CHOICE BASED CREDIT SYSTEM

SCHEME & SYLLABUS

B.Sc (Hons.) Mathematics

Department of Physical Sciences

University Institute of Sciences and Humanities (UISH)

Sant Baba Bhag Singh University

2018

Index

Scheme for B.Sc. –(Hons.) Mathematics

Semester 1

B.Sc (Hons.) Mathematics, Semester-I

I. Theory Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of Course
1	MAT 101-18	Differential Calculus	6:0:0	6:0:0	6	6	CC
2	PHY 103-18	Mechanics	4:0:0	4:0:0	4	4	GE
3	CHM 101-18	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4:0:0	4:0:0	4	4	GE
4	ENG 101-18	General English-I	3:0:0	3:0:0	3	3	AECC
5	PBI 101-18/ HCP 101-18	General Punjabi-I/HCP	3:0:0	3:0:0	3	3	AECC
6		NCC/NSS/NSO	2:0:0	Non-credit	2	NC	

II. Practical Subjects

1	PHY103-18	Mechanics	0:0:4	0:0:2	4	2	GE
2	CHM 103-18	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	0:0:4	0:0:2	4	2	GE
Total					30	24	

Total Contact Hours: 30

Total Credit Hours: 24

CC- Core Course

GE- Generic Elective

AECC-Ability Enhancement Compulsory core

B.Sc (Hons.) Mathematics , Semester-II

I. Theory Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of Course
1	MAT 102-**18**	Differential Equations	6:0:0	6:0:0	6	6	CC
2	MAT 116-18	Algebra	6:0:0	6:0:0	6	6	CC
3	PHY 102-**18**	Electricity and Magnetism	4:0:0	4:0:0	4	4	GE
4	CHM 102-**18**	Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I	4:0:0	4:0:0	4	4	GE
5	ENG 102-**18**	General English-II	3:0:0	3:0:0	3	3	AECC
6	PBI 102-**18** HCP 102-**18**	General Punjabi-II/HCP	3:0:0	3:0:0	3	3	AECC
7		NCC/NSS/NSO	2:0:0	Non-credit	2	NC	

II. Practical Subjects

1	PHY 104-**18**	Electricity and Magnetism	0:0:4	0:0:2	4	2	GE
2	CHM 104-**18**	Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I	0:0:4	0:0:2	4	2	GE
Total					**36**	**30**	

Total Contact Hours: 36

Total Credit Hours: 30

CC- Core Course

AECC-Ability Enhancement Compulsory core

B.Sc (Hons.) Mathematics, Semester-III

I. Theory Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of Course
1	MAT201-18	Real Analysis	5:1:0	5:1:0	6	6	CC
2	M AT209-18	Group Theory-I	5:1:0	5:1:0	6	6	CC
3	MAT213-18	Partial Differential Equations and System of Ordinary Differential Equations	5:1:0	5:1:0	6	6	CC
4	MAT207-18/	Logics and Gates/ Computer Graphics	2:0:0	2:0:0	2	2	SEC
5	EVS201-18	Environmental Studies	3:0:0	3:0:0	3	3	AECC
				Hours=23| Credits=23			

Total Contact Hours: 23

Total Credit Hours: 23

CC- Core Course

AECC-Ability Enhancement Compulsory core

SEC-Skill Enhancement course

B.Sc (Hons.) Mathematics, Semester-IV

I. Theory Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of Course
1	MAT218-18	Numerical Methods (Theory)	5:0:0	5:0:0	5	5	CC
2	MAT220-18	Numerical Methods (Practical)	0:0:1	0:0:1	2	1	CC
3	MAT222-18	Riemann Integration and Series of functions	5:1:0	5:1:0	6	6	CC
4	MAT22418	Ring Theory and Linear Algebra-I	5:1:0	5:1:0	6	6	CC
5	MAT226-18/	Graph Theory/ Operating System: Linux	2:0:0	2:0:0	2	2	SEC
				Hours=21| Credits=20			

