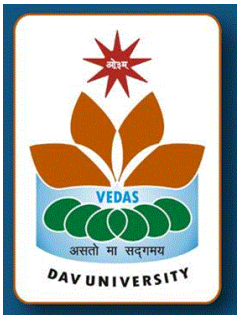
DAV UNIVERSITY JALANDHAR



Course Scheme & Syllabus

For

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

(As per Choice Based Credit System)

1st to 6th SEMESTER

Examinations 2015–2016 Session Onwards

Syllabi Applicable For Admissions in 2015

Scheme of B.Sc. (Hons.)
B.Sc. (Hons.) Mathematics
Semester 1

S.No	Course Code	Course Title	Course Type	L	T	P	Cr.
1	MTH 121	Calculus	Core	4	0	0	4
2	MTH 122	Calculus Lab	Core	0	0	4	2
3	MTH 123	Algebra	Core	5	1	0	6
4	ENG 151 A	Basic Communication Skills	AECC	3	0	0	3
5	ENG152	Basic Communication Skills Lab		0	0	2	1
6	CSA171	Computer Fundamentals and Programming Using C	AECC	4	0	0	4
7	CSA172	Computer Fundamentals and Programming Using C Lab	AECC	0	0	4	2
8	Generic Elective-I		GE				6
	Total						28

GE (Generic Elective-I) (Choose one)

S. No	Course Code	Course Title	L	T	P	Cr.
1	PHY 153A	Optics and Lasers	4	0	0	4
	PHY 154	Optics and Lasers Lab	0	0	4	2
2	CHE153A	Organic Chemistry	4	0	0	4
	CHE154	Organic Chemistry Lab	0	0	3	2
3	MTH 140	Finite Element Methods	5	1	0	6
4	ECO 214 A	Econometrics	5	1	0	6

Semester 2

S.No	Course Code	Course Title	Course Type	L	T	P	Cr.
1	MTH 124	Real Analysis	Core	5	1	0	6
2	MTH 125	Differential Equations	Core	4	0	0	4
3	MTH 126	Differential Equations Lab	Core	0	0	4	2
4	EVS 100	Environmental Studies	AECC	4	0	0	4
5	ENG 351	Technical Communication	AECC	3	0	0	3
6	SGS 107	Human value and General Studies	AECC	4	0	0	4
7	Generic Elective-II		GE				6
	Total						29

GE (Generic Electives)-II) (choose one)

S. No	Course Code	Course Title	L	T	P	Cr.
1	PHY 155A	Modern Physics	4	0	0	4
	PHY 156	Modern Physics Lab	0	0	4	2
2	CHE155A	Spectroscopy	4	0	0	4
	CHE156	Chemistry Lab	0	0	3	2
3	MTH 141	Mathematical Finance	5	1	0	6

Semester 3

S.No	Course Code	Course Title	Course Type	L	T	P	Cr.
1	MTH 221	Theory of Real Functions	Core	5	1	0	6
2	MTH 222	Group Theory I	Core	5	1	0	6
3	MTH 223	PDE and System of ODE	Core	4	0	0	4
4	MTH 224	PDE and System of ODE Lab	Core	0	0	4	2
5	Skill Enhancement Course-I		SEC	2	0	0	2
6	Generic Elective-III		GE				6
	Total						26

SEC (Skill Enhancement Course)-I (choose one)

S. No	Course Code	Course Title	L	T	P	Cr.
1	MTH 142	Logic and Sets	2	0	0	2
2	CSA 260	Operating systems	2	0	0	2

GE (Generic Electives-III) (choose one)

S.No	Course Code	Course Title	L	T	P	Cr.
1	PHY253A	Electricity and Magnetism and Electronics	4	0	0	4
	PHY254	EM and Electronics Lab	0	0	4	2
2	CHE253A	Inorganic Chemistry	4	0	0	4
	CHE254	Inorganic Chemistry Lab	0	0	3	2
3	MTH 143	Applications of Algebra	5	1	0	6

Semester 4

S.No	Course Code	Course Title	Course Type	L	T	P	Cr.
1	MTH 225	Numerical Methods	Core	4	0	0	4
2	MTH 226	Numerical Methods Lab	Core	0	0	4	2
3	MTH 227	Riemann Integration and Series of Functions	Core	5	1	0	6
4	MTH 228	Ring Theory and Linear Algebra I	Core	5	1	0	6
5	Skill Enhancement Course-II		SEC	2	0	0	2
6	Generic Elective-IV		GE				6
	Total						26

SEC (Skill Enhancement Course)-II (choose one)

S.No	Course Code	Course Title	L	T	P	Cr.
1	MTH 144	Latex and HTML	0	0	4	2
2	CSA 261	Data Base Management Systems	2	0	0	2

GE (Generic Electives)-IV (choose one)

S. No	Course Code	Course Title	L	T	P	Cr.
1	PHY 353A	Mechanics and Waves	4	0	0	4
	PHY 354	Mechanics and Waves Lab	0	0	4	2
2	CHE353A	Physical chemistry	4	0	0	4
	CHE354	Physical chemistry Lab	0	0	3	2
3	CSA 210	Programming in C#	4	0	0	4
	CSA 216	Programming in C# Laboratory	0	0	4	2
4	MTH 145	Combinatorial Mathematics	5	1	0	6

Semester 5

S.No	Course Code	Course Title	Course Type	L	T	P	Cr.
1	MTH 321	Multivariate Calculus	Core	5	1	0	6
2	MTH 322	Group Theory II	Core	5	1	0	6
3	Discipline Specific Elective-I		DSE	5	1	0	6
4	Discipline Specific Elective-II		DSE	5	1	0	6
	Total						24

DSE (Discipline Specific Electives)-I (choose one)

S.No	Course Code	Course Title	L	T	P	Cr.
1	MTH 324	Number Theory	5	1	0	6
2	MTH 325	Analytical Geometry	5	1	0	6
3	MTH 340	Project				6

DSE (Discipline Specific Electives)-II (choose one)

S.No	Course Code	Course Title	L	T	P	Cr.
1	MTH 326	Industrial Mathematics	5	1	0	6
2	MTH 327	Discrete Mathematics	5	1	0	6
3	MTH 328	Probability and Statistics	5	1	0	6

Semester 6

S. No	Course Code	Course Title	Course Type	L	T	P	Cr.
1	MTH 329	Metric Spaces and Complex Analysis	Core	5	1	0	6
2	MTH 330	Ring Theory and Linear Algebra II	Core	5	1	0	6
3	Discipline Specific Elective-III		DSE	5	1	0	6
4	Discipline Specific Elective-IV		DSE	5	1	0	6
	Total						24

DSE (Discipline Specific Electives)-III (choose one)

S.No	Course Code	Course Title	L	T	P	Cr.
1	MTH 331	Theory of Equations	5	1	0	6
2	MTH 332	Bio-Mathematics	5	1	0	6
3	MTH 333	Linear Programming	5	1	0	6

DSE (Discipline Specific Electives)-IV (choose one)

S. No	Course Code	Course Title	L	T	P	Cr.
1	MTH 334	Mathematical Modeling	5	1	0	6
2	MTH 335	Mechanics	5	1	0	6
3	MTH 336	Differential Geometry	5	1	0	6

Course Title: Calculus
Course Code: MTH 121

L	T	P	Credits
4	0	0	4

Course 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 **13 HOURS**

Hyperbolic functions, higher order derivatives, Leibniz rule and its applications, concavity and inflection points, asymptotes.

UNIT B **14 HOURS**

Curve tracing in Cartesian coordinates, tracing of standard curves in polar coordinates, L'Hospital's rule. Reduction formulae, derivations and illustrations of reduction formulae

UNIT C **14 HOURS**

Volumes by slicing; disks and washers methods, Volumes by cylindrical shells, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

UNIT D **15 HOURS**

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modeling ballistics and planetary motion, Kepler's second law.

Books Recommended

1. Thomas, George B., and Finney Ross L. *Calculus*. Pearson Education, 9th Ed, 2010.
2. Strauss, M.J., and G.L. Bradley and K. J. Smith. *Calculus*. Delhi: Dorling Kindersley (India) P. Ltd. (Pearson Education), 3rd Ed, 2007.
3. Anton, H., and I. Bivens, and S. Davis. *Calculus*. Singapore: John Wiley and Sons (Asia) P. Ltd., 7th Ed. 2002.
4. Courant, R., and F. John. *Introduction to Calculus and Analysis*. New York: Springer-Verlag (Volumes I & II), 1989.

Course Title: Calculus Lab
Course Code: MTH122

L	T	P	Credits
0	0	4	2

Course Objective: The objective of this course is to teach Calculus as a laboratory science with the computer and software and to use this as an essential tool in learning and using calculus.

List of Practical's (using any software)

(i) Plotting of graphs of function e^{ax+b}, log (ax + b), 1/(ax + b), sin(ax + b), cos(ax + b), |ax + b| and to illustrate the effect of a and b on the graph.

(ii) Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.

(iii) Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).

(iv) Obtaining surface of revolution of curves.

(v) Tracing of conics in Cartesian coordinates/ polar coordinates.

(vi) Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, parabolic, hyperbolic paraboloid using Cartesian coordinates.

(vii) Matrix operation (addition, multiplication, inverse, transpose).

Books Recommended

1. Thomas, George B., and Finney Ross L. *Calculus*. Pearson Education, 9th Ed, 2010.
2. Strauss, M.J., and G.L. Bradley and K. J. Smith. *Calculus*. Delhi: Dorling Kindersley (India) P. Ltd. (Pearson Education), 3rd Ed, 2007.
3. Anton, H., and I. Bivens, and S. Davis. *Calculus*. Singapore: John Wiley and Sons (Asia) P. Ltd., 7th Ed. 2002.
4. Courant, R., and F. John. *Introduction to Calculus and Analysis*. New York: Springer-Verlag (Volumes I & II), 1989.

Course Title: Algebra
Course Code: MTH123

L	T	P	Credits
5	1	0	6

Course Objective: This course is a prerequisite course for the students to further strengthen their algebra skills. By the end of this course, students will be able to solve different types of linear systems.

UNIT A **15 HOURS**

Polar representation of complex numbers, n^{th} roots of unity, De Moivre's theorem for rational indices and its applications.

