analysis are also included in this course.

UNIT-A **15 HOURS**

Laplace Transforms: Laplace transforms: definition, elementary transforms. Transforms of derivatives and integrals. Transforms of periodic functions. Convolution theorem. Inverse Laplace transforms. Application to ordinary differential equations.

UNIT-B **15 HOURS**

Complex Analysis: Complex numbers, absolute value, argument. Functions e^z, sin z, cos z, log z and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Harmonic functions and their conjugates.

UNIT-C **14 HOURS**

Integration of complex functions, Cauchy's theorem (statement only), Cauchy's theorem for multiply connected domains (statement only). Cauchy's integral formula (statement only) and simple consequences.

UNIT-D **12 HOURS**

Expansion into Laurent series, singularities, Residues, Cauchy residue theorem (statem*ent only).* Evaluation of definite integrals using contour integration

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995
5. Churchill, R. V, and Brown J. W. *Complex Variables and Application*. New Delhi: McGraw-Hill, 2008.

Course Title: Mathematics for Chemists-I
Paper Code: MTH 160

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: This course familiarizes the students with trigonometry, permutations and combinations, the theory of matrices which are used in solving equations in mechanics and other streams used in Mathematics, Physics etc. The objective is to provide basic understanding of the geometry of two and three dimensions.

UNIT-A **14 HOURS**

Trigonometry:

T- Ratios, addition and subtraction formulae, multiple angles, sub-multiple angles, trigonometric equations, inverse trigonometrical functions (proofs of articles are not required).

UNIT-B **14 HOURS**

Algebra: Fundamental principle of counting, Permutation and Combination with simple applications. Principle of mathematical induction, statement of Binomial Theorem and its applications.

UNIT-C **12 HOURS**

Determinants and Matrices:

Introduction to matrix, Different kinds of matrices, Addition, Multiplication, Symmetric and Skew symmetric matrix, Transpose of matrix. Determinant of matrix, properties of determinant, product of two determinant of third order. Adjoint and Inverse of matrix, Rank of matrices, Condition of Consistency of system of linear equations, Eigen vectors and Eigen values using matrices, Cayley's Hamilton Theorem (without proof).

UNIT-D **16 HOURS**

Co-ordinate Geometry:

Polar & Cartesian co-ordinates in plane, different forms of straight lines. Angle between two Straight lines. Conditions of parallelism and perpendicularity. Standard equations of circle, Parabola, ellipse and Hyperbola (without proof) and simple problems.

Solid Geometry: Sphere, Cone, Cylinder

Reference Books:

1. Mathematics, *A Text book for Class XI and XII (Parts I & II*). New Delhi: NCERT 2003.
2. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
3. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995
4. Narayan, Shanti. *A text book of Matrices*. New Delhi: S Chand & co Ltd, 2004.

Course Title: Mathematics for Chemists-II
Paper Code: MTH 260

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: This course is designed to introduce the fundamental concepts of continuity, differentiation and integration of functions of one variable. Its objective is to acquaint students with various applications of these topics relating to extreme value problems, problems of finding areas and distance travelled, moreover to describe connection between integral and differential calculus through Fundamental Theorem of Calculus.

UNIT-A **11 HOURS**

Function, Limit and Continuity:

Functions and graphs, Domain and Co-Domain, range, Inverse Functions, Exponential and Logarithmic Functions, limit of Functions, Algebraic Computations of limits, Continuity of Functions at a point, Continuity of Functions in interval.

UNIT-B **13 HOURS**

Differential of Explicit and Implicit functions:

An Introduction to the Derivative, Differentiation of standard Functions, Formulae on derivative of sum, difference, product and quotient of functions, chain rule, derivative of Trigonometric functions, Inverse Trigonometric functions, Exponential and Logarithmic Functions.

Differentiation of implicit functions, Derivative of functions expressed in parametric form, derivative of higher order**.**

UNIT-C **11 HOURS**

Applications of derivatives:

Increasing and decreasing functions, Sign of derivative, Maxima and Minima of a function of single variable. Rolle 's, Lagrange and Cauchy mean values theorems and their applications, Taylor theorem and Maclaurian's theorem with Lagrange's form of remainder and applications of formal expansions of functions. (Proofs of theorems are not required).

UNIT-D **11 HOURS**

Integral Calculus:

Integration as inverse of differentiation, Indefinite Integral of standard forms, Methods of Substitution, Methods of fractions, Integration by parts, Definite Integral.

Reference Books:

1. Narayan, Shanti and Mittal P. K. .*Differential Calculus*. New Delhi: S Chand & Co Ltd, 2005.
2. Narayan, Shanti and Mittal P. K. *Integral Calculus*, New Delhi: S Chand & Co Ltd, 2004.
3. Mathematics, *A Text book for Class XI and XII (Parts I & II*). New Delhi: NCERT 2003.

Course Title: Mathematics for Chemists-III
Paper Code: MTH 261

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: This course provides a comprehensive understanding of the origin and development of ideas to exhibit the techniques of solving ordinary and partial differential equations.

UNIT-A **14 HOURS**

Partial Differentiation and Multiple Integrals:

Introduction to Partial differentiation. Integral calculus: double, triple integrals, determination of C.G. using double and triple integrals. Integration by trapezoidal and Simpson's rule.

UNIT-B **15 HOURS**

Differential Equations:

Ordinary differential equations. Formation of differential equation, solution of linear differential equation of the first order and first degree. Solution of homogeneous and non-homogeneous differential equations with constant coefficient. The chemical application of the first differential equations.

Series solutions of Bessel and Legendre differential equations. Bessel function and Legendre Polynomials. Recurrence and orthognality relations, Rodrigue's Formulae.

UNIT-C **12 HOURS**

Parital differential equations:

Formation of partial differential equations. Linear PDE- Solution by Lagrange's Method. Non-linear PDE- Solution by Charpit's Method. Solution of homogeneous partial differential equations with constant coefficients.

UNIT-D **15 HOURS**

De-Moivre's theorem and its applications: Functions of complex variables. Analytic functions. C-R equations, complex line integral. Cauchy's integral theorem & Cauchy's integral formula. Taylor's theorem. Laurent's theorem. Cauchy's residue Theorem. Integration round unit circle.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.
5. Dence, Joseph B. *Mathematical Techniques in Chemistry*. New Delhi: Wiley, 1975

Course Title: Mathematics for Chemists-IV
Paper Code: MTH 360

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The aim of this course is to make the students acquire facility and confidence in the use of vectors and vector calculus so that they may employ the same in an effective manner to various applications.

UNIT-A **13 HOURS**

Vectors Algebra:

Definition of vector and scalar. Scalar & Vector product of two vectors. Scalars triple product and vector triple product and their applications. Work done by a force, moment of a force about a point

UNIT-B **14 HOURS**

Vectors Calculus:

Vector differentiation and integration of vectors. Vectors operators, Gradient, Divergence and Curl. Gauss, Stoke and Green's Theorem (Statement only) and their applications.

UNIT-C **15 HOURS**

Laplace Transform:

Definition of elementary transforms, transforms of integrals and derivatives. Laplace transforms of periodic functions, inverse Laplace transforms of periodic functions. Solutions of ordinary differential equations and simultaneous differential equations using Laplace transforms.

UNIT-D **14 HOURS**

Fourier Series:

Periodic Functions, Dirichlet Conditions, Fourier Series & Fourier coefficient, functions having arbitrary period, Sin and Cosine Series, half range expansions, Fourier integral (definitions), Harmonic Analysis.

Reference Books:

1 Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2 Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3 Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4 Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.
5 Dence, Joseph B. *Mathematical Techniques in Chemistry*. New Delhi: Wiley, 1975.

Course Title: Engineering Mathematics-I
Paper Code: MTH 151

L	T	P	Credits	Marks
4	1	0	4	100

Objective: The aim of this course is to familiarize the students with the theory of matrices which are used in solving equations in mechanics and the other streams. This course also provides a comprehensive understanding of the origin and development of ideas to exhibit the techniques origin and development of ideas to exhibit the techniques of solving ordinary differential equations.

UNIT-A **15 HOURS**

Rank of matrices, Inverse of Matrices, Gauss Jordan Method, reduction to normal form, Consistency and solution of linear algebraic system of equations, Gauss Elimination Method Eigen values and Eigen vectors, Diagonalisation of Matrix, Cayley Hamilton theorem. Orthogonal, Hermit ion and unitary matrices.

UNIT-B **14 HOURS**

Concept of limit and continuity of a function of two variables, Partial derivatives, Homogenous Function , Euler's Theorem, Total Derivative, Differentiation of an implicit function, chain rule, Change of variables,Jacobian, Taylor's and McLaurin's series. Maxima and minima of a function of two and three variables: Lagrange's method of multipliers.

UNIT-C **14 HOURS**

Formation of ordinary differential equations, solution of first order differential equations by separation of variables, Homogeneous equations, Reduce to Homogenous, exact differential equations, equations reducible to exact form by integrating factors, equations of the first order and higher degree, clairaut's equation.

UNIT-D **13 HOURS**

Solution of differential equations with constant coefficients: method of differential operators. Non – homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, Simultaneously Linear differential equation.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.

Course Title: Engineering Mathematics-II
Course Code: MTH-152

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
The objective of the course is to equip the students with the knowledge of concepts of vectors and geometry and their applications. A flavor of pure mathematics is also given to the readers.

Unit-A **14 HOURS**
Infinite Series: Convergence and divergence of series, Tests of convergence (without proofs): Comparison test, Integral test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series, Uniform Convergence and Power Series.

Unit-B **15 HOURS**
Differential Calculus: Curve tracing: Tracing of Standard Cartesian; Parametric and Polar curves.
Integral Calculus: Rectification of standard curves; Areas bounded by standard curves; Volumes and surfaces of revolution of curves; Applications of integral calculus to find Centre of gravity and moment of inertia.
Multiple Integrals: Double and triple integral and their evaluation, change of order of integration, change of variable, Application of double and triple integration to find areas and volumes.

Unit-C **13 HOURS**
Functions of Complex Variables: Complex Numbers and elementary functions of complex variable De-Moivre's theorem and its applications. Real and imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables. Summation of trigonometric series. (C+iS method).

Unit-D **15 HOURS**
Vector Calculus: Scalar and vector fields, differentiation of vectors, velocity and acceleration.
Vector differential operators: Del, Gradient, Divergence and Curl, their physical nterpretations. Line, surface and volume integrals.
Application of Vector Calculus: Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem. Green's theorem in plane, Stoke's theorem (without proofs) and their applications.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B., and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995

Course Title: Engineering Mathematics-III
Course Code: MTH-252

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
The objective of the course is to enable the students to understand the basic concepts related to Laplace transforms, Fourier series, ordinary differential and partial differential equations and their applications.