Total Contact Hours: 21

Total Credit Hours: 20

CC- Core Course

AECC-Ability Enhancement Compulsory core

SEC-Skill Enhancement course

B.Sc (Hons.) Mathematics, Semester-V

I. Theory Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of Course
1	MAT311-18	Multivariate Calculus	5:1:0	5:1:0	6	6	CC
2	MAT313-18	Group Theory-II	5:1:0	5:1:0	6	6	CC
3	MAT315-18/ MAT317-18 /MAT319-18	Portfolio Optimization/ Number Theory/ Analytical Geometry	4:0:0	4:0:0	4	4	DSE
4	MAT321-18/ MAT323-18/ MAT325-18	Industrial Mathematics/ Boolean Algebra and Automata Theory/ Probability and Statistics	4:0:0	4:0:0	4	4	DSE
				Hours=20| Credits=20			

Total Contact Hours: 20

Total Credit Hours: 20

CC- Core Course

DSE-Discipline Subject course

B.Sc (Hons.) Mathematics, Semester-VI

I. Theory Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of Course
1	MAT314-18	Metric Spaces and Complex Analysis	5:1:0	5:1:0	6	6	CC
2	MAT316-18	Ring Theory and Linear Algebra-II	5:1:0	5:1:0	6	6	CC
3	MAT318-18 MAT320-18 MAT322-18	Theory of Equations/ Bio-Mathematics/ Linear Programming	4:0:0	4:0:0	4	4	DSE
4	MAT324-18 MAT326-18 MAT328-18	Mathematical Modeling/ Mechanics/ Differential Geometry	4:0:0	4:0:0	4	4	DSE
					Hours=20| Credits=20		

Total Contact Hours: 20

Total Credit Hours: 20

CC- Core Course

DSE-Discipline Subject course

Summarized report of Course Scheme for _B.Sc (Hons.) Mathematics										
Sem	**L**	**T**	**P**	**Contact hrs/wk**	**Credits hrs/wk**	**CC**	**GE**	**AECC**	**SEC**	**DSE**
1	**22**	**0**	**4**	**30**	**24**	**6**	**12**	**6**		
2	**28**	**0**	**4**	**36**	**30**	**12**	**12**	**6**		
3	**20**	**3**	**0**	**23**	**23**	**18**		**3**	**2**	
4	**17**	**2**	**1**	**21**	**20**	**18**			**2**	
5	**18**	**2**	**0**	**20**	**20**	**12**				**8**
6	**18**	**2**	**0**	**20**	**20**	**12**				**8**
Total	**123**	**9**	**9**	**150**	**137**	**78**	**24**	**15**	**4**	**16**

SEMESTER-I

Course Code	PHY101-18
Course Title	Mechanics
Type of course	Theory
L T P	4:0:0
Credits	4
Course prerequisite	+2 PHYSICS
Course Objective	The aim of the subject is to enhance the knowledge of students in electrostatics, electrodynamics and mechanics.

Unit -I

Vectors: Vector algebra, Scalar and vector products Derivatives of a vector with respect to a parameter, Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients, Laws of Motion: Frames of reference, Newton's Laws of motion. Dynamics of a system of particles, Centre of Mass. Momentum and Energy: Conservation of momentum.

Unit-II

Work and Energy, Conservation of energy, Motion of rockets, Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum. Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness, Basic idea of global positioning system (GPS).

Unit-III

Oscillations: Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations. Elasticity: Hooke's law – Stress - strain diagram - Elastic moduli - Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion

Unit-IV

Torsional pendulum - Determination of Rigidity modulus and moment of inertia - q, η and σ by searles method Special Theory of Relativity: Constancy of speed of light, Postulates of Special Theory of Relativity, Length contraction, Time dilation, Relativistic addition of velocities.

Text and Reference Books

S. NO	NAME	AUTHOR(S)	PUBLISHER
1	INTRODUCTION TO ELECTRODYNAMICS	D J GRIFFITH	PRENTICE-HALL OF INDIA
2	PHYSICS- VOL 2	HALLIDAY AND RESNIK	
3	ELECTRICITY AND MAGNETISM	A S MAHAJAN AND A A RANGWALA	TATA MCGRAW-HILL
4	BERKELEY PHYSICS COURSE, VOL. 1, MECHANICS	E M PURCELL, ED	TATA MCGRAW-HILL
5	INTRODUCTION TO CLASSICAL MECHANICS	R G TAKWALE & P S PURANIK	TATA MCGRAW-HILL

Course Code	**MAT101-18**
Course Title	Differential Calculus
Type of course	Theory
L T P	6:0:0
Credits	6
Course prerequisite	+2 Mathematics
Course Objective	It develops the techniques to simplify algebraic expressions .In addition, it encourages students to expand their knowledge through practical application in their daily life.