UNIT B **13 HOURS**

Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.

UNIT C **15 HOURS**

Rank of a matrix, echelon form of a matrix, normal form of a matrix, linear dependence and independence of vectors, n-vector space, Subspaces of R^n, dimension of subspaces of R^n, introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices.

UNIT D **15 HOURS**

Systems of linear equations (homogeneous and non-homogeneous systems), solution sets of linear systems, applications of linear systems. Eigen values, Eigen Vectors and Characteristic Equation of a matrix.

Books recommended:

1. Grewal B.S. *Higher Engineering Mathematics.* New Delhi: Khanna Publishers, 2012. Print.
2. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
3. Lipschutz, S., and Marc Lars Lipson. *Linear Algebra, Schaum's outline.* New Delhi: Mc Graw Hill, 2009. Print.
4. Narayan, Shanti, and P.K. Mittal. *A Text Book of Matrices.* New Delhi: S. Chand & Co. Ltd., Reprint 2002. Print.

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Course Title: Real Analysis
Course Code: MTH 124

L	T	P	Credits
5	1	0	6

Course Objective: The aim of this course is to introduce students to the fundamentals of mathematical analysis and to reading and writing mathematical proofs.

UNIT A **15 HOURS**

Review of Algebraic and Order Properties of *R*, -neighborhood of a point in *R*, Idea of countable sets, uncountable sets and uncountability of *R.* Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of *R*, The Archimedean Property

UNIT B **15 HOURS**

Sets in IR (Intervals): Neighborhood of a point. Interior point. Open set. Union, Intersection of open sets. 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. Illustrations of Bolzano-Weierstrass theorem for sets. Definition of derived set. Closed set. Complement of open set and closed set. Union and intersection of closed sets as a consequence. No nonempty proper subset of *R* is both open & closed. Dense set in *R* as a set having non-empty intersection with every open interval. Q and *R* - Q are dense in *R*.

UNIT C **15 HOURS**

Sequences: Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

UNIT D **15 HOURS**

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's n^{th} root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

Books recommended:

1. Bartle, R.G. and D.R. Sherbert. *Introduction to Real Analysis,* 3rd Ed. Singapore: John Wiley and Sons (Asia) Pvt. Ltd., 2002.
2. Rudin, W. *Principles of Mathematical Analysis*, *3rd Edition*. New Delhi: McGraw-Hill Inc., 1976.
3. Berberian, S.K. *A First Course in Real Analysis*. New York: Springer Verlag, 1994.
4. Thomson, B.S., A.M. Bruckner and J.B. Bruckner. *Elementary Real Analysis.* Prentice Hall, 2001.
5. Apostol, T. M., *Calculus-I &II* (2nd edition). New Delhi: Wiley, 1969.

Course Title: Differential Equations
Course Code: MTH 125

L	T	P	Credits
4	0	0	4

Course Objective:

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 **13 HOURS**

Differential equations and mathematical models, General, particular, explicit, implicit and singular solutions of a differential equation, Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

UNIT B **12 HOURS**

Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting.

UNIT C **13 HOURS**

General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

UNIT D **12 HOURS**

Equilibrium points, Interpretation of the phase plane, predator-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

Books Recommended

1. Singhania R. *Ordinary and Partial Differential Equations*. New Delhi: S. Chand and Company, 2006.
2. Ross S.L. *Differential Equations,* 3rd edition. India: John Wiley and Sons, 2004.
3. Abell Martha L., and James P Braselton. *Differential Equations with Mathematica,* 3rd edition. Elsevier Academic Press, 2004.
4. Siddiqi A.H., and P. Manchanda. *A First Course in Differential Equation with Applications*. New Delhi: Macmillan India Ltd., 2006.
5. Codington E.A. *An Introduction to Ordinary Differential Equation*. New York: Dover Publications, 1989.
6 Kapur, J.N, *Mathematical Modelling,* New Age International (P) limited, New Delhi:200

Course Title: Differential Equations Lab
Course Code: MTH126

L	T	P	Credits
0	0	4	2

List of Practical's (using any software)

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Case of single cold pill and a course of cold pills.
7. Limited growth of population (with and without harvesting).
8. Predatory-prey model (basic Volterra model, with density dependence, effect of DDT, two prey one predator).
9. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
10. Battle model (basic battle model, jungle warfare, long range weapons).
11. Plotting of recursive sequences.
12. Study the convergence of sequences through plotting.
13. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
14. Study the convergence/divergence of infinite series by plotting their sequences of partial sum. Cauchy's root test by plotting n^{th} roots.
15. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ term.

Books Recommended

1. Barnes, Belinda and Glenn R. Fulford. *Mathematical Modeling with Case Studies: A Differential Equation Approach using Maple and Matlab, 2nd Ed.* London and New York: Taylor and Francis group, 2009.
2. Edwards, C.H. and D.E. Penny. *Differential Equations and Boundary Value problems Computing and Modeling.* India: Pearson Education, 2005.
3. Abell, Martha L and James P Braselton. *Differential Equations with MATHEMATICA, 3rd Ed.* Elsevier Academic Press, 2004.

Course Title: Theory of Real Functions
Course Code: MTH 221

L	T	P	Credits
5	1	0	6

Course Objective: The aim of this course is to define the limit of a function at a value, continuity and uniform continuity of a function and emphasize the proofs' development.

UNIT-A **15 HOURS**

Limits of functions (approach), sequential criterion for limits, divergence criteria, Limit theorems, one sided limits, Infinite limits and limits at infinity, Continuous functions, sequential criterion for continuity and discontinuity, Algebra of continuous functions, Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem.

UNIT- B **15 HOURS**

Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.
Differentiation: Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions, Relative extrema, interior extremum theorem.

UNIT-C **15 HOURS**

Rolle's Theorem, Mean value theorem, intermediate value property of derivatives, Darboux's theorem, Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities.

UNIT-D **15 HOURS**

Cauchy's mean value theorem, Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema, Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1 + x)$, $1/(ax+b)$ and $(1 +x)^n$.

Books Recommended

1. Bartle R. and D.R. Sherbert. *Introduction to Real Analysis*. New Delhi: John Wiley and Sons, 2003. Print.
2. Ross K.A. *Elementary Analysis: The Theory of Calculus*. New York: Springer, 2004. Print.
3. Mattuck, A. *Introduction to Analysis*. Massachusetts: Prentice Hall, 1999. Print.
4 Apostol, T. M., *Calculus-I &II* (2nd edition). New Delhi: Wiley, 1969.

Course Title: Group Theory I
Course Code: MTH 222

L	T	P	Credits
5	1	0	6

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

UNIT A **15 HOURS**

Symmetries of a square, dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups, Subgroups and examples of subgroups.

UNIT B **15 HOURS**

Centralizer, normalizer, center of a group, product of two subgroups, properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group.

UNIT C **15 HOURS**

Properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem, External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

UNIT D **15 HOURS**

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Books Recommended

1. Bhattacharya, P.B., S.K. Jain, and S.R. Nagpal. *Basic Abstract Algebra*. New Delhi: Foundation Books. Print.
2. Herstein, I.N. *Topics in Algebra*, Wiley Eastern Limited, India, 1975. Print.
3. Fraleigh J.B. *A First Course in Abstract Algebra*, 7th Ed. Pearson, 2002**.** Print.
4. Gallian J.A. *Contemporary Abstract Algebra*, 4th Ed. New Delhi: Narosa Publishing House, 1999. Print.
5. Rotman J.J. *An Introduction to the Theory of Groups*, 4th Ed. Springer Verlag, 1995. Print.

Course Title: PDE and System of ODE
Course Code: MTH 223

L	T	P	Credits
4	0	0	4

Course Objective:
The objective of this course is to equip the students with knowledge of some advanced concepts related to differential equations and partial differential equations.

UNIT A **14 HOURS**
Partial Differential Equations– Basic concepts and definitions, Mathematical problems. First-Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms of First-order Linear Equations. Method of Separation of Variables for solving first order partial differential equations.

UNIT B **12 HOURS**
Derivation of Heat equation, Wave equation and Laplace equation, Classification of second order linear equations as hyperbolic, parabolic or elliptic, Reduction of second order Linear Equations to canonical forms.

UNIT C **12 HOURS**
The Cauchy problem, the Cauchy-Kowaleewskaya theorem, Cauchy problem of an infinite string, Initial Boundary Value Problems, Semi-Infinite String with a fixed end, Semi-Infinite String with a Free end, Equations with non-homogeneous boundary conditions, Non-Homogeneous Wave Equation. Method of separation of variables, solving the vibrating string problem, solving the heat conduction problem.

UNIT D **13 HOURS**
Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients, Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions, The method of successive approximations, the Euler method, the modified Euler method, The Runge-Kutta method.

Books Recommended

1. Tyn Myint-U and Lokenath Debnath, *Linear Partial Differential Equations for Scientists and Engineers*, 4th edition, Springer, Indian reprint, 2006.
2. Ross S.L., *Differential equations*, 3rd Ed., John Wiley and Sons, India, 2004.
3. Abell Martha L., and James P. Braselton, *Differential Equations with Mathematica*, 3rd edition. Elsevier Academic Press, 2004.
4. Singhania R., *Ordinary and Partial Differential Equations*. New Delhi: S. Chand and Company, 2006.
5. Kreyszig, Erwin, *Advanced Engineering Mathematics*. New Delhi: John Wiley & Sons, 1999.

Course Title: PDE and System of ODE Lab
Course Code: MTH 224

L	T	P	Credits
0	0	4	2

List of Practicals (using any software)

(i) Solution of Cauchy problem for first order PDE.

(ii) Finding the characteristics for the first order PDE.

(iii) Plot the integral surfaces of a given first order PDE with initial data.