Unit-A **14 HOURS**
Fourier series: Periodic functions, Euler's formula. Dirichlet's conditions. Fourier series of discontinuous functions. Fourier series of Even and Odd functions, half range expansions, Fourier series of different wave forms, Complex form of Fourier series. Fourier Transformation.

Unit-B **14 HOURS**
Laplace Transforms: Laplace transforms of various standard functions, Linear property of Laplace transforms, Shifting property and change of scale, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

Unit-C **14 HOURS**
Partial Differential Equations: Formulation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation and their applications, solution by the method of separation of variables.

Unit-D **15 HOURS**
Analytic Function: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; **Complex Integration:** Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B., and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995

Course Title: Discrete Mathematics
Course Code: MTH -254

L	T	P	Credits	Marks
4	1	0	4	100

Objective:
The objective of this course is to acquaint the students with the basic concepts in Discrete Mathematics and Graph Theory. It includes the topic like Set Theory, Functions, Relations, Graph and Trees.

Unit-A **14 HOURS**
Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory and Venn Diagrams. Relations and Functions: Cartesian Products and Relations, Introduction to Binary relations, equivalence relations and partitions, Partial order relations, Hasse diagram. Inclusion and exclusion principle. Mathematical Induction.

Unit-B **13 HOURS**
Mathematical Logic: Basic logical operations, conditional and bi-conditional statements, tautologies, contradiction, Quantifiers, prepositional calculus. Recursively Defined Sequences. Solving Recurrence Relations. The Characteristic Polynomial. Solving Recurrence Relations: Generating Functions. Basics of Counting and the Pigeon-hole Principle.

Unit-C **14 HOURS**
Graphs and Planar Graphs: Basic Terminology, Special types of Graphs. The Handshaking Theorem, Paths and Circuits Shortest paths. Connectivity of Graphs. Isomorphism of Graphs. Homeomorphic Graphs. Eulerian and Hamiltonian Graphs. Planar and Non Planar Graphs. Euler's formula. Graph Coloring. Travelling Salesman Problem.

Unit-D **14 HOURS**
Trees: Basic Terminology. Binary Trees. Tree Traversing: Preorder, Postorder and Inorder Traversals. Minimum Spanning Trees, Prim's and Kruskal's Alogrithm. Boolean AIgebras: Boolean Functions, Logic Gates, Lattices and Algebraic Structures.

Reference Books:

1. Rosen, Kenneth H. *Discrete Mathematics and its Applications*. New Delhi: McGraw Hill, 2007.
2. Malik, D.S., and Sen M.K. *Discrete Mathematical Structures Theory and Applications*. New Delhi: Thomson Cengage Learning, 2004.
3. Lipschutz, Seymour, and Lipson Marc. *Schaum's Outline of Discrete Mathematics*. New Delhi: Schaum's Outlines, 2007

Course Title: Numerical Methods

Paper Code: MTH 256

L	T	P	Credits	Marks
4	0	0	3	75

Course Objectives

The course is an introductory course on Wavelets so as to enable the students to understand further topics related to solution of differential equations. Wavelets are a helpful tool to solve a variety of problems of science and engineering such as image processing, cloud computing etc.

UNIT-A **15 HOURS**

Approximate numbers, Significant figures, rounding off numbers. Error Absolute, Relative and percentage.

Operators: Forward, Backward and Shift (Definitions and some relations among them).

Non-Linear Equations: Bisection, Regula-Falsi, Secant, Newton-Raphson, Muller, Chebshev and General Iteration Methods and their convergence, Aitken Method for acceleration of the Convergence, Methods for multiple roots, Newton-Raphson and General iteration Methods for System of Non-Linear Equations, Methods for Complex roots and Methods for finding roots of Polynomial Equations

UNIT-B **14 HOURS**

Systems of Simultaneous Linear Equations: Direct methods: Gauss elimination method, Gauss Jordon method, Matrix inversion method; Iterative methods: Jacobi method and Gauss-Seidel method, Successive over relaxation iterative method, iterative method to determine A^{-1}, Eigen values problem: Power method for finding largest/smallest Eigen value.

UNIT-C **13 HOURS**

Lagrange's interpolation, Newton Interpolation, Finite Difference Operators, Piecewise and Spline Interpolation, Interpolating Polynomials using Finite Differences and Hermite Interpolation. Least square approximation, Uniform approximation, Rational approximation Numerical Differentiation, Error in Numerical Differentiation, Cubic Spline method, Maximum and Minimum values of a tabulated function.

UNIT-D **14 HOURS**

Numerical Integration:, Numerical Integration: Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Boole's and Weddle's Rule, Integration using Cubic Splines, Romberg Integration, Newton Cotes formulae, Adaptive Quadrature, Gaussian Integration, Euler-Maclaurin Sum Formula, Numerical Integration of Singular and Fourier Integrals, Numerical Double Integration.

Numerical solutions to first order ordinary differential equations: Taylor's Series method, Picard's Method, Euler's and modified Euler's methods, Runge Kutta methods

Reference Books:

1. K.E. Atkinson, **An Introduction to Numerical Analysis**, Wiley, 1989.
2. K. Eriksson, D. Estep, P. Hansbo and C. Johnson, **Computational Differential Equations**, Cambridge Univ. Press, Cambridge, 1996.
3. S.D. Conte and Carl De Boor, **Elementary Numerical Analysis, An Algorithmic Approach,** Tata McGraw Hill, New Delhi, 1981.

4. M.K. Jain, **Numerical Analysis for Scientists and Engineers**, S.B.W. Publishers, Delhi, 1971.

Course Title: Numerical Methods with C/C++
Course Code: MTH 257

L	T	P	Credits	Marks
0	0	2	1	25

List of Programs:

1. Write a program to solve a polynomial equation.
2. Write a program to find C (n, r).
3. Write a program to write a tridiagonal matrix.
4. Write a program to solve the system of linear equations
   a) Using Gauss Elimination b) using LU Decomposition.
5. Write a program in Matlab to find the characteristic roots and the characteristic functions
6. WAP on Bisection and False Position Method.
7. WAP on polynomial interpolation.
8. WAP on Taylor Series method.
9. WAP on Runge-Kutta Methods
10. WAP on Finite Difference Methods
11. WAP on Numerical Integration.
12. WAP on Trapezoidal and Simpson's rule.
13. WAP on Gaussian Quadrature.
14. WAP on Spline Interpolation.
15. WAP on Hermite Interpolation.

Reference Books:

1. Atkinson, K.E. *An Introduction to Numerical Analysis*. New Delhi: Wiley, 1989.
2. Eriksson, K., Estep, D., Hansbo, P. and Johnson, C. *Computational Differential Equations.* Cambridge: Cambridge Univ. Press, 1996.
3. Golub, G.H. and Ortega, J.M. *Scientific Computing and Differential Equations: An Introduction to Numerical Methods*. London: Academic Press, 1992.
4. Conte, S.D. and Boor, C.D. *Elementary Numerical Analysis, An Algorithmic Approach***.** New Delhi : Tata McGraw Hill, 1981.
5. Jain, M.K. *Numerical Analysis for Scientists and Engineers*. New Delhi: S.B.W. Publishers, 1971.

Course Title: Mathematical Foundation of Computer Science
Course Code: MTH 190

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: The syllabus of this course is specially designed for the beginners in computer science with the first exposure to mathematical topics essential to their study of computer science or digital logic. Topics like algorithm complexity will help them in learning the important concepts of C language and algorithm design and analysis.

UNIT-A **15 HOURS**

Matrix Algebra: Matrix Algebra Matrices, Types of Matrices, Operations on Matrices, and Properties Of Determinants (Statement Only). Minors, Cofactors, Adjoint and Inverse of a Matrix, Elementary Transformations in a Matrix Rank of a Matrix. Solution of Simultaneous Equations using Crammer'S Rule and Matrix Inversion Method. Characteristics of Polynomial. Eigen Values, Nature of Eigen values, Certain Types of Matrices, Cayley – Hamilton Theorem.

UNIT-B **14 HOURS**

Differentiation and Integration

Laws of Derivative, Chain Rule Differentiation Using Log, Repeated Derivatives, Derivatives of Implicit Functions Integration of Algebraic, Logarithmic and Exponential Function, Integration of Functions Using Partial Fraction (Simple Form Using Properties) Integration of Functions by Parts, Definite Integral.

UNIT-C **14 HOURS**

Statistics: Introduction to Statistics, Measures of Central Tendency Mean, Median and Modes. Measures of Dispersion, Mean Deviation, Standard Deviation and Coefficient of Variation. Applications of Logarithms: Problems Related To Compound Interest, Depreciation and Annuities.

UNIT-D **13 HOURS**

Algorithms and Complexity: Algorithms, Searching Algorithms, Sorting. Growth of Functions, Big O Notation, Big Omega and Big Theta Notation. Complexity of Algorithms, Mathematical Induction, the Basic of Counting, the Pigeonhole Principle.

Reference Books:

1. Grewal, B.S., *Advanced Engineering Mathematics*. New Delhi: Khanna Publisher, 2007.
2. Grimaldi, Ralph P., *Discrete and Combinational Mathematics* (5th edition.). New Delhi: Pearson Education, 2006.
3. Rajaraman, *Computer Oriented Numerical Methods* (3rd edition). New Delhi: PHI Publications, 1993.
4. Sancheti, D.C., *Business Mathematics* (11th edition), New Delhi: Sultan Chand & Sons, 2009.
5. Tremblay, J. P. and Manohar, R. P., *Discrete Mathematical Structures with Applications to Computer Science* (9th edition). New Delhi: MGH Publications.

Course Title: Basic Mathematics
Course Code: MTH 170

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: This course is designed to introduce the fundamental concepts of continuity, differentiation and integration of functions of one variable. Its objective is to acquaint students with various applications of these topics relating to extreme value problems, problems of finding areas and distance travelled, moreover to describe connection between integral and differential calculus through Fundamental Theorem of Calculus and This course familiarizes the students with the theory of matrices.

UNIT-A **15 HOURS**

Review of trigonometric functions, sum and product formulae for trigonometric functions, Trigonometric Equations.
Complex Numbers and Quadratic Equations Permutations and combinations Binomial Theorem.
Sequences and series

UNIT-B **14 HOURS**

Matrices, Operations on Matrices, Determinants, singular and non-singular matrices, Adjoint and Inverse of a matrix.
Co-ordinate Geometry: Rectangular Coordinate system. Straight lines. Circles and family of Circles. Parabola, Ellipse and Hyperbola-their equations in standard form

UNIT-C **14 HOURS**

Introduction. Limits. Continuity. Differentiability. Exponential and Logarithmic Differentiation. Derivative of a function in parameter second order Integral as ant derivative. Integration by substitution, by partial fractions and by parts. Definite integral and its properties. Areas of bounded regions. The definition of integral of a real valued function of real variable as limit of sum motivated by the determination of area. Fundamental theorem of integral calculus.