Unit-I

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit-II

Tangents and Normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

Unit-III

Rolle's Theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder

Unit-IV

Taylor's series, Maclaurin's series of sin x, cos x, e^x, log(l+x), $(l+x)^m$, Maxima and Minima, Indeterminate forms.

Text and Reference Books

S. NO	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	*CALCULUS*	H. ANTON, I. BIRENS AND S. DAVIS	JOHN WILEY AND SONS
2	*CALCULUS*	G.B. THOMAS AND R.L. FINNEY	PEARSON EDUCATION

Course Code	CHM 101-18
Course Title	Atomic structures , bonding , general organic and chemistry and aliphatic hydrocarbons
Type of course	Theory
L T P	4:0:0
Credits	4
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of the subject is to enhance the knowledge of students in Chemical bonding atomic / molecular structure, About basic concepts of organic chemistry.

Unit-I

Atomic Structure**:** Review of: Bohr's theory and its limitations, dual behavior of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s , 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). Rules for filling electrons in various orbitals, Electronic configurations of the atoms.Stability of half-filled and completely filled orbitals, concept of exchange energy. Energies of atomic orbitals, Anomalous electronic configurations.

Unit-II

Chemical Bonding and Molecular Structure Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approach

Unit-III

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyper-conjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles

and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

Unit-IV

Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction,Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution : Halogenation. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidatioN Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. $KMnO_4$

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	Stereochemistry	P.S. Kalsi	New age International
6	Organic reaction mechanism	Singh and Mukharje	New age International

Course Code	ENG101-18
Course Title	General English-I
Type Course	Theory
L T P	3 0 0
Credits	3
Course Pre-requisite	**NA**
Course Objective (CO)	1. The students will critically read and analyze the prescribed texts. 2. The students will demonstrate effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work. 3. The students will recognize the correct usage of present/past/future tenses in contextualized speech.

UNIT I

Tales of Life :

a. The Umbrella (Henry Rene Albert Guy de Maupassant)
b. The Story Teller (H.H. Munro Saki)
c. The Lament (Anton Pavlovich Chakhov)

UNIT II

Prose for Young Learners:

a. Universal Declaration Of Human Rights (U.N. Charter)
b. Symptoms (Jerome K. Jerome)

Exploring Tenses in English:

a. Present and Past
b. Present Perfect and Past

UNIT III

Tales of Life:

a.The Luncheon (William Somerset Maugham)
b.The Shroud (Prem Chand)

UNIT IV

Prose for Young Learners:

a. On Spendthrifts(A.G.Gardinar)
b. The Power of Women(Richard Gardon)
c. A Dialogue On Democracy (Albert Sydney Horby)

Exploring Tenses in English:

a. Future

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Singh, S	2008	Tales of Life	Press and Publication Department, Guru Nanak Dev University, Amritsar.
2	Tewari, A. K, Midha,V.K, Sharma, R.K	2011	Prose For Young Learners	Publication Bureau, Guru Nanak Dev University, Amritsar
3	Murphy, R	2015	English Grammar in Use	Cambridge University Press

Course Code	**PBI101-18**
Course Title	General Punjabi-I
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	NA
Course Objectives	1. ividAwrQI AwDuink pMjwbI kvIAW dI jIvnI qoN jwxU hoxgy[2. ividAwrQIAW nUM AwDuink pMjwbI kivqw dI ivSYgq jwxkwrI ho jwvygI[3. ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwrQIAW nUM pMjwbI DunIN ivauNqbMdI sMbMDI igAwn hwisl ho jwvygw[5. ividAwrQI pMjwbI aup- BwSwvW nUM pCwnxXog ho jwxgy[