(iv) Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following conditions

(a) $u(x,0)=\phi(x)$, $u_t(x,0)=\psi(x)$, $x \in R$, $t>0$

(b) $u(x,0)=\phi(x)$, $u_t(x,0)=\psi(x)$, $u(0,t)=0$, $x \in (0,\infty)$, $t>0$

(c) $u(x,0)=\phi(x)$, $u_t(x,0)=\psi(x)$, $u_x(0,t)=0$, $x \in (0,\infty)$, $t>0$

(d) $u(x,0)=\phi(x)$, $u_t(x,0)=\psi(x)$, $u(0,t)=0$, $u(1,t)=0$, $0<x<l$, $t>0$

(v) Solution of wave equation $\frac{\partial u}{\partial t} - k^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions

(a) $u(x,0)=\phi(x)$, $u(0,t)=a$, $u(l,t)=b$, $0<x<l$, $t>0$
(b) $u(x,0)=\phi(x)$, $x \in R$, $0<t<T$
(c) $u(x,0)=\phi(x)$, $u(0,t)=a$, $x \in (0,\infty)$, $t \geq 0$

Books Recommended

1. Tyn Myint-U, and Lokenath Debnath. *Linear Partial Differential Equations for Scientists and Engineers.* 4th edition, Springer, 2006. Indian reprint.
2. Ross S.L. *Differential equations.* 3rd Ed., John Wiley and Sons, India, 2004. Print.
3. Abell Martha L., and James P. Braselton. *Differential Equations with Mathematica.* 3rd edition. Elsevier Academic Press, 2004. Print.
4. Singhania R. *Ordinary and Partial Differential Equations*. New Delhi: S. Chand and Company, 2006. Print.

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Course Title: Numerical Methods

L	T	P	Credits
4	0	0	4

Course Code: MTH 225

Course 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, Inherent errors, Rounding errors, Truncation errors, Absolute, Relative and Percentage error.

Non-Linear Equations: Transcendental and Polynomial equations: Bisection method, Secant method, Regula-Falsi method, Newton's method, Rate of convergence. Newton's method for complex roots.

UNIT B **14 HOURS**

Generalized Newton's method, System of linear algebraic equations: Gauss Elimination and Gauss Jordan methods and their application to find A^{-1}, Gauss Jacobi method, Gauss Seidel method, Power method for finding largest/smallest Eigen value.

UNIT C **13 HOURS**

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

Interpolation: Divided difference operators. Newton's forward and backward difference interpolation. Newton's divided difference formula, Lagrange's interpolation, Hermite interpolation, Numerical Differentiation.

UNIT D **14 HOURS**

Numerical Integration: Trapezoidal rule, Simpson's $1/3^{rd}$- rule, Simpsons 3/8th rule, Boole's Rule and Weddle's Rule. (Order of Error in each case)

Numerical solutions to first order ordinary differential equations: Taylor series method**,** Picard method, Euler's method, Modified-Euler's method, Runge-Kutta methods of orders two, three and four.

Books Recommended

1. Shastry, S.S. *Introductory Methods of Numerical Analysis.* New Delhi: PHI Learning Private Limited, 2005. Print.
2. Iyenger, S.R.K., R.K. Jain, and Mahinder Kumar. *Numerical Methods for Scientific and Engineering Computation.* Delhi: New Age International Publishers, 2012. Print.
3. Gerald C.F., and P.O. Wheatley. *Applied Numerical Analysis.* India: Pearson Education, 2008. Print.
4. Grewal B.S. *Numerical Methods in Engineering and Science.* New Delhi: Khanna Publishers, 2014. Print.
5. James B., Scarborough. *Numerical mathematical Analysis.* Baltimore: Johns Hopkins Press,1950.

Course Title: Numerical Methods Lab

Course Code: MTH 226

L	T	P	Credits
0	0	4	2

List of Practicals (using any programming software)

(i) Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ----------+ 1/ N.
(ii) To find the absolute value of an integer.
(iii) Enter 100 integers into an array and sort them in an ascending order.
(iv) Bisection Method.
(v) Newton-Raphson Method.
(vi) Secant Method.
(vii) Regula Falsi Method.
(viii) Gauss-Jacobi Method.
(ix) Gauss-Seidal Method.
(x) Newton Interpolation.
(xi) Lagrange interpolation.
(xii) Trapezoidal rule.
(xiii) Simpson's $1/3^{rd}$ and $3/8^{th}$ rule.
(xiv) Taylor series method.
(xv) Euler's method.

Books Recommended

1. Shastry, S.S. *Introductory Methods of Numerical Analysis*. New Delhi: PHI Learning Private Limited, 2005. Print.
2. Iyenger, S.R.K., R.K. Jain, and Mahinder Kumar. *Numerical Methods for Scientific and Engineering Computation.* Delhi: New Age International Publishers, 2012. Print.
3. Gerald C.F., and P.O. Wheatley. *Applied Numerical Analysis*. India: Pearson Education, 2008. Print.
4. Mathews, John H., and D. Fink Kurtis. *Numerical Methods using Matlab*, 4th Ed. New Delhi: PHI Learning Private Limited, 2012. Print.
5. Grewal B.S. *Numerical Methods in Engineering and Science.* New Delhi: Khanna Publishers, 2014. Print.

Course Title: Riemann Integration and Series of Functions
Course Code: MTH 227

L	T	P	Credits
5	1	0	6

Course Objective: The aim of this course is to teach the fundamentals of Riemann integral, sequences and series of functions, uniformity and interchange of limit operators.

UNIT A **15 HOURS**

Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions.

UNIT B **15 HOURS**

Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.

Improper integrals; Convergence of Beta and Gamma functions.

UNIT C **15 HOURS**

Point wise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

UNIT D **15 HOURS**

Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.

Books Recommended

1. Ross, K.A. *Elementary Analysis. The Theory of Calculus*. Undergraduate Texts in Mathematics, Indian reprint: Springer (SIE), 2004. Print.
2. Bartle, R.G. and D.R. Sherbert. *Introduction to Real Analysis*, 3rd Ed. Singapore: John Wiley and Sons (Asia) Pvt. Ltd., 2002. Print.
3. Denlinger, Charles G. *Elements of Real Analysis*. Massachusetts: Jones & Bartlett (Student Edition), 2011. Print.

Course Title: Ring Theory and Linear Algebra I
Course Code: MTH 228

L	T	P	Credits
5	1	0	6

Course Objective: The main objective is to introduce basic notions in linear algebra and ring theory that are often used in mathematics, importantly in abstract algebra.

UNIT A **15 HOURS**

Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

UNIT B **15 HOURS**

Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III. Field of quotients.

UNIT C **15 HOURS**

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

UNIT D **15 HOURS**

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphism, Isomorphism theorems, invertibility and change of coordinate matrix.

Books Recommended

1. Bhattacharya, P.B., S.K.Jain, and S.R.Nagpal. *Basic Abstract Algebra, 2nd edition.* U.K: Cambridge University Press, 2004.
2. Hoffman, Kenneth, and Ray Alden Kunze. *Linear Algebra, 2nd edition.* Prentice-Hall of India Pvt. Ltd., 1971.
3. Fraleigh, John B. *A First Course in Abstract Algebra*, 7th *edition*. Pearson, 2002.
4. Artin, M. *Abstract Algebra*, *2nd Ed.,* Pearson, 2011.
5. Gallian, Joseph A. *Contemporary Abstract Algebra*, *4th Ed.*, Narosa Publishing House, 1999.
6. Lang, S. I*ntroduction to Linear Algebra, 2nd Ed.*, Springer, 2005.
7. Strang, Gilbert. *Linear Algebra and its Applications*, Thomson, 2007.

Course Title: Multivariate Calculus
Course Code: MTH 321
Use of Scientific calculator is allowed.

L	T	P	Credits
5	1	0	6

Course 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. In this course, concepts are extended from one variable calculus to functions of several variables.

UNIT-A **15 HOURS**

Functions of several variables, limit and continuity of functions of two variables, partial differentiation, total differentiability, differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters.

UNIT-B **15 HOURS**

Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems, Directional derivatives, gradient, maximal and normal property of the gradient, tangent planes, definition of vector field, divergence and curl.

UNIT-C **15 HOURS**

Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, Triple integrals, triple integral over a parallelopiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates.

UNIT-D **15 HOURS**

Change of variables in double integrals and triple integrals. Line integrals, applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, Divergence theorem.

Books Recommended

1. Thomas, G.B., and R.L. Finney. *Calculus*. 9th Ed., Delhi: Pearson Education, 2010.
2. Strauss, M.J., G.L. Bradley, and K. J. Smith. *Calculus.* 3rd Ed., Delhi: Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2007.
3. Anton, H., I. Bivens, and S. Davis. *Calculus Multivariable*. 9th Ed., Singapore: John Wiley and Sons (Asia) P. Ltd., 2009.
4. Marsden, E., A.J. Tromba, and A. Weinstein. *Basic Multivariable Calculus*. Indian reprint: Springer (SIE), 2005.
5. Jain, R. K., and Iyengar, S.R.K. *Advanced Engineering Mathematics* (2nd edition). New Delhi: Narosa Publishing House, 2003.

Course Title: Group Theory II

L	T	P	Credits
5	1	0	6

Course Code: MTH 322

Course Objective: The objective of this course is to understand the structure of finite groups and some properties of finite groups.

UNIT-A **15 HOURS**

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties.

UNIT-B **15 HOURS**

Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental Theorem of finite abelian groups.

UNIT-C **15 HOURS**

Group actions, stabilizers and kernels, permutation representation associated with a given group action, Applications of group actions: Generalized Cayley's theorem, Index theorem.

UNIT-D **15 HOURS**

Groups acting on themselves by conjugation, class equation and consequences, conjugacy in Sn, *p*-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of An for $n \geq 5$, non-simplicity tests.

Books Recommended

1. Bhattacharya, P.B., S.K. Jain, and S.R. Nagpal. *Basic Abstract Algebra*. UK: Cambridge University Press, 2006, Print.
2. Fraleigh, John B. *A First Course in Abstract Algebra*. 7th Ed., India: Pearson, 2002**.** Print.
3. Gallian, Joseph A. *Contemporary Abstract Algebra.* 4th Ed., Delhi: Narosa Publishing House, 1999. Print.
4. Dummit, David S., and Richard M. Foote. *Abstract Algebra*. 3rd Ed., Singapore: John Wiley and Sons (Asia) Pvt. Ltd., 2004. Print.
5. Rotman Joseph J., *An Introduction to the Theory of Groups,* 4th Ed. Springer Verlag, 1995. Print.