UNIT-D **13 HOURS**

Vector valued functions. Limit and continuity of vector functions. Differentiation of vector Functions. Arc length. Line, Surface and Volume integrals. The gradient, divergence and curl. The Del operator. Green's, Gauss' and Stokes' theorems (statements only). Applications to Physical problems

Reference Books:

1. Mathematics, *A Text book for Class XI and XII (Parts I & II)*. New Delhi: NCERT 2003.
2. Narayan, Shanti and Mittal P. K., *A Text Book of Matrices*. New Delhi: S. Chand & Co. Ltd., 2002.
3. Thomas, George B. and Finney, Ross L., Calculus and Analytic Geometry (9th Edition). New Delhi: Addison Wesley, 1998.

SUBSIDIARY COURSES FROM OTHER DEPARTMENTS

I. Physics

Course Code: PHY 153

L	T	P	Cr	Marks
4	0	0	4	100

Course Title: OPTICS AND LASERS

Total Lecture-45

AIM: The aim and objective of the course on **Optics and Lasers** for the students of B.Sc. (Hons) Chemistry, Mathematics, Microbiology is to enable them to understand the different phenomenon exhibited by the light as well as the basics of the laser light.

- The question paper for end semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGCNET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as textbook(s) are suggestive However, any other book may be followed

I INTERFERENCE 12 HOURS

Young's double slit experiment, Coherent Source, Theory of interference fringes, Types of interference, Fresnel's biprism, thickness of thin transparent sheet, Interference in thin films, Newton's rings and their application, Michelson Interferometer, Application of thin film interference; Anti reflection coatings; dielectric mirrors; interference filters; Holography.

II DIFFRACTION 12 HOURS

Difference between Fresnel and Franunhoffer diffraction, Franunhoffer diffraction at a single slit and its discussion, Fraunhoffer diffraction at double slit, missing orders in a double slit, Diffraction of N slits and its discussion, Diffraction grating, Missing orders, dispersive power, Rayleigh Criterion for resolving power, resolving power of a diffraction grating.

III POLARIZATION 11 HOURS

Polarised light and its production; polarisers and analyzers; anisotropic crystals; Polarization by transmission and reflection, Malus Law, Brewster's Law, Polarization by refraction, anisotropic crystals, Theory of double refraction, Elliptically and circularly polarized light, Quarterwave and halfwave plates, Production and detection of polarized light, Optical activity, specific rotation. Half shade polarimeter; LCD's.

IV **LASERS** 10 HOURS

Attenuation of light in an optical medium; thermal equilibrium; interaction of light with matter; Einstein relations; light amplification; population inversion; active medium, pumping; metastable states; principle pumping schemes; optical resonant cavity; axial modes; gain curve and laser operating frequencies, transverse modes; types of lasers; Qswitching; laser beam characteristics and applications.

Reference Books:

1. Subramanayam,N. , Lal, B.& Avadhamulu, M. N. *Textbook of Optics*. New Delhi: S. Chand & Company, 2006.
2. Jenkins, F.A. , White, H.E.*Fundamentals of Optics.*, USA: McGrawHill Publication, (4th Eds.)
3. Ghatak, Ajoy, *Optics*.New Delhi: Tata McGraw Hill Publication, 2008.

COURSE CODE: PHY 154
OPTICS LAB
Max Marks: 50

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment's.

Note:

- Students are expected to perform at least eighteen experiments out of following list. The experiments performed in first semester cannot be repeated in second Semester.
- The examination for both the courses will be of 3 hours duration.
- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test**.**

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results

List of Experiments: Students are expected to perform at least eight experiments out of following list.

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine the Dispersive Power of the Material of a given Prism using Mercury Light.
3. To determine the Resolving Power of a Prism.
4. To determine wavelength of sodium light using Fresnel Biprism.
5. To determine wavelength of sodium light using Newton's Rings.
6. To determine the Thickness of a Thin Paper by measuring the Width of the Interference Fringes produced by a Wedge Shaped Film.
7. To determination Wavelength of Sodium Light using Michelson's Interferometer.
8. To determine the wavelength of Laser light using Diffraction of Single Slit.
9. To determine the wavelength of (1) Sodium and (2) Mercury Light using Plane Diffraction Grating.
10. To determine the Dispersive Power of a Plane Diffraction Grating.
11. To determine the Resloving Power of a Plane Diffraction Grating.
12. To determine the (1) Wavelength and (2) Angular Spread of HeNe Laser using Plane Diffraction Grating.
13. To study the wavelength of spectral lines of sodium light using plane transmission grating.
14. To study the specific rotation of sugar solution Laurents half shade polarimeter method
15. To study the numerical aperture and propagation losses using HeNe laser Optical fibre set up.
16. To compare the focal length of two lenses by Nodal slide method.

Course Code: PHY155

L	T	P	Cr	Marks
4	0	0	4	100

Course Title: MODERN PHYSICS

Total Lecture 45

The aim and objective of the course on Modern Physics for the student of B.Sc. (Hons.) Physics is to equip them with the knowledge of wave particle duality, quantum mechanics and atomic nucleus and radioactivity

- The question paper for end semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as textbook(s) are suggestive However, any other book may be followed

I. Wave Particle Duality **10 HOURS**

Quantum theory of light, Xrays and their diffraction, Compton effect, pair production, Wave Properties of Particles; de Broglie waves, waves of probability, the wave equation, phase and group velocities, particle diffraction, uncertainty principle and its applications.

II. Quantum Mechanics **11 HOURS**

Difference between classical and quantum mechanics, wave function and wave equations. Schrodinger's equation, time dependent and steady state forms, Expectation values, particle in a box, reflection and transmission by a barrier, tunnel effect, harmonic oscillator.

III. Quantum Theory of Hydrogen Atom **12 HOURS**

Schrodinger's equation for the hydrogen atom, separation of variables, quantum numbers, principal quantum number, orbital quantum number,

Magnetic quantum number, electron probability density, radiative transitions, selection rules. Zeeman Effect, Anomalous Zeeman effect, Xray Spectra.

IV. Atomic Nucleus and Radioactivity **12 HOURS**

Nonexistence of electrons in the nucleus, The neutron, stable nuclei, nuclear sizes and shapes, binding energy, liquid drop model, shell model, meson theory of nuclear forces Radioactivity; Radioactive decay, Halflife, radioactive dating, radioactive series, alpha decay and its theory, beta decay, gammadecay, radiation hazards and radiation units.

Reference Books:

1. Beiser, A. *Concepts of Modem Physics*. New York: McGraw Hill, 1987.
2. Ghatak,A and Loknatham,S. *Quantum Mechanics-Theory and Application*.Netherland: Springer, 2004.
3. Kuhn, H. *Atomic Spectra*: London; Longman Green, 1969.

4. Heyde, K. *Basic ideas and Concepts in Nuclear Physics*.Bristol: Institute of Physics, 2004.

Course Code: PHY156
MODERN PHYSICS LAB
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Max Marks: 50

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

Note:

- Students are expected to perform at least eightten experiments out of following list. The experiments performed in first semester cannot be repeated in second Semester.
- The examination for both the courses will be of 3 hours duration.
- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test**.**

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results

1. Determination of Planck's constant using photocell.
2. Study of SolarCell characteristics
3. To find halflife period of a given radioactive substance using GM counter
4. Study of C.R.O. as display and measuring device, Study of Sinewave, square wave signals (half wave and full wave rectification)
5. Determination of ionization potential of mercury.
6. Study of excitations of a given atom by Franck Hertz set up.
7. To determine charge to mass ratio (e/m) of an electron by Thomson method.
8. Study of Arc emission spectrum of given samples (Fe and Cu).
9. To determine the heat capacity of given materials.
10. To find conductivity of given semiconductor crystal using four probe method.
11. To determine the Hall coefficient and mobility of given semiconductors.
12. To determine the operating plateau and dead time of a given G.M. Counter.
13. To find the coefficient of thermal conductivity of a bad conductor by Lee's method.
14. To find the ionization potential of mercury using gas filled diode.
15. To determine the thermionic work function of tungsten using directly heated diode.
16. To determine the speed of light in air.
17. To study the various laws of thermal radiation.
18. To demonstrate diaparaferro magnetism in an inhomogeneous magnetic field.
19. To measure the wave lengths of Balmar series of visible emission line from hydrogen. To determine the electronic charge by Millikan oil drop method.

L	T	P	Cr	Marks
4	0	0	4	100

Course Code: PHY253

Course Title: ELECTRICITY MAGNETISM AND ELECTRONICS

Total Lecture 45

AIM

The aim and objective of the course on **Electricity Magnetism and Electronics**is to equip the students of with knowledge ofbasic features of electricity and magnetism and electronics that can enable them to understand the working of electronic equipments.

- The question paper for endsemester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGCNET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as textbook(s) are suggestive However, any other book may be followed

Unit I **12 HOURS**

Vector Analysis

Vectors and Vector properties, Components of Vectors, Unit Vectors, Product of Vectors.

Electric Charges and Field

Electric Charges, Conductors, Insulators and Induced Charges,Coulomb Law, Electric Field and Forces, Electric field Calculations, Electric field lines. Electric

Dipoles.

Gauss law

Charges & Electric Flux and calculations, Gauss's Law, Electric Potential Energy and Potential Gradient.

Unit II **10 HOURS**

Magnetism

Magnetism, magnetic field, Magnetic field lines and flux, motion of charges particle in Magnetic field, BioSavart law, Ampere law, Magnetic Materials, Faraday's Law, Maxwell equations

Dielectric: Dielectric and Gauss's Law in Dielectric.

Electromotive Force

Electromotive force & Circuits, Mutual Inductance, Self-Induction and Inductors

Unit III **12 HOURS**

Conduction in Semiconductors

Electrons and holes in semiconductor, carrier concentration, donor and acceptor impurities, charge densities, Fermi Level in semiconductors, diffusion, carrier lifetimes, continuity equation

Diode Characteristics

Qualitative theory of pn junction, pn diode, band structure of an open circuit diode, current components, qualitative theory of diode currents, VI Characteristics.

Unit IV **11 HOURS**

Transistors

Junction Transistors, Transistor current components, transistor as an amplifier, CB and CE configuration

Applications

Half Wave rectifier, ripple factor, full wave rectifier, filters, photoconductivity, Photodiode

Reference Books:

1. Young, Hugh D and Freedman, Roger A *Sears's University Physics with Modern Physics*, 12thEdition Pearson Education, 2008
2. Resnick & Hlleday , *Fundamentals of |Physics*, 8th Edition ,Wiley.
3. Millman, J. and Halkias, C.C. *Electronic Devices and Circuits*: Tata McGraw Hill, 1991

Course Code: PHY 254

EM AND ELECTRONICS LAB

Max. Marks: 50

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment's.