iekweI- a

1. **AwDuink pMjwbI kivqw:** BweI vIr isMG (rauN ru^, smW, ie`Cw bl qy fUMGIAW SwmW), DnI rwm cwiqRk(rwDw sMdyS, isdkW vwilAW dy byVy pwr ny), pRo. pUrn isMG(purwxy pMjwb nUM AwvwzW), &IrozdIn Sr&(kurbwnI, ^Yr pMjwbI dI), pRo. mohn isMG(Awau n`cIey, nvW kOqk), nMd lwl nUrpurI(cuMm cuMm r`Ko, mzdUr), AMimRqw pRIqm(bwrW mwh, sMXog ivXog), fw. hrBjn isMG(qyry hzUr myrI hwizrI dI dwsqW), iSv kumwr btwlvI(ibrhoN dI rVHk, z^m), surjIq pwqr(cONk ShIdW ‘c ausdw Awi^rI BwSx, Zzl)
2. **pMjwb dy mhwn klwkwr(lyK):** ky. AY~l. sihgl, bVy gulwm AlI KW, soBw isMG, ipRQvIrwj kpUr, BweI smuMd isMG[

iekweI- A

1. pMjwbI DunI ivauNq : aucwrn AMg, aucwrn sQwn qy ivDIAW, svr, ivAMjn[
2. BwSw vMngIAW: BwSw dw tkswlI rUp, BwSw Aqy aup- BwSw dw AMqr, pMjwbI aupBwSwvW dy pCwx icMnH[

pusqk sUcI

pwT- pusqkW

lyKk	swl	Pusqk	pbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw; p.s.	2014	do rMg	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
gwrgI; b.	1995	pMjwb dy mhwn klwkwr	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr

sMbMiDq pusqkW

lyKk	swl	Pusqk	pbilSr
isMG; h.	1966	pMjwbI bwry	pMjwbI XUnIvristI, pitAwlw
isMG; qIrQ (fw.)	2014	pMjwbI AiDAwpn	AY~s. jI. pbilSrz, jlMDr
syKoN; suKivMdr isMG (fw.) Aqy syKoN; mndIp kOr	2015	pMjwbI BwSw dw AiDAwpn	kilAwxI pbilSrz, luiDAwxw

Course code	HCP101-18
Course title	History and Culture of Punjab -I
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	NA
Course objectives (CO)	1. The Student will acquire the knowledge about Punjab and its Historical Resources. 2. The Student will understand the Harppan Culture and different Vedic Periods. 3. The Students will analyze the Alexander's invasions.

Unit I

Ancient Punjab: Physical features, Political, Social, Economic, Geographical, Religious impact on History, Historical Sources: Literacy, Archaeological, Harappan Culture: Extent and Town Planning.

Unit II

Harppan Culture: Social, Economic and Religious life; Causes and Disappearance, Rig Vedic Age: The rise of Indo Aryans, Main features of the life in Early Vedic Age, Later Vedic Age: Political, Economic, Social, and Religious life of Later Vedic Aryans.

Unit III

Caste system: Origin and Evolution, The Epics: Historical importance of Ramayan and Mahabharat, Political condition on eve Alexander's Invasion.

Unit IV

Impact of Alexander's Invasion on Social and Culture Life., Position of Women: Harppan, Early Vedic and Later Vedic Age.

Important Historical places of Punjab: Mohenjodaro, Harappa, kotla Nihang khan, Sanghol, Banawali, Taxila, Hastinapur,Indraprastha,Srinagar, Sakala,Purusapura

Text and References Books:

S.NO.	Author's	Title	Publisher
1	Sukhdev Sharma	History And Culture Of Punjab	New Academic Publisher
2	Romila Thapar	A History of India, Vol. I	Penguin Books

Course Code	CHM 103-18
Course Title	Atomic structures , bonding , general organic and chemistry and aliphatic hydrocarbons
Type of course	PRACTICAL
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about the separation of organic molecules and estimation of inorganic salt and metal ions.

Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)

(a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

(b) Identify and separate the sugars present in the given mixture by paper chromatography.