Course Title: Number Theory
Course Code: MTH 324

L	T	P	Credits
5	1	0	6

Course Objective: The objective is for the students to obtain a foundational knowledge of elements of Number Theory through step-by-step proofs of classical theorems, as well as to sharpen their skills through problem-solving. The material of the course will be such that one can be initiated to the subject gradually and thus future study will be made more natural.

UNIT-A **15 HOURS**

Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem.

UNIT-B **15 HOURS**

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function.

UNIT-C **15 HOURS**

Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function. Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity.

UNIT-D **15 HOURS**

Quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the equation $x^2 + y^2 = z^2$, Fermat's Last theorem.

Books Recommended

1. Burton, David M. *Elementary Number Theory,* 7th Ed., Delhi: Tata McGraw-Hill, 2007. Print.
2. Robinns, Neville. *Beginning Number Theory,* 2nd Ed., Delhi: Narosa Publishing House Pvt. Ltd., Delhi, 2007. Print.
3. Jones, G.A., and J.M. Jones. *Elementary Number Theory,* Springer, 1998, Print.

Course Title: Analytical Geometry

L	T	P	Credits
5	1	0	6

Course Code: MTH 325

Course Objective:

The course is an introductory course on Analytical Solid Geometry so as to enable the reader to understand the three dimensional geometry.

UNIT A **15 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 B **15 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 C **15 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 D **15 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.

Books Recommended

1. Narayan, S. and P.K. Mittal, *Analytical Solid Geometry*. Delhi: S. Chand & Company Pvt. Ltd., 2008. Print.
2. Thomas, G.B., and R.L. Finney. *Calculus*. 9th Ed., Delhi: Pearson Education, 2005. Print.
3. Jain, P.K., and A. Khalil, *A text book of Analytical Geometry of three dimensions*. Wiley Eastern Ltd, 1999.
4. Chatterjee, Dipak. *Analytical Solid Geometry,* India: PHI Learning, 2003. Print.
5. Loney, S.L. *The Elements of Coordinate Geometry*, London: McMillan and Company, 1895, Print.

Course Title: Industrial Mathematics
Course Code: MTH 326

L	T	P	Credits
5	1	0	6

Course Objective: Industrial Mathematics is to enable students to acquire the fundamentals of applied mathematics in areas of classical and numerical analysis, differential equations and dynamical systems, and probability and statistics.

UNIT-A **15 HOURS**

Medical Imaging and Inverse Problems. The content X-Ray is based on Mathematics of complex numbers and matrices and CT scan based on the knowledge of equations.
Introduction to Inverse problems: Why should we teach Inverse Problems? Illustration of Inverse problems through problems taught in Pre-Calculus, Calculus, Matrices and differential equations.

UNIT-B **15 HOURS**

Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.
X-ray: Introduction, X-ray behavior and Beers Law (The fundament question of image construction) Lines in the place.

UNIT -C **15 HOURS**

Radon Transform: Definition and Examples, Linearity, Phantom (Shepp - Logan Phantom - Mathematical phantoms).
Back Projection: Definition, properties and examples.

UNIT -D **15 HOURS**

CT Scan: Revision of properties of Fourier and inverse Fourier transforms and applications of their properties in image reconstruction. Algorithms of CT scan machine. Algebraic reconstruction techniques abbreviated as ART with application to CT scan.

Books Recommended

1. Feeman , Timothy G. *The Mathematics of Medical Imaging. A Beginners Guide,* Springer Under graduate Text in Mathematics and Technology, Springer, 2010. Print.

2. Groetsch, C.W. *Inverse Problems*. Activities for Undergraduates, The Mathematical Association of America, 1999. Print.

3. Kirsch, Andreas. *An Introduction to the Mathematical Theory of Inverse Problems* 2nd Ed. Springer, 2011. Print.

Course Title: Discrete Mathematics
Course Code: MTH 327

L	T	P	Credits
5	1	0	6

Course 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 and Boolean algebra.

UNIT I **15 HOURS**
Set Theory, Relations and Functions: Natural Numbers- Well Ordering Principle, Principle of Mathematical Induction, Sets, Algebra of Sets, Ordered Sets, Subsets, Relations, Equivalence Relations and Partitions, Hasse diagram, Lattices, Functions, Special functions, Composition of Functions, one-one, onto and Inverse of a function, Number of one-one functions.

UNIT II **15 HOURS**
Basic Counting Principles and Recurrence Relations: Permutation, Combinations, Pigeonhole Principle, Inclusion-exclusion Principle, Number of onto functions, Partitions, Recurrence Relations, Characteristic Equation, Homogeneous and non-homogeneous linear recurrence relations with constant coefficients, Generating Functions for some standard sequences.

UNIT III **15 HOURS**
Graphs and Trees: Basic Terminology, Special Graphs, Handshaking Theorem, Isomorphism of Graphs, Walks, Paths, Circuits, Eulerian and Hamiltonian Paths, Planar and Non Planar Graphs, Coloring of Graph, Directed graphs, Travelling Salesman Problem, Binary Trees, Tree Traversing: Preorder, Post-order and In-order Traversals, Minimum Spanning Trees, Shortest path problems, Prim's and Kruskal's Algorithm.

UNIT IV **15 HOURS**
Logic and Boolean algebra: Propositions, Basic logic operators, Logic equivalence involving Tautologies and Contradiction, Conditional Propositions, Quantifiers, Introduction to Boolean algebra, laws of Boolean algebra, Boolean function, Sum of product form, K-map, logic gates and circuits.

Books Recommended

1. Rosen, K. H. *Discrete Mathematics and its Applications*, 6th Edition, McGraw Hill, 2007. Print.
2. Malik, D.S., and M.K. Sen. *Discrete Mathematical Structures: Theory and Applications*, New Delhi: Thomson Cengagae Learning, 2004. Print.
3. Lipschutz, S. and M.L. Lipson. *Schaum's Outline of Discrete Mathematics*. New Delhi: Schaum's Outlines, 2007. Print.
4. Ram, B. *Discrete Mathematics*. Pearson Publications, 2011. Print.
5. Liu, C. L., *Elements of Discrete Mathematics***.** McGraw Hill, International Edition, Computer Science Series.1986. Print.
6. Trembley, J.P. and R.P. Manohar. *Discrete Mathematical Structures with Applications to Computer Science*. McGraw Hill, 1975. Print.

Course Title: Probability and Statistics
Course Code: MTH 328

L	T	P	Credits
5	1	0	6

Course Objective: The course is designed to develop greater skill and understanding of statistics and probability and to explore properties of probability distributions.

UNIT A **12HOURS**

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function.

UNIT B **13HOURS**

Discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.

UNIT C **13HOURS**

Joint distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables, correlation coefficient, joint moment generating function (jmgf).

UNIT D **12 HOURS**

Linear regression for two variables, Multiple correlation, Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers, Central Limit theorem for independent and identically distributed random variables with finite variance.

Books Recommended

1. Gupta, S.C., and V.K. Kapoor. *Fundamentals of Mathematical Statistics*. New Delhi: S. Chand & Sons, 2002. Print.
2. Mood, A.M., F.A. Graybill, and D.C., Boes. *Introduction to the theory of Statistics*. Delhi: McGraw Hill, 1974. Print.
3. Hogg, Robert V., Joeseph McKean and Allen T Craig. *Introduction to Mathematical Statistics.* London : Pearson Education Limited, 2014. Print.
4. Baisnab, A. P., and M. Jas. *Elements of Probability and statistics*. Delhi: Tata McGraw Hill, 2004. Print.
5. Meyer, P.L., *Introductory Probability and Statistical Applications.* Delhi: Addison-Wesley Publishing Company, 1970. Print.
6. Ross, Sheldon. *Introduction to Probability Models*, 9th Ed., Academic Press, Indian Reprint, 2007. Print.
7. Mood, Alexander M., Franklin A. Graybill and Duane C. Boes. *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw- Hill, Reprint 2007. Print.

Course Title: Metric Spaces and Complex Analysis
Course Code: MTH 329

L	T	P	Credits
5	1	0	6

Course Objective: The aim of this course is to introduce the theory of metric, to show how the theory and concepts grow naturally from problems and examples.

UNIT A **15 HOURS**

Metric spaces: definition and examples. Sequences in metric spaces, Cauchy sequences. Complete Metric Spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, Cantor's theorem. Subspaces, dense sets, separable spaces.

UNIT B **15 HOURS**

Continuous mappings, sequential criterion and other characterizations of continuity, Uniform continuity, Homeomorphism, Contraction mappings, Banach Fixed point Theorem. Connectedness, connected subsets of R, Limits, Limits involving the point at infinity, continuity.

UNIT C **15 HOURS**

Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability, Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

UNIT D **15 HOURS**

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals, Cauchy-Goursat theorem, Cauchy integral formula, Liouville's theorem and the fundamental theorem of algebra.Convergence of sequences and series, Taylor series and its examples, Laurent series and its examples, absolute and uniform convergence of power series.

Books Recommended

1. Copson, E.T. *Metric Spaces,* London: Cambridge University Press, 1988. Print
2. Copson, E.T. *Theory of the function of the complex variable*, London: Oxford Clarendon Press, 1970, Print.
3. Zill, G. Dennis. and Patrick. D. Shanahan. Complex Analysis: A first Course with Applications: Burlington: Jones & Bartlett Learning, 2015. Print.
4. Brown, J. W. and R. V. Churchill. *Complex Variables and Applications,* 8th Ed. Delhi: McGraw Hill International Edition, 2009. Print
5. Bak, Joseph and D. J. Newman. *Complex Analysis,* 2nd Ed. *Undergraduate Texts in Mathematics*. New York: Springer-Verlag New York, Inc, 1997. Print.

Course Title: Ring Theory and Linear Algebra II
Course Code: MTH 330

L	T	P	Credits
5	1	0	6

Course Objective: Here some advanced topics of ring theory and linear algebra are included. The emphasis will be to combine the abstract concepts with examples in order to intensify the understanding of the subject.

UNIT-A **15 HOURS**

Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion.

UNIT-B **15 HOURS**

Unique factorization in Z[x]**.**Divisibility in integral domains, irreducibles, primes, unique factorization domains, Euclidean domains.

UNIT-C **15 HOURS**

Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator.