Note:

- Students are expected to perform at least eighteen experiments out of following list. The experiments performed in first semester cannot be repeated in second Semester.
- The examination for both the courses will be of 3 hours duration.
- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test**.**

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results

1. To verify the Thevenin, Norton, Superposition, and Maximum Power Transfer Theorem.
2. To measure the Input and Output Impedance of an Unknown Network and to convert it into Equivalent T and π Circuits.
3. To study (a) Halfwave Rectifier and (b) Fullwave Bridge Rectifier and investigate the effect of C, L and π filters.
4. To study the characteristics of pnjunction diode.
5. To study the Forward and Reverse characteristics of a Zener Diode and to study its use as a Voltage Regulator.
6. To study the Characteristics of a Photodiode.
7. To determine the Characteristics of pn junction of a Solar Cell.
8. To study the CE Characteristics of a Transistor.
9. To study the various Transistor Biasing Configurations.
10. To study the Frequency Response of Voltage Gain of a RCCoupled Amplifier.
11. To design an Oscillator of given specifications using Transistors.
12. To study the characteristics of Junction Field Effect Transistor.
13. To study the characteristic of Metal Oxide Semiconductor Field Effect Transistor.
14. To study the magnetic field produced by a current carrying solenoid using a pickupcoil/Hall sensor and to find the value of permeability of air.
15. To determine the frequency of A.C. mains using sonometer.
16. To study C.R.O. as display and measuring device by recording sines and square waves, output from a rectifier, verification (qualitative) of law of electromagnetic induction and frequency of A.C. mains**.**
1. To measure thermo e.m.f. of a thermocouple as a function of temperature and findinversion temperature.
17. Determination of given inductance by Anderson's bridge.

18. To determine the value of an air capacitance by deSauty Method and to findpermittivity of air. Also, determine the dielectric constant of a liquid.
19. Study of R.C. circuit with a low frequency a.c. source.
20. Studies based on LCR Board: Impedance of LCR circuit and the phase and between voltage and current.
21. To measure low resistance by Kelvin's double bridge/ Carey Foster's bridge.
22. To study the basic ideas of equal a priori probability, law of two independent events, and probability distribution of identical particles in two compartments for a two option system using coloured dice.

L	T	P	Cr	Marks

PHY 353 MECHANICS AND WAVES

4	**0**	**0**	**4**	**100**

Lecture 45

AIM

The aims and objectives of the course on the **Mechanics and Waves** of the students of B.Sc. (Hons) Chemistry and Mathematics is to acquaint them with the coordinate system, central force problem, simple harmonics motion as well furthering the idea of wave phenomena.

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- The question paper for end semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGCNET (Objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as textbook(s) are suggestive However, any other book may be followed

I LAWS OF MOTION **11 HOURS**

Inertial reference frame, Newton's laws of motion, motion in uniform field, components of velocity and acceleration in different coordinate systems, uniformly rotating frame, fictitious force, Coriolis force and its applications.

II CENTRAL FORCES **11 HOURS**

Conservative and Nonconservative forces, Two particle central force problem, reduced mass, equation of motion, conservation of linear and angular momenta, conservation of energy, Nature of motion under central force and differential equation of motion under central force, Kepler's laws.

III SIMPLE HARMONIC MOTION **11 HOURS**

Simple harmonic motion, differential equation of S.H. M. and its solution, velocity and acceleration of S.H.M., Energy of a simple harmonic oscillator, examples of simple harmonic motion, similarities between electrical and mechanical oscillators.

IV WAVE MOTION **12 HOURS**

Type of waves, the wave equation and its solution, Characteristic impedance of a string, Impedance matching, Reflection and transmission of energy, Reflected and transmitted energy coefficients, Standing waves on a string of fixed length, Energy of a vibrating string. Wave and group velocity their measurements.

Reference Books:

1. Purcell, E.M. *Berkeley Physics Course (Vol. 1), Mechanics*, (Ed), McGrawHill Publication.
2. Feymman, RP, Lighton, RB and Sands, M *The Feymman Lectures in Physics (Vol. 1*),Delhi: BI Publications,
3. Puri, S.P. *Fundamentals of Vibration and Waves:* Tata McGraw Hill Company, New Delhi.
4. Arora, C.L. and Hemne, P.S. *Physics for degree students*, New Delhi: S. Chand Company, 2010.
5. Tayal, D.C. *Mechanics by*, Mumbai: Himalayan Publishing House, 2013.
6. Srivastava, P.K. *Mechanics*: New Age International

Course Code: PHY 354

MECHANICS AND WAVE LAB

Max. Marks: 50

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment's.

Note:

- Students are expected to perform at least eighteen experiments out of following list. The experiments performed in first semester cannot be repeated in second Semester.
- The examination for both the courses will be of 3 hours duration.
- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test**.**

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results

1. Use of Vernier callipers, Screw gauge, Spherometer, Barometer,Sphygmomanometer, Lightmeter, dry and wet thermometer, TDS/conductivity meterand other measuringinstruments based on applications of the experiments. Use ofPlumb line and Spirit level.

2. To analyse the given experimental Data by using the least squares curve fitting and the knowledge of straight line fitting of the experimental data. Also determine the standard deviation and their use in expressing the experimental results. (Note: To achieve these objectives on a sample data of some experiment to be decided by the teacher concerned.)

3. To study the variation of time period with distance between centre of suspension

   and centre of gravity for a bar pendulum and to determine:

   (i) Radius of gyration of bar about an axis through its C.G. and perpendicular toits length.

   (ii) The value of g in the laboratory.

4. Determination of acceleration due to gravity 'g' by Kater's pendulum method.

5. To study moment of inertia of a flywheel.

6. Determination of height (of inaccessible structure) using sextant.

7. To determine the Young's modulus by (i) bending of beam using traveling microscope/laser, (ii) Flexural vibrations of a bar.

8. To study one dimensional collision using two hanging spheres of different materials.
9. To study the magnetic field produced by a current carrying solenoid using a pickup coil/Hall sensor and to find the value of permeability of air.
10. To determine the frequency of A.C. mains using sonometer.
11. To study C.R.O. as display and measuring device by recording sines and square waves, output from a rectifier, verification (qualitative) of law of electromagnetic induction and frequency of A.C. mains.
12. To measure thermo e.m.f. of a thermocouple as a function of temperature and find inversion temperature.
13. Determination of given inductance by Anderson's bridge.
14. To determine the value of an air capacitance by deSauty Method and to find permittivity of air. Also, determine the dielectric constant of a liquid.
15. Study of R.C. circuit with a low frequency a.c. source.
16. Studies based on LCR Board: Impedance of LCR circuit and the phase and between voltage and current.
17. To measure low resistance by Kelvin’s double bridge/ Carey Foster’s bridge.
18. To study the basic ideas of equal a priori probability, law of two independent events, and probability distribution of identical particles in two compartments for a two option system using colored dice.

II. Chemistry

Course Title: Spectroscopy
Course Code: CHE155

L	T	P	Credits
4	0	0	4

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic of spectroscopy. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the spectroscopy and its applications. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

PART A

Pure Rotational Spectra (12 Hours)

Classification of molecules according to their moment of inertia. Rotational energy levels of hydrogen chloride. Determination of molecular geometry by rotational spectrum, isotopic substitution effects. Stark effect, Estimation of molecular dipole moments, Selection rules, Rotational Raman Spectra, anisotropic polarizabilty, specific selection rule in Raman Spectra, Stokes and anti – Stokes lines.

PART B

Vibrational Spectra (12 Hours)

Diatomic molecules, Force constants, Fundamental vibration frequencies, anharmonicity of molecular vibrations and its effect on vibrational frequencies, second and higher harmonies. Frequencies of the vibrational transitions of HCl. Vibrational rotation spectra of CO. P, Q and R branches.

PART C

Infrared and Raman Spectra (9 Hours)

Vibrations of polyatomic molecules. Examples of CO_2, H_2O.Mechanics of measurement of infrared and Raman spectra absorption of common functional groups. Their dependence on chemical environment (bond order, conjugation, hydrogen bonding), the number of active infrared and Raman active lines. Fermi resonance, combination bands and overtones, complications due to interactions of vibrations of similar frequency. Application of IR in structure elucidation of organic compounds.

PART D

UV and Visible Spectroscopy **(12 Hours)**

Measurement technique, Beer – Lambert's Law, molar extinction coefficient, oscillator strength and intensity of the electronic transition, Frank Condon Principle, Ground and first excited electronic states of diatomic molecules, relationship of potential energy curves to electronic spectra. Chromophores, auxochromes, electronic spectra of polyatomic molecules. Woodward rules for conjugated dienes, unsaturated carbonyl groups, extended conjugation. Red shift, blue shift, hypo and hyperchromic effects.

Reference Books:

1 Silverstein, R.M. and Webster, F.X. Spectrometric Identification of Organic Compounds, Wiley, 6th edition, 2007.

2. Kemp, W. Organic Spectroscopy, ELBS, 1996.

3. Banwell, C.N. Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, 4th edition, 1995.

4. Sharma, Y.R. Elementary Organic Spectroscopy; Principle and Chemical Applications, S. Chand & Company Ltd., 2005.

Course Title: Chemistry Lab
Course Code: CHE156

L	T	P	Credits
0	0	3	2

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic concepts of Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Determine the strength of HCl solution by titrating against NaOH solution conductometerically.
2. Determination of total hardness of water (tap) using standard EDTA solution and Eriochrome black T indicator.
3. Determination of alkalinity of water.
4. Determination of surface tension of given liquid by using Stalagmometer.
5. Determination of residual chlorine in a water sample.
6. To determine the specific and molecular rotations of an optically active substance by using polarimeter.
7. 2. To determine the composition of an unknown solution with a polarimeter.
8. Determination of the viscosity of given lubricating oil by using Redwood Viscometer.
9. Determination of distribution coefficient of I_2 between CCl_4 and Water.
10. To study the kinetics of hydrolysis of methyl acetate in the presence of hydrochloric acid.

Reference Books:

1. Levitt, B.P. Findlays Practical Physical Chemistry, London & New York: Longman Group Ltd. 8th edition, 1978.
2. Khosla, B.D., Garg, V.C. and Gulati, A. Senior Practical Physical Chemistry, New Delhi: R.Chand & Co., 11thedition, 2002.
3. Das, R.C. and Behra, B., Experimental Physical Chemistry, Tata McGraw Hill Publishing Co. Ltd., 1983.
4. Vogel's Textbook of Quantitative Chemical Analysis (revised by Jeffery, Bassett, Mendham and Denney), 5th edition, ELBS, 1989.
5. Svehla, G. Vogel's Qualitative Inorganic Analysis (revised), 6th edition, New Delhi: Orient Longman, 1987.
6. Christian G.D. Analytical Chemistry, John Wiley & Sons Inc.