Text and References Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	G Svehla	Prentice Hall
2	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
3	Advanced Experimental Chemistry. Vol. I	Physical, J.N. Gurtu and R. Kapoor	S. Chand & CO.
4	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
5	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS
6	Advanced Practical Physical Chemistry	J.B. Yadav	KRISHNA Prakashan Media (P) Ltd,

Course Code	**PHY103-18**
Course Title	Mechanics
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 physics
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students and provide them with exposure of basic measuring instruments, electricity and electronics apparatuses

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine **g** and velocity for a freely falling body using Digital Timing Technique
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g

Text and Reference Books

S. No	Name	Author(S)	Publisher
01	*Practical Physics*	C. L. Arora	S. Chand

SEMESTER -II

Course Code	PHY102-18
Course Title	Electricity and Magnetism
Type of course	Core
L T P	4 0 0
Credits	4
Course prerequisite	10+2 PHYSICS
Course Objective (CO)	The subject will add one more step to the students of first year in the fields of magnetism, electromagnetic theory, & properties of matter.

Unit-I

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors(statement only).

Unit-II

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Unit-III

Magnetism:Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials

Unit-IV

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law,self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.Maxwell`s equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Introduction to Electrodynamics*	D J Griffith	Prentice-Hall of India
2	*Physics Vol 2*	Halliday and Resnik	
3	*Electricity and Magnetism*	A S Mahajan and A A Rangwala	Tata McGraw-Hill
4	*Berkeley Physics Course, Vol. 1, Mechanics*	E M Purcell, Ed	Tata McGraw-Hill

Course Code	MAT102-18
Course Title	Differential equations
Type of course	Core
L T P	6 0 0
Credits	6
Course prerequisite	10+ 2 mathematics
Course Objective (CO)	It develop the knowledge about Differential Equations and partial equations.

Unit-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

Unit -II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-III

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Unit-IV

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Differential Equations*	Shepley L. Ross	John Wiley and Sons
2	*Elements of Partial Differential Equations*	Sneddon	McGraw-Hill

Course Code	MAT116-18
Course Title	Algebra
Type of course	Core
L T P	6 0 0
Credits	6
Course prerequisite	10+ 2 mathematics
Course Objective (CO)	It develops the knowledge about complex number system, Systems of linear equations and linear transformations.

Unit-I

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications.

Unit -II

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-III

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence.

Unit-IV

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R_n, dimension of subspaces of R_n and rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix.

Text and Reference Books

1. Titu Andreescu and Dorin Andrica, *Complex Numbers from A to Z*, Birkhauser, 2006.
2. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005**.**
3. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

Course Code	CHM 102-18
Course Title	Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I
Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of the subject is to enhance the knowledge of students regarding Physical concepts of chemistry like Chemical Energetic, Chemical Equilibrium. General organic chemistry of aromatic systems and functional groups.

Unit-I

Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermo-chemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Unit-II

Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G^{o}, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

Ionic Equilibria:Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Unit-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides,Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Unit-IV

Alcohols, Phenols and Ethers (Up to 5 Carbons) Alcohols: Preparation: Preparation of 1^{o}, 2^{o} and 3^{o} alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk.$KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben– Hoesch Condensation, Schotten – Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde)Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Organic reaction mechanism, 3rd ed. Latest edition	V. K. Ahluwalia	Narosa publishing house, New Dehli
2	Organic Chemistry	Morrison and Boyd	Prentice Hall
3	Fundamentals of Organic Chemistry	Solomons	John Wiley
4	The Elements of Physical Chemistry	P.w. Aikins	Oxford
5	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

Course Code	ENG102-18
Course Title	General English-II
Type Course	Theory
L T P	3 0 0
Credits	3
Course Pre-requisite	**10+2**
Course Objective (CO)	To develop understanding of the significance of English as a subject in the present context, to feel pleasure and to develop the understanding of the significance of basic competencies in language acquisition. This course will enable students to understand the foreign language as well as the use of language and to enable students to acquire language skills such as listening, speaking, reading, and writing and integrate them for communicative purposes.