UNIT-D **15 HOURS**

Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator, Least Squares Approximation, minimal solutions to systems of linear equations, Normal and self-adjoint operators, Orthogonal projections and Spectral theorem.

Books Recommended

1. Bhattacharya, P.B., S.K.Jain, and S.R.Nagpaul. Basic Abstract Algebra, 2nd Edition.U.K: Cambridge University Press, 2004.
2. Hoffman, Kenneth, and Ray Alden Kunze. Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
3. Fraleigh, John B. A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
4. Artin, M. Abstract Algebra, 2nd Ed., Pearson, 2011.
5. Gallian, Joseph A. Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.
6. Lang, S. Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
7. Strang, Gilbert. Linear Algebra and its Applications, Thomson, 2007.
8. Kumaresan S. Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.

Course Title: Theory of Equations
Course Code: MTH 331

L	T	P	Credits
5	1	0	6

Course Objective: The aim of this course is to study general properties of polynomials and to find the roots of different types of polynomials.

UNIT A **15 HOURS**

General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

UNIT B **15 HOURS**

Symmetric functions, Applications of symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

UNIT C **15 HOURS**

Symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations.

UNIT D **15 HOURS**

Separation of the roots of equations, Strums theorem, Applications of Strum's theorem, Conditions for reality of the roots of an equation and biquadratic. Solution of numerical equations.

Books Recommended

1. Burnside, W. S. and A. W. Panton. *The Theory of Equations*. Dublin & London: Dublin University Press, 1954. Print.
2. MacDuffee, C. C. *Theory of Equations*. John Wiley & Sons Inc., 1954. Print.

Course Title: Bio-Mathematics

Course Code: MTH 332

L	T	P	Credits
5	1	0	6

Course Objective: Biomathematics is contributing both in its basic research and the development of specialized computer software to support investigation and healthcare.

UNIT-A **15 HOURS**

Mathematical Biology and the modeling process: an overview. Continuous models: Malthus model, logistic growth, Allee effect, Gompertz growth, Michaelis-Menten Kinetics, Holling type growth, Bacterial growth in a Chemostat, Harvesting a single natural population, Prey predator systems and Lotka Volterra equations, Populations in competitions, Epidemic Models (SI, SIR, SIRS, SIC), Activator-Inhibitor system, Insect Outbreak Model: Spruce Budworm, Numerical solution of the models and its graphical representation.

UNIT-B **15 HOURS**

Qualitative analysis of continuous models: Steady state solutions, stability and linearization, multiple species communities and Routh-Hurwitz Criteria, Phase plane methods and qualitative solutions, bifurcations and limit cycles with examples in the context of biological scenario.

UNIT-C **15 HOURS**

Spatial Models: One species model with diffusion, two species model with diffusion, Conditions for diffusive instability, Spreading colonies of microorganisms, Blood flow in circulatory system, travelling wave solutions, spread of genes in a population.

UNIT-D **15 HOURS**

Discrete Models: Overview of difference equations, steady state solution and linear stability analysis, Introduction to Discrete Models, Linear Models, Growth models, Decay models, Drug Delivery Problem, Discrete Prey-Predator models, Density dependent growth models with harvesting, Host-Parasitoid systems (Nicholson-Bailey model), Numerical solution of the models and its graphical representation. Case Studies: Optimal Exploitation models, Models in Genetics, Stage Structure Models, Age Structure Models.

Books Recommended

1. Keshet, L.E. *Mathematical Models in Biology*. SIAM, 1988.Prinnt.
2. Murray, J. D. *Mathematical Biology*. Springer, 1993.Print.
3. Fung, Y.C. *Biomechanics*. Springer-Verlag, 1990.Print.
4. Brauer, F., P.V.D. Driessche, and J. Wu. *Mathematical Epidemiology*. Springer, 2008. Print.
5. Kot, M. *Elements of Mathematical Ecology*. Cambridge University Press, 2001.Print.

Course Title: Linear Programming

Course Code: MTH 333

L	T	P	Credits
5	1	0	6

Course 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 **15 HOURS**

Introduction to linear programming problem, Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method, Big-M method and their comparison.

UNIT-B **15 HOURS**

Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of dual.

UNIT-C **15 HOURS**

Transportation problem and its mathematical formulation, northwest-corner method least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

UNIT-D **15 HOURS**

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, and linear programming solution of games.

Books Recommended

1. Bazaraa, Mokhtar S, John J. Jarvis, and Hanif D. Sherali. *Linear Programming and Network Flows,* India: John Wiley and Sons, 2004. Print.

2. Hillier, F.S. and G.J. Lieberman. *Introduction to Operations Research,* Singapore: Tata McGraw Hill, 2009.Print.

3. Taha, Hamdy A. *Operations Research, An Introduction,* India: Prentice-Hall, 2006.Print.

4. Hadley, G. *Linear Programming,* New Delhi: Narosa Publishing House , 2002.Print.

Course Title: Mathematical Modeling

Course Code: MTH 334

L	T	P	Credits
5	1	0	6

Course Objective: The objective of the course is to introduce mathematical modelling, that is, the construction and analysis of mathematical models inspired by real life problems. The course will present several modelling techniques and the means to analyze the resulting systems.

UNIT-A **15 HOURS**

Power series solution of a differential equation about an ordinary point, solution about a regular singular point, Bessel's equation and Legendre's equation,

UNIT-B **15 HOURS**

Laplace transform and inverse transform, application to initial value problem up to second order.

UNIT-C **15 HOURS**

Monte Carlo Simulation Modeling: simulating deterministic behavior (area under a curve, volume under a surface), Generating Random Numbers: middle square method, linear congruence,

UNIT-D **15 HOURS**

Queuing Models: harbor system, morning rush hour, Overview of optimization modeling, Linear Programming Model: geometric solution algebraic solution, simplex method, sensitivity analysis

Books Recommended

1. Tyn Myint, U, and Lokenath Debnath, *Linear Partial Differential Equation for Scientists and Engineers*. Indian: Springer, 2006.

2. Giordano Frank R., Maurice D. Weir, and William P. Fox, *A First Course in Mathematical Modeling*. London and New York: Thomson Learning, 2003.

3. Kapur, J.N, *Mathematical Modelling,* New Age International (P) limited, New Delhi:2005.

Course Title: Mechanics
Course Code: MTH 335

L	T	P	Credits
5	1	0	6

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 **15 HOURS**
Preliminary concepts, Force Systems - coplanar, collinear, concurrent, parallel, equivalent force systems; Forces acting at a point- parallelogram law of forces, resolved parts of a force, triangle law of forces, $\lambda - \mu$ theorem, Lami's theorem, polygon law of forces; Parallel forces- two like parallel, unlike parallel; Moments- moment of a force, Varigon's theorem.

UNIT-B **15 HOURS**
Couple- moment of couple, equivalence of two couples, couples in parallel planes, resultant of force and couple, resolution of a force into a force and a couple; equilibrium of a rigid body under the action of coplanar forces; Friction- definition and nature of friction, laws of friction, equilibrium of a particle on a rough plane; Centre of gravity- basic concepts of center of gravity (C.G.).

UNIT-C **15 HOURS**
Dynamics- state of rest and motion, displacement, velocity, speed, acceleration; motion with constant acceleration; Newton's laws of motion, weight carried by a lift, Atwood's machine, motion on a smooth inclined plane, constrained motion along a smooth inclined plane; motion under variable acceleration.

UNIT-D **15 HOURS**
Simple harmonic motion (S.H.M.), periodic motion; projectile motion; Curvilinear motion in a plane- tangential and normal accelerations, angular displacement, angular velocity, angular acceleration; Central force motion- areal velocity, angular momemtum, central orbit, Kepler's laws of planetary motion; work, power and energy, potential energy of a gravitational field.

Books Recommended

1. Loney S.L., *The elements of statics and dynamics*, 5th edition. Cambridge University Press, 1947.
2. Chorlton, F., *Text book of Dynamics*. CBS Publishers, Reprint 2002.
3. Synge, J. L., and B. A. Griffth, *Principles of mechanics*, 2nd edition. Mc-Graw Hill Book Comapny, 1947.
4. Shames I.H., and G. Krishna Mohan Rao, *Engineering Mechanics: Statics and Dynamics*, 4th edition. New-Delhi: Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2009.
5. Hibbeler R.C., and A. Gupta, *Engineering Mechanics: Statics and Dynamics*, 11th edition. New-Delhi: Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2009.

Course Title: Differential Geometry

L	T	P	Credits
5	1	0	6

Course Code: MTH 336

Course Objective:

To introduce students to Differential Geometry. Surfaces; the shape operator; principal, Gaussian and mean curvatures; minimal surfaces; geodesics.

UNIT-A **15 HOURS**

Theory of Space Curves: Space curves, Planer curves, Curvature, torsion and Serret-Frenet formulae. Osculating circles, Osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

UNIT-B **15 HOURS**

Theory of Surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem. Rodrigue's formula, Conjugate and Asymptotic lines.

UNIT-C **15 HOURS**

Developables: Developable associated with space curves and curveson surfaces, Minimal surfaces.

UNIT-D **15 HOURS**

Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metric tensor and 3-index Christoffel symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.

Books Recommended

1. Willmore T.J., *An Introduction to Differential Geometry*. Dover Publications, 2012.
2. O'Neill B., *Elementary Differential Geometry*, 2nd edition. Academic Press, 2006.
3. Weatherburn C.E., *Differential Geometry of Three Dimensions*. Cambridge: Cambridge University Press, 2003.
4. Struik D.J., *Lectures on Classical Differential Geometry*. Dover Publications, 1988.
5. Lang S., *Fundamentals of Differential Geometry*. Springer, 1999.
6. Spain B., *Tensor Calculus: A Concise Course*. Dover Publications, 2003.

Course Title: Finite Element Methods

L	T	P	Credits
5	1	0	6

Course Code: MTH 140

Course Objective: This course will enable the students to learn the concepts governing FE equations for systems obtained by ordinary differential equations and partial differential equations.

UNIT-A **15 HOURS**

Introduction to finite element methods, comparison with finite difference methods, Methods of weighted residuals, collocations, least squares and Galerkin's method.Variational formulation of boundary value problems equivalence of Galerkin and Ritz methods.

Applications to solving simple problems of ordinary differential equations.