Course Title: Inorganic Chemistry

Course Code: CHE253

L	T	P	Credits
4	0	0	4

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic concepts of Inorganic Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of Inorganic chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

PART A

Atomic Structure and periodic properties **(12 Hours)**

Wave mechanical model of Hydrogen atom, The de Broglie relationship, The uncertainty principle, Schrodinger wave equation and its derivation, Significance of Ψ and Ψ^2, Quantum numbers, Normal and orthogonal wave functions, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations. Concept of extra stability of half and completely filled electronic configuration, Electronic configuration of elements, Penetration and shielding (The Slater's rules). The origin and distribution of the elements, The structure of the periodic table, Atomic parameters and their variation in periodic table, Electronegativity and various scales.

PART B

Ionic Compounds (Bonding and structures) **(12 Hours)**

Properties of ionic substances, Occurrence of ionic bonding, The radius ratio rules, Efficiency of packing, Hexagonal close packing, Cubic close packing, Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Calcium carbide, Lattice energy, Born-Haber cycle, The calculations of the lattice energy on the basis of Born-Lande equation, Covalent character in predominantly ionic compounds, Imperfections of crystals, Polarizing power and polarisability of ions, Fajan's rule.

PART C

Covalent Bond **(12 Hours)**

The Lewis theory, Valence bond theory - A mathematical approach, Resonance, Valence Shell Electron Pair Repulsion Model (VSEPR theory), Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory. Concept of hybridization, Rules for obtaining hybrid orbitals, Extent of d-orbital participation in molecular bonding (SO_2, PCl_5, SO_3), Molecular orbital theory (LCAO method), Symmetry of molecular orbitals, Applications of MOT to homo- and hetero-nuclear diatomic molecules, Molecular orbital energy level diagrams (Be_2, N_2, O_2, F_2, NO, CO, HCl, NO_2, BeH_2).

PART D

Coordination chemistry **(8 Hours)**

Werner's theory, nomenclature of coordination complexes, isomerism in coordination complexes, chelating agents, metal chelates and chelate effects, names and abbreviations of important ligands, polydenate ligands, polypyarzolyborates, macrocylic ligands, macrocylic effect, ketoenolates, troplonates, tripod ligands, conformation of chelate rings, factors determining kinetic and thermodynamic stability.

Reference Books:

1 Shriver, D.F.C., Atkins, P.W. and Langford, C.H. *Inorganic Chemistry,* ELBS Oxford, 1991.
2. Huheey, J.E. Keiter, E.A. and Keiter, R.L. *Inorganic Chemistry,* 4th edition, Singapore: Pearson Education, 1999.
3. Lee, J.D. *Concise Inorganic Chemistry,* ELBS, Oxford, 1994.

Course Title: Inorganic Chemistry Lab

Course Code: CHE254

L	T	P	Credits
0	0	3	2

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic concepts of Inorganic Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in inorganic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

Qualitative Analysis

Identification of cations and anions in a mixture which may contain combinations of acid ions.

These must contain interferring acid anions and one, the insoluble.

a) Special Tests for Mixture of anions

I. Carbonate in the presence of sulphate.
II. Nitrate in the presence of nitrite
III. Nitrate in the presence of bromide and iodide.
IV. Nitrate in the presence of chlorate.
V. Chloride in the presence of bromide and iodide.
VI. Chloride in the presence of bromide.
VII. Chloride in the presence of iodide.
VIII. Bromide and iodide in the presence of each other and of chloride.
IX. Iodate and iodide in the presence of each other.
X. Phosphate, arsenate and arsenite in the presence of each other.
XI. Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
XII. Borate in the presence of copper and barium salts.
XIII. Oxalate in the presence of fluoride.
XIV. Oxalate, tartrate, acetate, citrate in the presence of each other.

b) Separation and identification of cations in mixtures

i) Separation of cations in groups.
ii) Separation and identification of Group I, Group II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations.

Reference Books:

1. 1. 1. Svehla, G. and Sivasankar, B. *Vogel's Qualitative Inorganic Analysis (revised),* Pearson, 7th edition, 1996.
2. Bassett, R. C., Denney, G. H. and Jeffery, J. Mendham, *Vogel's Textbook of Quantitative Inorganic Analysis (revised)*, 4th edition, Orient Longman, 1978.

BSc (Physics, Botany, Zoology, Biotechnology, Microbiology, Biochemistry, Mathematics)

(Semester 5)

Course Title: PHYSICAL CHEMISTRY
Course Code: CHE353

L	T	P	Credits
4	0	0	4

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic concepts of Physical Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of physical chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

PART A

Chemical Thermodynamics **(15Hours)**

Objectives and limitations of Chemical Thermodynamics, State functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy.

First Law of Thermodynamics: First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas. Irreversible isothermal and adiabatic expansion, .Enthalpy change and its measurement, standard heats of formation and absolute enthalpies. Kirchoff's equation.

Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle), Entropy, Entropy changes of an ideal gas with changes in P,V, and T, Free energy and work functions, Gibbs-Helmholtz Equation.,

Criteria of spontaneity in terms of changes in free energy, Third law of thermodynamics, Absolute entropies.

PART B

Chemical Equilibrium **(5 Hours)**

General characteristics of chemical equilibrium, thermodynamicderivation of the law of chemical equilibrium, Van't Hoff reaction isotherm. Relation between Kp, Kc and Kx. Temperature dependence of equilibrium constant-Van't Hoff equation, homogeneous & heterogeneous equilibrium, Le Chetalier's principle.

PART C

Chemical Kinetics **(15 Hours)**

Rates of reactions, rate constant, order and molecularity of reactions.Chemical Kinetics: Differential rate law and integrated rateexpressions for zero, first, second and third order reactions. Half-lifetime of a reaction, Methods for determining order of reaction, Effect of temperature on reaction rate and the concept of activation energy, Reaction mechanism, Steady state hypothesis

Catalysis

Homogeneous catalysis, Acid-base catalysis and enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis, Unimolecular surface reactions.

PART D

Electro-Chemistry **(5 Hours.)**

Specific conductance, molar conductance and their dependence on electrolyte concentration, Ionic Equilibria and conductance, Essential postulates of the Debye-Huckel theory of strong electrolytes, Mean ionic activity coefficient and ionic strength, Transport number and its relation to ionic conductance and ionic mobility, Conductometric titrations, pH scale, Buffer solutions, salt hydrolysis, Acid-base indicators.

Electrochemical cells **(5Hours.)**

Distinction between electrolytic and electrochemical cells, Standard EMF and electrode potential, Types of electrodes, Reference electrode, Calculation of NG, NH, NS and equilibrium constant from EMF data, Potentiometric determination of pH, Potentiometric titrations.

Reference Books:

1. Atkins, P.W. *Physical Chemistry,* Oxford University Press, 8th edition, 2006 (Indian Print).
2. Engel, T. and Reid, P. *Physical Chemistry,* Pearson Education, 1st edition, 2006.
3 Castellan, G. W. *Physical Chemistry,* Wisley/Narosa, 3rd edition, 1985 (Indian Print).
4. Barrow, G. M. *Physical Chemistry*, New York: McGraw Hill, 6th edition, 1996.
5. Silbey, R. J., Albert, R. A. and Bawendi, Moungi G. *Physical Chemistry,* 4th edition, New York: John Wiley, 2005.

This syllabus has been designed as per national syllabus suggested by UGC and covers 20% extra syllabus as per requisite of honors degree.

L	T	P	Credits

Course Title: PHYSICAL CHEMISTRY LAB
Course Code: CHE354

0	0	3	2

Course Objectives: **Time: 04 Hours**

To teach the fundamental concepts of Physical Chemistry and their applications. The syllabus pertaining to B.Sc. (Other branches.) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

Expected Prospective:

The students will be able to understand the basic objective of experiments in organic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Treatment of experimental data

Recording of experimental data. Significant number, accuracy and precision, error analysis.

2. Liquids and Solutions

(i) To determine relative viscosities of aqueous solutions of glycerol at different concentrations. (ii) Calculate partial molar volume of glycerol at infinite dilution from density measurement.

(ii) To determine viscosity-average molecular weight, number-average molecular weight and mean diameter of polyvinyl alcohol molecule from intrinsic viscosity data.

3. Thermochemistry

(i) To determine heat capacity of a calorimeter and heat of solution of a given solid compound.

(ii) To determine heat of solution of Solid calcium chloride and calculate lattice energy of calcium chloride using Born-Haber cycle.

(iii) To determine heat of hydration of copper sulphate.

4. Distribution Law

(i) To determine distribution (i.e. partition) coefficient of a solute between water and a non-aqueous solvent.

5. Surface Phenomena

To study the adsorption of acetic acid/oxalic acid from aqueous solution on charcoal. Verify Freundlich and Langmuir adsorption isotherms.

6. Colorimetery

(i) To verify Lambert-Beer law.

7. pH-metry

(i) To titrate a strong acid against a strong base pH-metrically.

(ii) To titrate a weak acid against a strong base and determine the ionization constant of the weak acid.

Reference Books:

1 Levitt, B.P. *Findlays Practical Physical Chemistry,* London & New York: Longman Group Ltd., 8th edition, 1978.

2. Khosla, B.D., Garg, V.C. and Gulati, A. *Senior Practical Physical Chemistry*, New Delhi: R. Chand & Co., 11thedition, 2002.

3. Das, R.C. and Behra, B. *Experimental Physical Chemistry*, Tata McGraw Hill Publishing Co. Ltd. 1983.

4. *Vogel's Textbook of Quantitative Chemical Analysis* (revised by Jeffery, Bassett, Mendham and Denney), ELBS, 5th edition, 1989.

5. Svehla, G. *Vogel's Qualitative Inorganic Analysis (revised),* 6th edition, New Delhi: Orient Longman, 1987.
6. Christian, G.D. *Analytical Chemistry*, Wiley, 6th edition.

This syllabus has been designed as per national syllabus suggested by UGC and covers 20% extra syllabus as per requisite of honors degree.

Course Title: Organic Chemistry
Course Code: CHE153

L	T	P	Credits
4	0	0	4

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic concepts of Organic Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of Organic chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ /Subjective type surprise test will be considered towards final each of 12.5% weightage to the final.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

PART A

Compounds of Carbon **(8 Hours)**

Differences in chemical and physical behaviour as consequences of structure. Discussion (with mechanism) of reactions of hydrocarbons' ranging from saturated acyclic and alicyclic, unsaturated dienes and aromatic systems. Huckel rule; as applied to 4n+2 systems. Industrial sources and utility of such compounds in daily life for medicine clothing and shelter.