Texts Prescribed:

Unit-I Tales of Life

a. The Doll's House(Katherine Mansfield)
b. Eveline (James Joyce)
c. Toba Tek Singh (Saadat Hassan Manto)
d. The Taboo (Victor Astafyev)
e. A Strand of Cotton (Suneet Chopra)

Unit-II Prose for Young Learners

a. Beauty And The Beast(R.K.Narayan)
b. With A Song On Their Lips (Hugh & Colleen Gantzer)
c. My Financial Careers (Stephen Leacock)
d. The School For Sympathy (E.V. Lucas)
e. AIDS (U.N.Report)

UNIT-III Exploring Grammar

a. Modals
b. Passive

UNIT-IV

c. Reported Speech
d. Questions and Auxiliary verbs

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Singh, S	2008	Tales of Life	Press and Publication Department, Guru Nanak Dev University, Amritsar.
2	Tewari, A. K, Midha,V.K, Sharma, R.K	2011	Prose For Young Learners	Publication Bureau, Guru Nanak Dev University, Amritsar
3	Murphy, R	2015	English Grammar in Use	Cambridge University Press

Course Code	**PBI102-18**
Course Title	General Punjabi-II
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	NA
Course Objectives	1. ividAwrQI AwDuink pMjwbI khwxIkwrW dI jIvnI qoN jwxU hoxgy[2. ividAwrQIAW nUM AwDuink pMjwbI khwxI dI ivSYgq jwxkwrI ho jwvygI[3. ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwrQI muhwvry, AKwxW dI Fu`kvIN vrqoN krnW is`K jwxgy

iekweI- a

1. pMjwbI in`kI khwxI: BUAw (nwnk isMG), bwZI dI DI (gurmuK isMG muswi&r), pymI dy inAwxy(sMq isMG syKoN), bwgW dw rwKw(sujwn isMG), qYN kI drd nw AwieAw(krqwr isMG du`gI), DrqI hyTlw bOlD(kulvMq isMG ivrk), dUjI vwr jyb k`tI geI(nvqyj isMG), lCmI(pRym pRkwS), bu`q iSkn(AjIq kOr), b`s kMfktr(dlIp kOr itvwxw)[
2. pMjwb dy mhwn klwkwr (lyK): sqIS gujrwl, gurcrn isMG, Twkur isMG,blrwj swhnI, suirMdr kOr[

iekweI- A

1. Sbd bxqr Aqy Sbd rcnw: pirBwSw Aqy mu`Fly sMklp
2. (a) pYrHw rcnw, muhwvry Aqy AKwx[
   (A) pYrHw pVH ky pRSnW dy au~qr dyxw[

pusqk sUcI

pwT- pusqkW

LyKk	swl	pusqk	pbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw, p.s.	2014	do rMg	pbIIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
gwrgI, b.	1995	pMjwb dy mhwn klwkwr	pbIIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr

sMbMiDq pusqkW

LyKk	swl	psqk	pbilSr
isMG, h.	1966	pMjwbI bwry	pMjwbI XUnIvristI, pitAwlw
isMG, q.	2014	pMjwbI AiDAwpn	AY~s. jI. pbilSrz, jlMDr
syKoN, s.s. Aqy syKoN, m.k.	2015	pMjwbI BwSw dw AiDAwpn	kilAwxI pbilSrz, luiDAwxw

Course ode	HCP 102-18
Course title	History And Culture Of Punjab –II
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	NA
Course objectives (CO)	1. The Student will acquire the knowledge Of Mauryan Empire. 2. The Student will understand the impact of Buddhism & Jainism on Punjab. 3. To aware the learners Depiction of Punjab in the accounts of Chinese travelers.

Unit-I

The Mauryan Empire: Social, Economic and Religious life, Buddhism and Jainism: Impact on Punjab with special reference to 4th Buddhist Council., The Kushanas: Impact of Kanishka's rule on Punjab.

Unit-II

Gandhara School of Art: Salient features, The Guptas: Cultural and Scientific Developments.

Position of Women: Under the Mauryas, the Guptas and the Vardhanas.

Unit-III

Depiction of Punjab in the accounts of Chinese travelers. Fahien and Hwen Tsang. Main developments in literature, Education: Significant Developments: Taxila.

UNIT IV

Society and Culture on the eve of the Turkish invasion of Punjab,Punjab in the Kitab-ul-Hind of Alberuni,Important Historical places: Lahore, Multan Bathinda, Uchh, Jalandhar, Thanesar, Kangra, Taxila, Kundalvana, Pehowa, Thatta.