UNIT-B **15 HOURS**

Linear, quadratic and higher order elements in one dimensional and assembly, solution of assembled system.

UNIT-C **15 HOURS**

Simplex elements in two and three dimensions, quadratic triangular elements, rectangular elements, serendipity elements and isoperimetric elements and their assembly, discretization with curved boundaries.

UNIT-D **15 HOURS**

Interpolation functions, numerical integration, and modeling considerations**.**
Solution of two dimensional partial differential equations under different Geometric conditions.

Books Recommended

1. Reddy, J.N. *Introduction to the Finite Element Methods*. Tata McGraw-Hill, 2003.Print.

2. Bathe, K.J. *Finite Element Procedures*. Prentice-Hall, 2001**.**Print.

3. Cook, R.D., D.S. Malkus and M.E. Plesha. *Concepts and Applications of Finite Element Analysis*. John Wiley and Sons, 2002.Print.

4. Hughes, Thomas J.R. *The Finite Element Method: Linear Static and Dynamic Finite Element Analysis*. Dover Publication, 2000.Print.

5. Buchanan, George R. *Finite Element Analysis*. McGraw Hill, 1994.Print.

Course Title: Mathematical Finance

L	T	P	Credits
5	1	0	6

Course Code: MTH 141

UNIT-A **15 HOURS**

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson Methods), comparison of NPV and IRR. Bonds, bond prices and yields.

UNIT-B **15 HOURS**

Macaulay and modified duration, term structure of interest rates: spot and forward rates, explanations of term structure, running present value, floating-rate bonds, immunization, convexity, putable and callable bonds.

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UNIT-C **15 HOURS**

Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints).

UNIT-D **15 HOURS**

Two fund theorem, risk free assets, One fund theorem, capital market line, Sharpe index. Capital Asset Pricing Model (CAPM), betas of stocks and portfolios, security market line, use of CAPM in investment analysis and as a pricing formula, Jensen's index.

Books Recommended

1. Luenberger, David G. *Investment Science.* Delhi: Oxford University Press, 1998.Print.

2. Hull, John C. *Options, Futures and Other Derivative.* India: Prentice-Hall, 2006.Print.

3. Ross, Sheldon. *An Elementary Introduction to Mathematical Finance*. USA: Cambridge University Press, 2003.Print.

Course Title: Logic and Sets
Course Code: MTH 142

L	T	P	Credits
2	0	0	2

Course Objective:
The objective of this course is to acquaint the students with the basic concepts in Discrete Mathematics, which includes the topic like Mathematical Logic, Recursive Relations and Boolean algebra.

UNIT-A **14 HOURS**
Logic: Introduction, propositions, truth table, negation, conjunction and disjunction, implications, bi-conditional propositions, converse, contra positive, inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

UNIT -B **12 HOURS**
Set Theory: Natural Numbers- Well Ordering Principle, Principle of Mathematical Induction, Sets, subsets, Set operations and the laws of set theory and Venn diagrams, examples of finite and infinite sets, Finite sets and counting principle. Empty set, properties of empty set.

UNIT -C **12 HOURS**
Set Operations: Standard set operations, classes of sets, power set of a set, difference and symmetric difference of two sets, set identities, generalized union and intersections.

UNIT –D **14 Hours**
Relations and Functions: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, Hasse diagram, Functions, Special functions, Composition of Functions, one-one, onto and Inverse of a function, Number of one-one functions.

Books Recommended

1. Grimaldi, R.P. *Discrete Mathematics and Combinatorial Mathematics*. Pearson Education, 1998.
2. Halmos, P.R. *Naive Set Theory*. Springer, 1974.
3. Kamke, E. *Theory of Sets*. Dover Publishers, 1950.
4. Rosen K.H., *Discrete Mathematics and its Applications*, 6th edition. McGraw Hill, 2007.
5. Malik D.S., and M.K. Sen. *Discrete Mathematical Structures: Theory and Applications*. New Delhi: Thomson Cengagae Learning, 2004.
6. Ram, B. *Discrete Mathematics*. Pearson Publications, 2011.

Course Title: Applications of Algebra
Course Code: MTH 143

L	T	P	Credits
5	1	0	6

Course Objective: The aim of this course is to make the students learn about the applications of algebra such as Coding theory, Fibonacci numbers.

UNIT-A **15 HOURS**

Balanced incomplete block designs (BIBD): definitions and results, incidence matrix of a BIBD, construction of BIBD from difference sets, construction of BIBD using quadratic residues, difference set families, construction of BIBD from finite fields, Coding Theory: introduction to error correcting codes, linear cods, generator and parity check matrices, minimum distance, Hamming Codes, decoding and cyclic codes.

UNIT-B **15 HOURS**

Symmetry groups and color patterns: review of permutation groups, groups of symmetry and action of a group on a set; colouring and colouring patterns, Polya theorem and pattern inventory, generating functions for non-isomorphic graphs, Special types of matrices: idempotent, nilpotent, involution, and projection tri diagonal matrices, circulant matrices, Vandermonde matrices, Hadamard matrices, permutation and doubly stochastic matrices, Frobenius- König theorem, Birkhoff theorem.

UNIT-C **15 HOURS**

Positive Semi-definite matrices: positive semi-definite matrices, square root of apositive semi-definite matrix, a pair of positive semi-definite matrices, and their simultaneous diagonalization. Symmetric matrices and quadratic forms: diagonalization of symmetric matrices, quadratic forms, constrained optimization, singular value decomposition, and applications to image processing and statistics.

UNIT-D **15 HOURS**

Applications of linear transformations: Fibonacci numbers, incidence models, and differential equations, Least squares methods: Approximate solutions of system of linear equations, approximate inverse of an m×n matrix, solving a matrix equation using its normal equation, finding functions that approximate data. Linear algorithms: LDU factorization, the row reduction algorithm and its inverse, backward and forward substitution, approximate inverse and projection algorithms.

Books Recommended

1. Herstein, I. N., and D. J. Winter. *Primer on Linear Algebra*. New York: Macmillan Publishing Company, 1990.Print.
2. Nagpaul, S. R, and S. K. Jain. *Topics in Applied Abstract Algebra*. Belmont: Thomson Brooks and Cole, 2005.Print.
3. Klima, Richard E, Neil Sigmon, and Ernest Stitzinger. *Applications of Abstract Algebra with Maple*. CRC Press LLC: Boca Raton, 2000.Print.
4. C Lay, David. *Linear Algebra and its Applications* 3rd Ed. Pearson Education Asia Indian Reprint, 2007.print.
5. Zhang, Fuzhen. *Matrix theory*. Springer-Verlag New York Inc: 1999.Print.

Course Title: Latex and HTML
Course Code: MTH 144

L	T	P	Credits
0	0	4	2

Practicals:
Elements of LaTeX; Hands-on-training of LaTex; graphics in LaTeX; PSTricks; Beamer presentation; HTML, creating simple web pages, images and links, design of web pages.

Books Recommended

1. J. Erickson, Martin, and Donald Bindner. *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*. CRC Press: Boca Raton FL, 2011.Print.

2. Lamport, L. *A Document Preparation System User's Guide and Reference Manual.* New York: Addison-Wesley, 1994.Print.

Course Title: Combinatorial Mathematics
Course Code: MTH 145

L	T	P	Credits
5	1	0	6

UNIT-A **15 HOURS**

Basic counting principles, Permutations and Combinations (with and without repetitions), Binomial theorem, Multinomial theorem, Counting subsets, Set-partitions, Stirling numbers

UNIT-B **15 HOURS**

Principle of Inclusion and Exclusion, Derangements, Inversion formulae
Generating functions: Algebra of formal power series, Generating function models, Calculating generating functions, Exponential generating functions.

UNIT-C **15 HOURS**

Recurrence relations: Recurrence relation models, Divide and conquer relations, Solution of recurrence relations, Solutions by generating functions.
Integer partitions, Systems of distinct representatives.

UNIT-D **15 HOURS**

Polya theory of counting: Necklace problem and Burnside's lemma, Cyclic index of a permutation group, Polya's theorems and their immediate applications.

Latin squares, Hadamard matrices, Combinatorial designs: *t* designs, BIBDs, Symmetric designs.

Books Recommended

1. Van Lint, J.H, and R.M. Wilson. *A Course in Combinatorics* 2nd Ed. Cambridge University Press, 2001.Print.
2. Krishnamurthy, V. *Combinatorics Theory and Application*. Affiliated East-West Press, 1985.Print.
3. Cameron, P.J. *Combinatorics Topics, Techniques, Algorithms*. Cambridge University Press, 1995. Print.
4. Hall, M. Jr. *Combinatorial Theory* 2nd Ed. John Wiley & Sons, 1986. Print.
5. Sane, S.S. *Combinatorial Techniques*. Hindustan Book Agency, 2013. Print.
6. Brualdi, R.A. *Introductory Combinatorics* 5th Ed. Pearson Education Inc, 2009.Print.

Course Title Operating Systems
Course Code: CSA260
Course Duration: 25-30 Hours

L	T	P	Credits
2	0	0	2

Course Objective: To understand and learn the fundamentals of Operating System including dealing with memory management, process management, CPU scheduling, deadlocks and file management.

UNIT– A **10 Hours**

Introduction to Operating System

- OS, History of OS, Types of OS
- Functions/operations of OS, User services/jobs, system calls
- Traps, architectures for operating systems

CPU Scheduling

- Process states, virtual processors
- interrupt mechanism, scheduling algorithms
- Preemptive scheduling & Non-Preemptive scheduling

UNIT – B **7 Hours**

Process Management

- Process overview, process states and state transition
- Classical synchronization problems, Multithreading.

System Deadlock

- Deadlock characterization, Deadlock prevention and avoidance
- Deadlock detection and recovery, practical considerations

UNIT– C **7 Hours**

Storage Management

- Storage allocation methods: Single contiguous allocation
- Multiple contiguous allocation

Memory Management

- Paging, Segmentation combination of Paging and Segmentation
- Cache memory, hierarchy of memory types, associative memory.