PART B

Stereochemistry **(15 Hours)**

Structure, reactivity and stereochemistry. Configuration and conformation. Optical activity due to chirality; d,l, meso and diastereoisomerism, sequence rules. Reactions involving stereoisomerism. Geometrical isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature. Conformational isomerism – conformational analysis of ethane and n-butane; conformations cyclohexane, axial and equatorial bonds, conformations of monosubstituted cyclohexane derivatives. Newman projection and Sawhorse formula, Fischer and flying wedge formulae.

PART C

Alkyl Halides **(8 Hours)**

Structure of alkyl halides and their physical properties. Preparation from alcohols, hydrocarbons, alkenes and by halide exchange method.

Reactions : (i) Nucleophilic substitution (SN2 and SN1) kinetics, mechanism, stereochemistry, steric and electronic factors, reactivity of alkyl halides, rearrangement, dependence on nucleophile, role of solvent (ii) Elimination E2 and E1 mechanism, stereochemistry, kinetics, rearrangement.

Alcohols **(4 Hours)**

Structure, physical properties (Hydrogen bonding), Methods of preparation: Grignard synthesis (scope and limitations),

Reactions: Reactions with hydrogen halides. Mechanism and rearrangement, Reaction with Phosphorous trihalides, mechanism of Dehydration rearrangement.

PART D

Ethers **(2 Hours)**

Structure, Physical properties, preparation (Williamson synthesis). Reactions: Cleavage, by acids, Electrophilic substitution in ethers.

Aldehydes and Ketones **(8 Hours)**

Structure, Physical Properties; Methods of Preparation: Oxidation of Primary and secondary alcohols, Oxidation of methylbenzenes, Reduction of acid chlorides, Friedel- Crafts Acylation,

Reactions; Nucleophilic addition, Addition of Grignard reagents, Addition of cyanide. Addition of Bisulphite, Addition of derivatives of ammonia. Acetal Formation, Cannizzaro reaction, Aldol Condensation.

Reference Books:

1. Morrison R.N. and Boyd, R.N. *Organic Chemistry*, Pearson Education, Dorling Kindersley (India) Pvt. Ltd.
2. Finar, I.L. *Organic Chemistry* (Volume 1), Pearson Education, Dorling Kindersley (India) Pvt. Ltd.
3. Eliel, E.L. and Wilen, S.H. *Stereochemistry of Organic Compounds*, London: Wiley, 1994.
4. March, Jerry. *Advanced Organic Chemistry: Reactions, Mechanism and Structure*, John Wiley, 6th edition, 2007

Course Title: ORGANIC CHEMISTRY LAB
Course Code: CHE154

L	T	P	Credits
0	0	3	2

Course Objectives: **Time: 04 Hours**

This course is intended to learn the basic concepts of Organic Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in organic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Calibration of Thermometer
80-82^o (Naphthalene), 113-114^o (acetanilide).
132.5-133^o (Urea), 100^o (distilled Water)
2. Determination of melting point
Naphthalene 80-82^o, Benzoic acid 121.5-122^o
Urea, 132.5-133^o, Succinic acid 184-185^o
Cinnamic acid 132.5-133^o, Salicylic acid 157-5-158^o
Acetanilide 113-5-114^o, m-Dinitrobenzene 90^o
P-Dichlorobenzene 52^o. Aspirin 135^o.
3. Determination of boiling points
Ethanol 78^o, Cyclohexane 81.4^o, Toluene 110.6^o, Benzne 80^o.
4. Mixed melting point determination
Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)
5. Distillation
Simple distillation of ethanol-water mixture using water condenser,
Distillation of nitrobenzene and aniline using air condenser.
6. Crystallization
Concept of induction of crystallization
Phthalic acid from hot water (using fluted filter paper and stemless funnel), Acetanilide from boiling water,
Naphthalene from ethanol,
Benzoic acid from water.
7. Decolorisation and crystallization using charcoal
Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorising carbon) from ethanol.
8. Sublimation (Simple and Vacuum)
Camphor, Naphthalene, Phthalic acid and Succinic acid.
9. Extraction: the separatory funnel, drying agent:
Isolation of caffeine from tea leaves
10. Steam distillation

Purification of aniline/nitrobenzene by steam distillation.

Reference Books:

1. 1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G. Vogel's Text Book of Practical Organic Chemistry, 5th edition, ELBS, 1989.
2. Pavia, D.L., Lampanana, G.M. and Kriz, G.S. Jr. Introduction to Organic Laboratory Techniques, Thomson Brooks/Cole, 3rd edition, 2005.
3. Mann, F.G. and Saunders. P.C. Practical Organic Chemistry, London: Green & Co. Ltd., 1978.
4. Svehla, G. Vogel's Qualitative Inorganic Analysis (revised), Orient Longman, 7th edition, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H. and Mendham, J. Vogel's Textbook of Quantitative Inorganic Analysis (revised), Orient Longman, 4th edition, 1978.

III. ENVIRONMENTAL

L	T	P	Credits	Marks
3	0	0	2	50

Course Title: Environment Education
Paper Code: EVS102

Course Objective: This course aims at understanding the students in aspects of environmental problems, its potential impacts on global ecosystem and its inhabitants, solutions for these problems as well as environmental ethics which they should adopt to attain sustainable development.

Unit 1

The multidisciplinary nature of environmental studies (2 Hours)

Definition, scope and importance, Need for public awareness

Natural Resources: Renewable and non-renewable resources: (8 Hours)

Natural resources and associated problems.

(a) **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) **Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) **Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Ecosystem: (4 Hours)

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids

- Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Unit II

Biodiversity and its conservation **4 Hours**

- Introduction – Definition: Genetic, Species and Ecosystem Diversity
- Bio-geographical classification of India
- Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity, global and national efforts.
- Genetically modified crops
- Cartagena Protocol
- Biodiversity Act

Environmental Pollution **8Hours**

- Definition, causes, effects and control measures of:

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear pollution

- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

Indoor Pollution: **2 Hours**

- Practical tips on how to save the self from self-inflicted pollution.
- Basics of toxicity.

- Problems of lifestyle based diseases.
- Solutions needed for safety.

Unit III

Social Issues and the Environment **7 Hours**

- Population growth, variation among nations, Population explosion – Family Welfare Programmes.
- Environment and human health,
- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Laws: The Environment Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and control of Pollution) Act 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980.
- Issues involved in enforcement of environmental legislation
- Public Awareness

Unit IV

Human Population and Environment5 Hours

- Population Growth and Variations among Nations
- Population Explosion
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

Global environmental issues **5 Hours**

- Stockholm Conference
- Brundtland Commission
- Montreal Protocol
- Kyoto protocol
- Earth Summit
- World Summit

Field Work **5 Hours**

- Visit to a local area to document environmental assets river/ forest/ grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-Pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Reference Books:

1. Odum, EP. *Basic Ecology*. Japan : Halt Saundurs, 1983.
2. Botkin, DB, and Kodler EA. *Environmental Studies: The Earth as a living planet.* New York: John Wiley and Sons Inc., 2000.
3. Singh, JS, Singh, SP, and Gupta SR. Ecology, *Environment and Resource Conservation.* New Delhi: Anamaya Publishers, 2006.
4. De, AK. *Environmental Chemistry*. New Delhi: Wiley Eastern Ltd., 1990.
5. Sharma, PD. *Ecology and Environment*. Meerut Rastogi Publications, 2004

Course Title: Road Safety and Legal Awareness
Paper Code: EVS103

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: This course aims to aware the students about safety measures taken during driving and commuting on roads.

Unit I

Road Safety **6 Hours**

- Road safety: Concept and its importance.
- Attitude of people towards road safety
- Role of traffic police in road safety
- Traffic rules
- Traffic signs
- How to obtain driving license
- Traffic offences, penalties and procedures
- Common driving mistakes
- Significance of first-aid in road safety
- Role of civil society in road safety and Traffic police-public relationship
- Motor Vehicle Act 1998 (2010)

Unit II

Legal Awareness **4 Hours**

- Legal literacy
- Child labour
- Domestic Violence
- Right to Education

Reference Books:

1. Botkin, DB, and Kodler EA. *Environmental Studies: The Earth as a living planet.* New York: John Wiley and Sons Inc., 2000.
2. Singh, JS, Singh, SP, and Gupta SR. Ecology, *Environment and Resource Conservation.* New Delhi: Anamaya Publishers, 2006.
3. Sharma, PD. *Ecology and Environment*. Meerut Rastogi Publications, 2004

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.

IV. ENGLISH

Course Title: Basic Communication Skills

L	T	P	Credits	Marks
4	0	0	3	75

Course Code: ENG151

No. Of Lectures: 60

Course Objective:

- To enhance students' vocabulary and comprehensive skills through prescribed texts.
- To hone students' writing skills.

Learning Outcomes: Students will be able to improve their writing skills as well as will enrich their word power.

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced tests will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. Students are expected to provide reasoning/solution/working for the answer. They will attempt all questions. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise tests will be taken. Two best out of four objective/MCQ type surprise tests will be considered towards final, each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

Unit – A Applied Grammar (Socio-Cultural Context)	
• Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection	5 hours
• Tenses (Rules and Usages in Socio-cultural contexts)	6 hour
• Modals: Can, Could, May, Might, Will, Would, Shall, Should, Must, Ought to	5hours

• Passives	5 hours
• Reported/Reporting Speech	5 hour
Unit – B Reading (Communicative Approach to be Followed)	
• J M Synge: Riders to the Sea (One Act Play)	7 hours
• Anton Chekhov : Joy (Short Story)	5 hours
• Swami Vivekanand : The Secret of Work (Prose)	7 hours
Unit – C Writing	
• Paragraph and Essay Writing	***5Hours***
• Letter Writing: Formal and Informal	***5 hours***
• Notice and Email	***5hours***

Reference Books:

a. Books

1. Kumar, Sanjay and PushpLata. *Communication Skills*. India: OUP, 2012. Print.
2. Vandana, R. Singh. *The Written Word* by. New Delhi: Oxford University Press, 2008. Print.

b. Websites

1. www.youtube.com (to download videos for panel discussions)
2. www.letterwritingguide.com
3. www.teach-nology.com
4. www.englishforeveryone.org
5. www.dailywritingtips.com
6. www.englishwsheets.com
7. www.mindtools.com

Course Title: Basic Communication Skills

L	T	P	Credits	Marks
0	0	2	1	25

Course Code: ENG 152

No. Of Lectures: 30

Course Objective:

- To improve fluency in speaking English.
- To promote interactive skills through Group Discussions and role plays.

Learning Outcome: Students will get exposure to speaking through the above mentioned interactive exercises. In addition, they will develop a technical understanding of language learning software, which will further improve their communicative skills.