Text and References Books:

S.NO.	Author's	Title	Publisher
1	Sukhdev Sharma	History And Culture Of Punjab	New Academic Publisher
2	Romila Thapar	A History of India, Vol. I	Penguin Books
3	L.M.Joshi	History and Culture of the Punjab, Vol. I	Punjabi University, Patiala

Course Code	CHM 104-18
Course Title	Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry-I
Type of course	PRACTICAL
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of this course is to provide practical knowledge about the preparation of organic compounds, Thermo-chemistry and Ionic equilibrium.

Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.

Ionic equilibria

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) Preparation of buffer solutions:

(i) Sodium acetate-acetic acid

(ii) Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.

2 Criteria of Purity: Determination of melting and boiling points.

3 Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company Limited.
3	Vogel's Textbook of Practical Organic Chemistry (5th Edition) 2003	A.I. Vogel , A.R. Tatchell , B.S. Furnis , A.J. Hannaford , P.W.G. Smith	Pearson

Course Code	**PHY104-18**
Course Title	Electricity and Magnetism
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+ 2 physics
Course Objective (CO)	The course is to impart practical knowledge to the students and provide them with practical exposure of electricity and magnetism

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
   (i) Measurement of charge and current sensitivity
   (ii) Measurement of CDR
   (iii) Determine a high resistance by Leakage Method
   (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and
   (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer Theorem

S. No	**Name**	**Author(S)**	**Publisher**
01	*Practical Physics*	C. L. Arora	S. Chand

SEMESTER-III

Course	**B.Sc {Hons. Maths}, 3rd Semester**
Course Code	**MAT201-18**
Course Title	Real analysis
Type of course	Core
L T P	6 0 0
Credits	6
Course prerequisite	BSc. 1st with mathematics as core subject
Course Objective (CO)	To have the knowledge of basic properties of field of real numbers and convergence

Unit-I

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

Unit-II

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Unit-III

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

Unit-IV

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	*Introduction to Real Analysis*	R.G. Bartle and D. R Sherbert	John Wiley and Sons
2	*Elementary Analysis*	K.A. Ross	Springer Verlag,
3	*Intermediate Real Analysis*	E. Fischer	Springer Verlag

Course	**B.Sc {Hons. Maths}, 3rd Semester**
Course Code	**MAT209-18**
Course Title	**Group Theory -I**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to provide knowledge about the group theory.

Unit-I

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

Unit-I

Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups.

Unit-I

Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, 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-I

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

Text and Reference Books:

S. No	Name	Author(S)	Publisher
1	*A First Course in Abstract Algebra*	John B. Fraleigh	7th Ed., Pearson, 2002
2	*Abstract Algebra*	M. Artin	2nd Ed., Pearson, 2011,
3	*An Introduction to the Theory of Groups*	Joseph J. Rotman	4th Ed., Springer Verlag, 1995
4	*Topics in Algebra*	I.N. Herstein	Wiley Eastern Limited, India, 1975

Course	B.Sc {Hons. Maths}, 3rd Semester
Course Code	**MAT213-18**
Course Title	Partial Differential Equations and System of Ordinary Differential Equations
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to provide knowledge about the advancement in differential equation.

Unit-I

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-II

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-II

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-IV

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.

Text and Reference Books:

S. No	Name	Author(S)	Publisher
1	*Linear Partial Differential Equations for Scientists and Engineers*	Tyn Myint-U and Lokenath Debnath	4th edition, Springer, Indian reprint, 2006.
2	*Differential equations*	S.L. Ross	3rd Ed., John Wiley and Sons, India, 2004,

Course	**B.Sc {Hons. Maths}, 3rd Semester**
Course Code	**MAT207-18**
Course Title	**Logic and Sets**
Type of course	**SEC**
L T P	2 0 0
Credits	2
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of the subjects that students have basic knowledge of sets, relation and basic operators.

Unit-I

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.

Unit-II

Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Unit-III

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. Standard set operations. Classes of sets. Power set of a set.

Unit-IV

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, nary relations.