UNIT – D

6 Hours

File Management

- Overview of File Management System
- Disk Space Management, Directory Structures

Device Management

- Goals of I/O software, Design of device drivers, Device scheduling policies

Reference Books:

1. Galvin and Silberschatz A., *Operating System Concepts*, Eigth Addition, New York: J. Wiley & Sons, 2009.
2. Crowley, *Operating Systems: A Design Oriented Approach*, New Delhi: Tata McGraw Hill, 2008.
3. Donovan J.J, *Systems Programming*, New York: McGraw Hill, 1972.
4. Dhamdhere. D.M, *System Programming and Operating Systems*, New Delhi: Tata McGraw Hill, 1999.
5. Madnick and Donovan, *Operating System*, New York: McGraw Hill, 1978.
6. Beck Leland, L., *System Software*, Delhi: Pearson Education, 2000.
7. Henson, P.B., *Operating System Principles*, Delhi: Prentice Hall
8. Tenenbaum, *A.S. Operating System*: Design and Implementation, New Delhi: PHI, 2013.

Course Title: Database Management Systems
Course Code: CSA261
Course Duration: 25-30 Hours

L	T	P	Credits
2	0	0	2

Course Objective: The concepts related to database, database design techniques, transaction management, SQL, database operations are introduced in this subject. This creates strong foundation for data base creation

UNIT– A **7 Hours**

Data Base Concepts

- Data base vs. file oriented approach, Data Independence
- Data Base Models
- General Architecture of a Data Base Management Software Components of a DBMS
- Advantages and Disadvantages of DBMS

UNIT – B **7 Hours**

Introduction to Data Models

- Entity Relationship model, hierarchical model network model, relational model
- object oriented database, object relational database
- Comparison of OOD & ORD, comparison of network, hierarchical and relational models.

UNIT – C **8 Hours**

Data Base Design

- Entities, Attributes, ER Diagrams
- Functional dependencies; Normalization
- Multivalued dependencies, decomposition
- Relational algebra and calculus
- The relational calculus query processor and optimizer, Storage organization for relations.

UNIT – D **8 Hours**

Database Protection

- Recovery
- Concurrency Management
- Database Security
- Integrity and Control
- Disaster Management

Reference Books:

1. Desai. B.C., *An Introduction to Database Systems*, New Delhi: Galgotia Publ. Private Ltd, 2000.

2. Date. C.J, *Data Base Systems*, Vols. I & II, New Delhi: Narosa Publishers, 2002.

3. Silberscatz, Korth and Sudarshan, *Database System Concepts*, Third Ed., New York: McGraw Hill International Editions, Computer Science Series, 2010.

4. Peter Rob Carlos Coronel, *Data Base Systems* (3rd Edition), New Delhi: Galgotia Publications (P) Ltd, 2001.

Course Title: Programming in C#
Course Code: CSA210
Course Duration: 45-60 Hours

L	T	P	Credits
4	0	0	4

Course Objective: This course provides the knowledge about creating windows forms, namespaces, assemblies, handling exceptions, casting, memory management and pointers. They also learn the concepts of threads and database connectivity.

UNIT-A

Introduction to .NET Environment **10 Hours**

- .Net Architecture, The Relationship of C# To .Net , The Common Language Runtime , Advantages of Managed Code, Use of Attributes, Deployment.
- The Common Language Runtime, Framework Base Classes, User and Programs Interface, Visual Studio .NET, .NET Languages, Benefits of The .NET Approach

UNIT-B

C# Fundamentals **13 Hours**

- C# Basics , Variables , Predefined Data Types : Value Types and Reference Types , CTS Types ,Conditional Statements ,Loops , Jump Statements , Enumerations
- Arrays , Using Statement , Namespace , Aliases , The Main() Method , Multiple Main Methods , Passing Arguments To Main() . More on Compiling C# Files, Console I/O, Using Comments.
- The C# Preprocessor Directives,C# Programming Guidelines. Objects and Type: Classes and Structs, Partial Classes, Static Classes, The Object Class Inheritance: Types of Inheritance, Virtual Methods, Hiding Methods, Calling Base Versions of Functions.
- Sealed Classes and Methods, Constructors of Derived Classes , Modifiers, Interfaces , Derived Interfaces
- Differencebetween C++ and C#, Difference between Java and C#.

UNIT-C **10 Hours**

Operators and Casts

- Operator Shortcuts, The Ternary Operator, The Checked and unchecked Operators, The Is Operator , The as Operator , The Sizeof Operator , The Type of Operator , Nullable Types and Operators , The Null Coalescing Operator , Operator Precedence
- Type Safety, Type Conversions, Boxing and Unboxing , Comparing Objects For Equality , Operator Overloading , User Defined Casts.

Object oriented aspects of C#

- Classes, Objects, Inheritance, Polymorphism, Interfaces,
- Operator Overloading, Delegates, Events, Errors and Exceptions

UNIT-D **12 Hours**

I/O and Object serialization

- I/O: System. I/O, Streams, TextWriter, TextReader

Writing windows forms applications and deploying windows forms applications

- Writing Windows Forms Applications: Understanding Windows Forms, Window Form Controls,Menus, MDI Forms
- Using Inheritance In Windows Forms, Using Common Dialog Controls,
- Deploying Windows Forms Applications
- Introduction To Deployment, ClickOnce Deployment,Creating An Installation Package For Project

Reference Books

1. Nagel Christian, Evgen Bill and GiynnJay, *Professional C# 2005*, Wrox Publications, 2006
2. Dietel & Dietel , *C# How to Program*, New Delhi: Pearson Education, 2007.
3. Sharp John & Jagger John,*Visual C#.Net*, New Delhi: PHI, New Delhi, 2005.
4. Francisco, *Visual Studio .Net*, Microsoft Publication, 2012.
5. Jones, Bradley L, *Teach Yourself C# in 21 Days*. Sams publishing, 2001
6. Balagurusamy, E., *Programming in C#*, New Delhi:Tata McGraw-Hill (UNIT I, II),2004.

Course Title: Programming in C# Laboratory
Course Code: CSA216

L	T	P	Credits
0	0	4	2

- Implementation of OOPs Concepts
- Namespaces
- Array and Strings
- Structures and Enumerations
- Delegates and Events
- Exception Handling

Course Title: Computer Fundamentals and Programming using C
Course Code: CSA171
Course Duration: 45-60 Hours

L	T	P	Credits
4	0	0	4

Course Objective: This course will enable the student to gain an understanding of the core concepts and technologies which constitute Information Technology. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C language (structured programming).

UNIT-A

Computer Fundamentals **12 Hours**

- Block Structure of a Computer, Characteristics of Computers
- Computer generations, Applications of Computers.

Number System

- Bit, byte, binary, decimal, hexadecimal, and octal systems, conversion from one system to the other, representation of characters, integers and fractions. Addition, subtraction, multiplication and division of binary numbers.

Memory Types

- RAM, ROM, Cache and Secondary memory.

Input and Output Devices

- Keyboard, Mouse, Monito, Light pen, Joystick, Mouse, Touch screen; OCR, OMR, MICR.
- Impact, nonimpact, working mechanism of Drum printer, Dot Matrix printer, Inkjet printer and Laser printer, plotters.

UNIT-B **13 Hours**

Fundamentals of C

- Character Set, Identifiers and Key Words, Data Types
- Constants, Variables, Expressions, Statements, Symbolic Constants.

Operations and Expressions

- Arithmetic Operators, Unary Operators, Relational Operators,
- Logical Operators, Assignment and Conditional Operators, Library functions.

Data Input and Output

- Single Character Input, Single Character Output, Entering Input Data
- More About Scan Functions, Writing Output Data, More About Print Functions
- Gets and Puts Functions, Interactive Programming.

UNIT-C **13 Hours**

Control Structures

- Introduction, Decision Making with If – Statement, If Else and

Nested If,

- While And Do-While, For Loop.
- Jump Statements: Break, Continue, Goto, Switch Statement.

Functions

- Introduction To Functions, Function Declaration, Function Categories
- Standard Functions, Parameters And Parameter Passing, Pass – By Value/Reference
- Recursion, Global and Local Variables, Storage Classes.

Arrays

Introduction to Arrays, Array Declaration, Single and Multidimensional Array, Memory Representation, Matrices, Strings, String Handling Functions.

UNIT-D **10 Hours**

Structure and Union

- Declaration of Structure, Accessing Structure Members, Structure Initialization, Arrays of Structure, Nested Structures, Unions.

Pointers

- Introduction To Pointers, Address Operator And Pointers, Declaring and Initializing Pointers,
- Assignment through Pointers, Pointers and Arrays.

Files

- Introduction, Creating a Data File, Opening and Closing a Data File, Processing a Data File.

Preprocessor Directives

Introduction and Use, Macros, Conditional Preprocessors, Header Files

Reference Books

1. Kanetkar Yashvant P, *Let us C*, New Delhi :BPB Publications, Seventh Edition (2007).
2. Balagurusami E, *Programming in ANSI C*, New Delhi: Tata McGraw Hill, Fourth Edition (2010).
3. Gottfried Byron S., *Programming in C*, New Delhi: McGraw Hills, Second Edition 1996.
4. Kernighan & Richie,*The C Programming Language*, New Delhi: PHI Publication, Second Edition(2009) .
5. Gottfriet Bryon, *Schaum Outline Series, Programming in C*, New Delhi: McGraw Hills, 2010
6.Sinha, P.K. and Sinha, P., Foundations of Computing. New Delhi: BPB First Edition, 2002.
7.Norton Peter , Introduction to Computers, McGraw Hill.
8.Rajaraman V, Fundamentals of Computers, New Delhi: Prentice Hall of India, Second Edition, 1996.

Course Title: Computer Fundamentals and Programming using C Laboratory
Course Code: CSA172

L	T	P	Credits
0	0	4	2

Implementation of C programming concepts:

- Control Structures, Loops, Arrays, Strings
- Functions, Structures, Union, Files, etc.

Physics

Course Code: PHY 153A

L	T	P	Credits
4	0	0	4

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.

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

L	T	P	Credits
0	0	3	2

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: PHY155A

L	T	P	Credits
4	0	0	4

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.

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

L	T	P	Credits
0	0	3	2

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.

Course Code: PHY253A

L	T	P	Credits
4	0	0	4

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.

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

L	T	P	Credits
0	0	3	2

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.