Unit – A Speaking/Listening	
• Movie-Clippings	10 hours
• Role Plays	10 hours
• Group Discussions	10 hours

Instructions:

1. Each student will prepare a scrap file on any of the topics given by class teacher. Student should be able to justify the contents of his/her Scrap file, which carries the weightage of 10 marks. Marks will be given for originality, creativity and presentation of thoughts.
2. In the end of semester, viva exam will be conducted. Viva will be for 10 marks. Spoken English will be the focus of exam. Examiner will ask questions related to scrap file and other general (non-technical) topics.
3. In the End-term exam, lab activity will carry the weightage of 10 marks.
4. Acknowledge all the sources of information in your scrap file.

Reference Books:

Books

1. Gangal, J. K. *A Practical Course In Spoken English.* India: Phi Private Limited, 2012. Print.
2. Kumar, Sanjay and PushpLata. *Communication Skills*. India: OUP, 2012. Print.

Websites

1. www.youtube.com (to download videos for panel discussions)
2. www.englishforeveryone.org
3. www.talkenglish.com
4. www.mindtools.com

Course Title: ENGLISH

L	T	P	Credits	Marks
4	0	0	4	100

Course Code: ENG180
Total Lectures: 60

Course Objective: To familiarize students of non-literary programmes with some of the basics of literary studies through a critical study of the prescribed texts

Learning Outcomes:

Unit – A *Never Never Nest* by Cedric Mount	
• Consumerist Lifestyle	3 hours
• Bank Loans and Modern Times	3 hours
• Character Analysis	5 hours
• Stylistic Analysis	4 hours
Unit – B *Guide* by R. K. Narayana	
• Interpersonal Relationships	4 hours
• Religious Beliefs/Rituals in Rural India	4 hours
• Character Analysis	4 hours
• Stylistic Analysis	3 hour
Unit – C *Twelfth Night* by Shakespeare	
• Salient Features of Shakespearean Comedy	5 hours
• Character Analysis	5 hours
• Stylistic and Thematic Analysis	5 hours
Unit – D *Animal Farm* by George Orwell	
• Marxist Principles	5 hours
• As a Progressive Text	5 hours
• Symbolic Analysis	5 hours

Reference Books:

1. Falvey, Peter ,Peter Kennedy. *Learning Language Through Literature: A Sourcebook for Teachers of English in Hong Kong.* HKU: Hong Kong University Press, 1997.
2. www.britishcouncil.com
3. Kumar, Sukrita Paul. *Language, Literature And Creativity*. New Delhi: Orient Blackswan Pvt Ltd, 2010.
4. Swann, Joan , Robert Pope and Ronald Carter. *Creativity in Language and Literature: The State of the Art.* USA : Palgrave MacMillan, 2011.

V. COMPUTER APPLICATIONS

Course Title: Principles of Computer Science

Course Code: CSA251
Course Duration: 45 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to introduce students to the basic knowledge about the data storage, manipulations, and type of functions of operating system, network protocols, algorithm designing, data structures and software engineering concepts.

UNIT-A **12 Hours**

Data Storage

 Storage of Bits, Main Memory, Mass Storage

 Coding Information of Storage

 The Binary System, Storing Integers

Data Manipulations

 The Central Processing Unit, The Stored Program Concept

 Program Execution, Arithmetic/Logic Instruction

UNIT-B **12 Hours**

Operating System and Networks

 The Evaluation of Operating System, Operating System Architecture

 Functions of Operating System, Types of Operating System

 Networks, Network Protocols

Algorithms

 The Concept of Algorithm, Algorithm Representation

 Iterative Structures, Recursion Structures

UNIT-C **11 Hours**

Programming Language

 Historical Perspective, Traditional Programming Concepts

 Program Units, Parallel Computing

Data Structures

 Array, List, Stacks, Queues

UNIT-D **10 Hours**

Software Engineering

 The Software Engineering Discipline, The Software Life Cycle

 Development Tools and Techniques

Database Structures

 General Issues, The Relational Model

 Object Oriented Database, Maintaining Database Integrity

 Entity Relationship Model

Reference books:

1. Brookshear, J.Gein. *Computer Science: An Overview*. Addition-Wesley.
2. Lippman, Stanley B., and Lojoie, Josee. *C++ Primer Third Edition.* Addition-Wesley.
3. Kanetker, Yashwant. *Let us C*. New Delhi: BPB Publications. 2011
4. Balagurusamy E. *Programming in ANSI C*. New Delhi: McGrawHill. 2011.

Course Title: Programming in C
Course Code: CSA255
Course Duration: 45 Hours

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: The objective of the course is to introduce students to the basic knowledge about the data storage, manipulations, and type of functions of operating system, network protocols, algorithm designing, data structures and software engineering concepts.

UNIT-A **12 Hours**

Data Storage

- Storage of Bits, Main Memory, Mass Storage
- Coding Information of Storage
- The Binary System, Storing Integers

Data Manipulations

- The Central Processing Unit, The Stored Program Concept
- Program Execution, Arithmetic/Logic Instruction

UNIT-B **12 Hours**

Operating System and Networks

- The Evaluation of Operating System, Operating System Architecture
- Functions of Operating System, Types of Operating System
- Networks, Network Protocols

Algorithms

- The Concept of Algorithm, Algorithm Representation
- Iterative Structures, Recursion Structures

UNIT-C **11 Hours**

Programming Language

- Historical Perspective, Traditional Programming Concepts
- Program Units, Parallel Computing

Data Structures

- Array, List, Stacks, Queues

UNIT-D **10 Hours**

Software Engineering

- The Software Engineering Discipline, The Software Life Cycle
- Development Tools and Techniques

Database Structures

- General Issues, The Relational Model
- Object Oriented Database, Maintaining Database Integrity
- Entity Relationship Model

Reference books:

1. Gottfried and Byron S. *Programming with C*. New Delhi: Tata McGraw Hill. 1992.
2. Balagurusamy E. *Programming in ANSI C*. New Delhi: McGrawHill. 2011.

3. Hanly R. Jeri and Koffman Elliot P. *Problem Solving and Program Design in C*. India: Addison Wesley. 2011.
4. Kanetker, Yashwant. *Let us C*. New Delhi: BPB Publications. 2011.

Course Title: Programming in C Laboratory

L	T	P	Credits	Marks
0	0	2	1	25

Course Code: CSA256

Implementation of C programming concepts:

- Control Structures, Loops, Arrays, Strings

- Functions, Structures, Union, Files, etc.

VI. General Knowledge and Current Affairs

Course Title : General Knowledge and Current Affairs
Course Code : SGS-102

L	T	P	Credits	Marks
2	0	0	2	50

COURSE OBJECTIVES

The study of General Knowledge and Current Affairs has become even more important today. It is not only a major constituent of most competitive examinations but also aids in acquiring general awareness.

The objectives of this course are :

- To introduce students with the course and contents of various competitive examinations
- To prepare a foundation for appearing in various competitive examinations
- To sensitize the students about the current issues and events of national and international importance
- To provide opportunity to the students to study inter disciplinary subjects like Geography, Science, Economy, Polity, History, International Relations etc.

Learning Outcomes:

- Students would get an opportunity to aspire, plan and prepare for various competitive examinations in advance.
- It would polish their personalities and sharpen the skills of debates, group discussions, communication, interview etc.
- Students would acquire general awareness of National and International Events.

Unit — A

General Geography

World Geography :

The Universe, The Solar System, The Earth, Atmosphere, The World we live in, Countries rich in Minerals, Wonders of the World, Biggest and Smallest. **3 hours**

Indian Geography :

Location, Area and Dimensions, Physical Presence, Indian States and Union Territories, Important sites and Monuments, Largest-Longest and Highest in India. **3 hours**

General History

Glimpses of India History, Ancient Indian, Medieval India, Modern India, Various Phases of Indian National Movement, Prominent Personalities. Glimpses of Punjab history with special reference to period of Sikh Gurus. **3 hours**

Glimpses of World History

Important Events of World History, Revolutions and Wars of Independence, **3 hours**

Political Philosophies like Nazism, Fascism, Communism, Capitalism, Liberalism etc.

Unit — B

General Polity

World Politics – Major Actors and their political relations, UNO and other organizations viz: WTO, EU, SAARC, ASEAN, BRICS, WTO, OIC, OAU, OPEC, GCC etc. **3 hours**

Indian Polity : Constitution of India :

Important Provisions, Basic Structure, Union Government, Union Legislature and Executive, State Government: State Legislature and Executive, Indian Judiciary, The Election Commission, Panachayati Raj System, RTI etc. **3 hours**

General Economy :

The process of liberalization, privatization, globalization and Major World Issues. Indian Economy, Indian Financial System, Major Economic Issues, Economic Terminology. **3 hours**

Unit — C

General Science :

General appreciation and understandings of science including the matters of everyday observation and experience. Inventions and Discoveries. **3 hours**

Sports and Recreation : **3 hours**

The World of Sports and recreation. Who's Who is sports, Major Events, Awards and Honours. Famous personalities, Festivals. Arts and Artists.

Current Affairs :

National and International Issues and Events in News. Governments Schemes and Policy Decisions. **3 hours**

India and Neighbours:

Current phase relations with China, Pakistan, Bangladesh, Nepal, Sri Lanka and Afghanistan **3 hours**

Unit — D

Miscellaneous Information

Who is who

Books and Authors, Persons in News, Awards and Honours, Abbreviations and Sports **2 hours**

Total : 35 Hours

Reference Books:

Books

1. Aggarwal, R. S. *Advance Objective General Knowledge*, S. Chand Publisher (2013)
2. Sen, S. *Concise General Knowledge Manual 2013*, Unique Publishers,2013
3. Verma, R P. *Encyclopedia of General Knowledge and General Awareness,* Penguin Books Ltd (2010)
4. Thorpe, Edgar. And Thorpe, Showick. *General Knowledge Manual 2013-14*, the Pearson, Delhi.
5. Mohanty, Muktikanta. *General Knowledge Manual 2013-14*, Macmillan Publishers India Ltd., Delhi.
6. India 2013, *Government of India (Ministry of Information Broadcasting*), Publication Division, 2013.
7. Methew, Mammen. *Manorama Year Book 2013-14*, Malayalam Manorama Publishers, Kottayam, 2013.

8. *Spectrum's Handbook of General Studies – 2013-14*, Spectrum Books (P) Ltd., New Delhi
9. *Unique Quintessence of General Studies – 2013-14*, Unique Publishers, New Delhi.

CURRENT AFFAIRS

Magazines

Economic and Political Weekly, Yojna, the Week, India Today, Frontline, Spectrum.
Competition Success Review, Competition Master, Civil Services Chronicle, Current Affairs, World Atlas Book

Newspapers

The Hindu, Times of India, The Hindustan Times, The Tribune

VII. HUMAN VALUES AND ETHICS

L	T	P	Credits	Marks
2	0	0	2	50

Course Title : Human Values and Ethics

Course Code : SGS - 101

Course Objectives

- To sensitize students about the role and importance of human values and ethics in personal, social and professional life.
- To encourage students to read and realize the values of enlightened human beings.