- 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:

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**.**
17. To measure thermo e.m.f. of a thermocouple as a function of temperature and findinversion temperature.
18. Determination of given inductance by Anderson's bridge.
19. To determine the value of an air capacitance by deSauty Method and to findpermittivity of air. Also, determine the dielectric constant of a liquid.
20. Study of R.C. circuit with a low frequency a.c. source.
21. Studies based on LCR Board: Impedance of LCR circuit and the phase and between voltage and current.
22. To measure low resistance by Kelvin's double bridge/ Carey Foster's bridge.
23. 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.

Course Title: Mechanics and Waves

Course Code: PHY 353A

L	T	P	Credits
4	0	0	4

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..

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

L	T	P	Credits
0	0	3	2

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.

Course Title: Organic Chemistry
Course Code: CHE153 A
Course Objectives:

L	T	P	Credits
4	0	0	4

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.

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:

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.

Chemistry

Course Title: Spectroscopy

L	T	P	Credits
4	0	0	4

Course Code: CHE155 A

Course Objectives:

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.

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:

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 A

L	T	P	Credits
4	0	0	4

Course Objectives:

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.

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

L	T	P	Credits
0	0	3	2

Course Code: CHE254

Course Objectives:
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.

Course Title: PHYSICAL CHEMISTRY
Course Code: CHE353 A

L	T	P	Credits
4	0	0	4

Course Objectives: 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.

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.

Course Title: PHYSICAL CHEMISTRY LAB
Course Code: CHE354

L	T	P	Credits
0	0	3	2

Course Objectives:

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.

Course Title: Econometrics
Course Code: ECO 214 A

L	T	P	Credits
5	1	0	6

Course Objectives:

To provide the student with the basic principles of the specification of dynamic econometric models.

Unit-I

Nature, Meaning and Scope of econometric; Difference between mathematical economics, statistics and econometrics; Goals of econometrics.

Simple linear regression model (Two variables): Sources of disturbance terms, assumptions, least squares estimators and their properties; Gauss Markov's theorem.

Unit-II

General linear regression model: Definition, assumptions, least – squares estimation.testing significance of regression coefficients, concepts of R2 and R-2. Estimation of quadratic, semi – log and double log functions; simple and compound rates of growth (applications).

Unit-III

Concept of analysis of variance approach; One – way ANOVA (application only); Applications of ANOVA technique in regression analysis – testing significance of R2, significance of improvement in R2 due to additional explanatory variables, chow's test.

Unit-IV

Problems of Multicollinearity, Autocorrelation and Hetroscedasticity: Nature, Consequences, tests and remedies (elementary treatment).

Recommended Reading:

1. Koutsoyiannis, A, (2011), "Theory of Econometrics", Palgrave Macmillan.
2. Theil, H., (1981), "Introduction to Econometrics", Prentice hall, New Delhi.
3. Gujarti, D. N., (2010), Basic Econometrics", Tata McGraw hill.

Course Title: Basic Communication Skills

Course Code: ENG151A

No. of Lectures: 60

L	T	P	Credits
3	0	0	3

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.

Unit – A Applied Grammar (Socio-Cultural Context)

1. Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection 5 hours
2. Tenses (Rules and Usages in Socio-cultural contexts) 6 hour
3. Modals: Can, Could, May, Might, Will, Would, Shall, Should, Must, Ought to 5hours
4. Passives 5 hours
5. Reported/Reporting Speech 5 hour

Unit – B Reading (Communicative Approach to be Followed)

1. J M Synge: Riders to the Sea (One Act Play) 7 hours
2. Anton Chekhov : Joy (Short Story) 5 hours
3. Swami Vivekanand : The Secret of Work (Prose) 7 hours

Unit – C Writing

1. Paragraph and Essay Writing 5Hours
2. Letter Writing: Formal and Informal 5 hours
3. Notice and Email 5hours

References:

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). Web.
2. www.letterwritingguide.com. Web.
3. www.teach-nology.com. Web.
4. www.englishforeveryone.org. Web.
5. www.dailywritingtips.com. Web.
6. www.englishwsheets.com. Web.
7. www.mindtools.com. Web.

Course Title: Basic Communication Skills Lab

Course Code: ENG 152

No. of Lectures: 30

L	T	P	Credits
0	0	2	1

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

1. Movie-Clippings 10 hours
2. Role Plays 10 hours
3. Group Discussions 10 hours

References:

Books

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

Websites

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

Course Title: Technical Communication
Course Code: ENG351
Total Lectures: 45

L	T	P	Credits
3	0	0	3

Course Objective: This paper, with a practice-oriented approach, aims to hone students' skills in all the dimensions of technical communication.

Learning Outcomes: Students will show adequate understanding of technical communication skills.

Unit-1

- Nature of Technical Communication
- Verbal and Non-Verbal Communication
- Barriers to Communication

Unit-2

- Conversation: Formal and Informal
- Sounds of English (Speech Skills)
- Panel Discussion and Group Discussion
- Oral Presentation

Unit-3

- Report Writing
- Business and Technical Proposals
- Memos

Unit-4

- C.V. and Resume
- Business Letters and Application Letters
- Interview

Suggested Readings

Koneru, Aruna. *Professional Communication*. Delhi: McGraw, 2008. Print.

Rizvi, M. Ashraf. *Effective Technical Communication*. Delhi: McGraw, 2005. Print.

Sharma, R.C. and Krishna Mohan. *Business Correspondence and Report Writing*. Delhi: McGraw, 2013. Print.

Tyagi, Kavita and Padma Misra. *Basic Technical Communication*. Delhi: PHI Learning, 2013. Print.

Course Title: Human Values and General Studies

L	T	P	Cr.
4	0	0	4

Course Code: SGS107

Course Objectives

a) To sensitize students about the role and importance of human values and ethics in personal, social and professional life.
b) To enable students to understand and appreciate ethical concerns relevant to modern lives.
c) To prepare a foundation for appearing in various competitive examinations
d) To sensitize the students about the current issues and events of national and international importance
e) To provide opportunity to the students to study inter disciplinary subjects like Geography, Science, Economy, Polity, History, International Relations etc.

Part - A

Human Values

1. **Concept of Human Values:** Meaning, Types and Importance of Values. **2 Hrs**
2. **Value Education :** Basic guidelines for value education **2 Hrs**
3. **Value crisis and its redressal** **1 Hrs**

Being Good and Responsible

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

Part - B

Value – based living

1. Vedic values of life **2 Hrs**

2. *Karma Yoga* and *Jnana Yoga* **2 Hrs**

3. *Ashta Marga* and *Tri-Ratna* **2 Hrs**

Ethical Living:

1. Personal Ethics **2 Hrs**
2. Professional Ethics **3 Hrs**
3. Ethics in Education **2 Hrs**

Part-C

General Geography

World Geography **3 Hrs**

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

Indian Geography **3 Hrs**

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

General History **3 Hrs**

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

Glimpses of World History **3 Hrs**

Important Events of World History, Revolutions and Wars of Independence, Political Philosophies like Nazism, Fascism, Communism, Capitalism, Liberalism etc.

Indian Polity: Constitution of India **3 Hrs**

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.

General Economy **3 Hrs**

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

Part-D

General Science **3 Hrs**

General appreciation and understandings of science including the matters of everyday observation and experience, Inventions and Discoveries

Sports and Recreation **3 Hrs**

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

Current Affairs **3 Hrs**

National and International Issues and Events in News, Governments Schemes and Policy Decisions

Miscellaneous Information

Who is who **2 Hrs**

Books and Authors, Persons in News, Awards and Honours, Abbreviations and Sports

References:

1.Human Values, A N Tripathi, New Age International Publishers, New Delhi, Third Edition, 2009

2.Professional Ethics, R. Surbiramanian, Oxford University Press, New Delhi, 2013.

3. Human Values and Professional Ethics, Rishabh Anand, Satya Prakashan, New Delhi, 2012

4. Human Values and Professional Ethics, Sanjeev Bhalla, Satya Prakashan, New Delhi, 2012.

5. Human Values and Professional Ethics, Ritu Soryan Dhanpat Rai & Co. Pvt. Ltd., First Edition, 2010.
6. Human Values and Professional Ethics by Suresh Jayshree, Raghavan B S, S Chand & Co. Ltd. , 2007.
7.Human Values and Professional Ethics, Yogendra Singh, Ankur Garg, Aitbs publishers, 2011.
8. Human Values and Professional Ethics, Vrinder Kumar, Kalyani Publishers, Ludhiana, 2013.
9. Human Values and Professional Ethics, R R Gaur, R. Sangal, GP Bagaria, Excel Books, New Delhi 2010.
10. Values and Ethics, Dr. Bramwell Osula, Dr. Saroj Upadhyay, Asian Books Pvt. Ltd., 2011.
11. Indian Philosophy, S. Radhakrishnan, George Allen & Unwin Ltd., New York: Humanities Press INC, 1929.
12. Essentials of Hinduism, Jainism and Buddhism, A N Dwivedi, Books Today, New Delhi – 1979
13. Dayanand : His life and work, Suraj Bhan, DAVCMC, New Delhi – 2001.
14. Esence of Vedas, Kapil Dev Dwivedi, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
15. Vedic Concepts, Prof. B B Chaubey, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
16. Advance Objective General Knowledge, R. S. Aggarwal, S. Chand Publisher (2013)
17. Concise General Knowledge Manual 2013, S. Sen, Unique Publishers,2013
18. Encyclopedia of General Knowledge and General Awareness by R P Verma, Penguin Books Ltd (2010)
19. General Knowledge Manual 2013-14, Edgar Thorpe and Showick Thorpe, The Pearson, Delhi.
20. General Knowledge Manual 2013-14, Muktikanta Mohanty, Macmillan Publishers India Ltd., Delhi.
21. India 2013, Government of India (Ministry of Information Broadcasting), Publication Division, 2013.
22. Manorama Year Book 2013-14, Mammen Methew, Malayalam Manorama Publishers, Kottayam, 2013.

23. Spectrum's Handbook of General Studies – 2013-14, Spectrum Books (P) Ltd., 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

Course Title: Environmental Studies

Course Code: EVS100

L	T	P	Credits
4	0	0	4

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.

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

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

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)

Suggested Readings:

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