- To enable students to understand and appreciate ethical concerns relevant to modern lives.

Learning Outcomes:

Students becoming responsible citizens and better professionals who practise Values and Ethics in every sphere of life.

Unit - A

Human Values

1.	**Concept of Human Values:** Meaning, Types and Importance of Values.	**2 hours**
2.	**Human Values :** Lessons from the lives and teachings of great thinkers.	3 **hours**
3.	**Value Education :** The content of value education	**2 hour**
4.	**Value crisis and its redressal.**	**1 hour**

Unit - B

Being Good and Responsible

1.	Self Exploration and Self Evaluation	**2 hour**
2.	Acquiring Core Values for Self Development	**2 hour**
3.	Living in Harmony with Self, Family, Society and Nature	**3 hours**
4.	Values enshrined in the Constitution : Liberty, Equality Fraternity and Fundamental Duties.	3 **hours**

Unit - C

Value – based living

1.	Vedic values of life	**2 hour**
2.	*Karma Yoga* and *Jnana Yoga*	**2 hours**
3.	*Ashta Marga* and *Tri-Ratna*	**2 hours**
4.	Truth, Contentment and Wisdom	**2 hours**

Unit - D

Ethical Living:

Ethics: Difference between Ethics and Values

1.	Personal Ethics	**2 hours**
2.	Professional Ethics	**3 hours**
3.	Ethics in Governance	**2 hours**
4.	Ethics in Education	**2 hours**

Total = 35 hours

Reference Books:

1. Sreedharan,E. and Wakhlu,Bharat. Ed. *Restoring Values.* New Delhi: Sage Publications Ltd., 2010.
2. Nagarajan, K. *Indian Ethos and Values*.New Delhi: Tata McGraw Hill, 2011
3. Tripathi, A N. *Human Values*. New Delhi: New Age International Publishers, 2009

4. Sankar. *Indian Ethos and Values in Management*. New Delhi: Tata McGraw Hill Education Pvt. Ltd.

5. Osula.*Values and Ethics.* New Delhi: Asian Books, 2001.

6. Surbiramanian, R. *Professional Ethics*. New Delhi: Oxford University Press, 2013.

7. Anand, Rishabh. *Human Values and Professional Ethics,* New Delhi: Satya Prakashan, 2012

8. Bhalla, Sanjeev. *Human Values and Professional Ethics*.New Delhi: Satya Prakashan, 2012.

9. Soryan, Ritu. *Human Values and Professional Ethics*. New Delhi: Dhanpat Rai & Co. Pvt. Ltd., 2010.

10. Jayshree, Suresh, and B S, Raghavan. *Human Values and Professional Ethics.* New Delhi: S Chand & Co. Ltd.,2007.

11. Shukla, Dr. R K, Misra, Anuranjan. *Human Values and Professional Ethics*, A B Publication, 2010.

12. Sharma,Vayu. *Human Values and Professional Ethics*. New Delhi: Education of India Language publishers, 2012.

13. Kannan,S, and Srilakshmi,K. *Human Values and Professional Ethics*.New Delhi: Taxmann Publication, Pvt. Ltd., 2009

14. Srivastava, Smriti. *Human Values and Professional Ethics*. New Delhi: S K Kataria & Sons, 2001

15. Singh, Yogendra, and Garg, Ankur. *Human Values and Professional Ethics*. New Delhi: Aitbs publishers, 2011.

16. Kumar, Vrinder. *Human Values and Professional Ethics*. Ludhiana: Kalyani Publishers, 2013.

17. Gaur,R R, Sangal, R. Bagaria, GP. *Human Values and Professional Ethics*. New Delhi: Excel Books, 2010.

18. Osula, Dr. Bramwell and Upadhyay, Dr. Saroj. *Values and Ethics,* New Delhi : Asian Books Pvt. Ltd., 2011.

19. *Complete works of Swami Vivekanand*, Calcutta: Advaita Ashram, 1931.

20. Radhakrishnan, S. *Indian Philosophy*, George Allen & Unwin Ltd., New York: Humanities Press INC, 1929.

21. Dwivedi, A N. *Essentials of Hinduism, Jainism and Buddhism,* New Delhi: Books Today– 1979

22. Saraswati, Maharishi Dayanand. *Light of Truth: Satyarth Parkash*. New Delhi: Arya Swadhyay Kendra, 1975.

23. Bhan, Suraj. *Dayanand : His life and work.* New Delhi : DAVCMC, 2001.

24. Raghavan, V, and Iyer, N. *Moral and Political Thoughts of Mahatma Gandhi*. New Delhi : Oxford University Press India, 2000.

25. Singh, Narain. *Guru Nanak Dev's view of life*. Amritsar: Bhagat Puran Singh All India Pingalwara Society, 2010.

26. Dwivedi, Kapil Dev. *Esence of Vedas*. Hoshiarpur : Katyayan Vedic Sahitya Prakashan,1990.

27. Chaubey,B B. *Vedic* Concepts. Hoshiarpur : Katyayan Vedic Sahitya Prakashan, 1990.

28. Radhakrishnan, Saravapalli. *Mahatma Gandhi : Essays and Reflections on his life*. Mumbai: Zaico Publication, 1977.

29. Hardayal, Lala. *Hints for Self Culture*, Mumbai:Jaico Publishing House, 1961.

30. Saraswati Dayanand, *The Light of Truth (The Satyartha Prakashan)*.New Delhi:

31. Krishnamurti J. *The First and Last Freedom*

32. Maharishi, Sri Raman. *Who Am I.*

33. Balsekar, Ramesh S. *Peace and Harmony in Daily Living*. New Delhi: Yogi Impressions.

Course Title: Stenography

Course Code: SGS104

L	T	P	Credits	Marks
3	0	0	1	25

Course Objective: The course is to inculcate writing and listening skills among the students. This would act as building blocks for the learner to begin the study of stenography. As the learners are from the senior secondary background the course has been created keeping in mind their requirements for the future.

Learning Outcome:

After going through this course the participant would have understood the basic concepts of shorthand language and would be able to apply them in daily life. Completion of the course will improve their

speed of writing and typing. They would be able to pronounce the English words correctly and can use effective English communication.

Unit A I. The Consonants II. The Vowels III. Intervening Vowels and Position Grammalogues, Punctuation IV. Alternative Signs for r and h V. Diphthongs Abbreviated w. VI. Phaseography Tick the VII. Circle s and z—Left and Right Motion VIII. Stroke s and z IX. Large Circles sw and ss or sz X. Loops st and str.	12 hours
Unit B XI. Initial Hooks to Straight Strokes and Curves XII. Alternative Forms for fr, vr, etc. Intervening Vowels XIII. Circle or Loop Preceding Initial Hook XIV. n and f Hooks XV. Circles and Loops to Final Hooks.XVI The shun hook. XVII. The Aspirate. XVIII. Upward and Downward r.XIX. Upward and downward l and sh. XX. Compound consonants XXI. Vowel indication**.**	12 hours
Unit C XXII. The halving principle (section 1). XXIII. The halving principle (section 2). XXIV. The Doubling principle. XXV. Diphonic or two vowel signs. XXVI. Medial semicircle. XXVII. Prefixes negative words. XXVIII. Suffixes and terminations. XXIX. Contractions. XXX. Figures, etc .proper names.	11 hours
Unit D XXXI. Note taking, transcription, etc. XXXII. Essentials vowels. XXXIII. Special contractions. XXXIV. Advanced pharseography. XXXV. Intersections. XXXVI. Business phrases. XXXVIII. Banking and stockbroking phrases. XXXIX. Insurance and shipping phrases. XL. Technical and railway phrases. XLI. Legal phrases. XLIII. Special list of words. XLIV. Shorthand in practice.	10 hours
Total	**45 hours**

Reference Book:

Pitman. *Pitman Shorthand Instructor and Key*, New Delhi: Pearson publisher. 2001.

Course Title: Stenography Lab

Course Code: SGS105

L	T	P	Credits	Marks
0	0	1	1	25

Course Objective: The course is to inculcate writing and listening skills among the students. This would act as building blocks for the learner to begin the study of stenography. As the learners are from the senior secondary background the course has been created keeping in mind their requirements for the future.

Learning Outcome:

After going through this course the participant would have understood the basic concepts of typing and would be able to apply them in daily life. Completion of the course will improve their speed of typing and typing skills.

Unit A Beginner : Basics-fjdk, sla;, ghty,vmbn,ruei,woqp,cx. .	04 hours
Unit B Shift keys, numeric pad, Digits and symbols	03 hours
Unit C Intermediate- Syllables and words.	04 hours
Unit D Expert- Paragraphs and Stories	04 hours
Total	**15 hours**

Course Title: Business Mathematics

Course Code: MTH153

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives: This course builds the foundation of students for other quantitative courses and also prepares them for competitive exams.

Learning Outcomes: The students will be able to handle the quantitative aptitude part in competitive examinations. They will also better understand the quantitative portions in the functional areas of management.

UNIT-A

Matrices and Determinants **(14)**

Concepts of basic algebra, Set theory, Types of Matrices, Algebra of Matrices, Determinants, Adjoint of a Matrix, Inverse of a Matrix via adjoint Matrix, Homogeneous System of Linear equations, Condition for Uniqueness for the homogeneous system, Solution of Non-homogeneous System of Linear equations (not more than three variables), Condition for existence and uniqueness of solution, Solution using inverse of the coefficient matrix.

UNIT-B

Ratio and Proportion **(10)**

Ratio and Proportion, Percentage-Meaning and Computations of Percentages, time, speed, distance, Simple Interest, Compound interest (reducing balance & Flat Interest rate of interest), Equated Monthly Installments(EMI), Problems.

UNIT-C

Commercial Arithmetic **(13)**

Profit and Loss: terms and formulae, Trade discount, Cash discount, Problems involving cost price, selling Price, Trade discount and Cash Discount. Introduction to commission and brokerage, Problems on Commission and brokerage, Partnership, Stock and Shares.

UNIT-D

Progressions **(12)**

Concept of LCM,GCD,HCF, Progression: Arithmetic, Geometric, Harmonic, Mean, Median, Mode, Remainder theorem, even odd functions, Binomial theorem, Quadratic equations, Properties of Logrithm, Permutation and Combination.

Reference Books:

1. Hazarika P., *Business Mathematics*. New Delhi: Sultan Chand & Sons, 2008.
2. Kapoor V.K., *Business Mathematics.* New Delhi: Sultan Chand & Sons.
3. Bari, *Business Mathematics.* Mumbai : New Literature Publishing Company