Books Recommended

S. No	Title	Author(S)	Publisher
1	*Discrete Mathematics and Combinatorial Mathematics*	R.P. Grimaldi	Pearson Education, 1998.
2	*Naive Set Theory,*	*Naive Set Theory*	Springer, 1974
3	*Theory of Sets*	E. Kamke	Dover Publishers, 1950

Course	**B.Sc {Hons. Maths}, 3rd Semester**
Course Code	**CSE 233-18**
Course Title	**Computer Graphics**
Type of course	**SEC**
L T P	2 0 0
Credits	2
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of the subjects that students have basic knowledge of computer Graphics

Development of computer Graphics: Raster Scan and Random Scan graphics storages, displays processors and character generators, colour display techniques, interactive input/output devices. Points, lines and curves: Scan conversion, line-drawing algorithms, circle and ellipse generation, conic-section generation, polygon filling anti aliasing. Two-dimensional viewing: Coordinate systems, linear transformations, line and polygon clipping algorithms.

Books Recommended

1. D. Hearn and M.P. Baker, *Computer Graphics*, 2nd Ed., Prentice–Hall of India, 2004.
2. J.D. Foley, A van Dam, S.K. Feiner and J.F. Hughes, *Computer Graphics: Principals and Practices*, 2nd Ed., Addison-Wesley, MA, 1990.
3. D.F. Rogers, *Procedural Elements in Computer Graphics*, 2nd Ed., McGraw Hill Book Company, 2001.
4. D.F. Rogers and A.J. Admas, *Mathematical Elements in Computer Graphics*, 2nd Ed., McGraw Hill Book Company, 1990.

Course Code	EVS201-18
Course Title	Environmental Science
Type of course	Theory
L T P	3 0 0
Credits	3
Course prerequisite	NA
Course Objective (CO)	To make students aware about environment and need of maintaining it with best possible knowledge.

UNIT-I

Introduction to Environment and Ecosystem: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness, Concept of Ecosystem, Structure, interrelationship, producers, Consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

UNIT-II

Environmental Pollution & Natural Resources: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes.Role of an individual in prevention of pollution. Pollution case studies.Disaster Management: Floods, earthquake, cyclone and landslides, Natural Resources and associated problems, use and over exploitation, case studies of forest mresources and water resources.

UNIT-III

Social Issues and the Environment :From Unsustainable to Sustainable development, Urban problems 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. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation

UNIT-IV

Human Population and the Environment & Field Work: Population growth, variation among nations. Population explosion –Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies

Visit to a local area to document environemntal assetsriver/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.

Text and reference books:

S. No	Title	Author(S)	Publisher
1	A Textbook for Environmental Studies	Erach Bharucha	
2	Environmental Biology,	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
3	Environmental Science,	Miller T.G. Jr.	Wadsworth

SEMESTER IV

Course	**B.Sc {Hons. Maths}, 4th Semester**
Course Code	**MAT218-18**
Course Title	**Numerical Methods (Theory)**
Type of course	Core
L T P	5 0 0
Credits	5
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of the subjects that students will be familiar with the notation and terminology related to finding the errors, significant numbers and Able to interpolate the problems using numerical methods

Unit-I

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation.
Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Unit-II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit-II

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Unit-II

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule.
Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.

Books Recommended

S. No	Title	Author(S)	Publisher
1	*A Friendly Introduction to Numerical Analysis*	Brian Bradie	Pearson Education, India, 2007
2	*Numerical Methods for Scientific and Engineering Computation*,	M.K. Jain, S.R.K. Iyengar and R.K. Jain	6th Ed., New age International Publisher, India, 2007.
3	*Applied Numerical Analysis*	C.F. Gerald and P.O. Wheatley	Pearson Education, India, 2008

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Course	**B.Sc {Hons. Maths}, 4th Semester**
Course Code	**MAT220-18**
Course Title	**Numerical Methods (Practical)**
Type of course	Core
L T P	0 01
Credits	1
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of the subjects that students will be familiar with the practical concept of numerical methods by computer software.

List of Practical (using any 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) Regulai Falsi Method.
(viii) LU decomposition Method.
(ix) Gauss-Jacobi Method.
(x) SOR Method or Gauss-Siedel Method.
(xi) Lagrange Interpolation or Newton Interpolation.
(xii) Simpson's rule.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*A Friendly Introduction to Numerical Analysis*	Brian Bradie	Pearson Education, India
2.	*Numerical Methods for Scientific and Engineering Computation*	M.K. Jain, S.R.K. Iyengar and R.K. Jain	New age International Publisher, India
3.	*Applied Numerical Analysis*	C.F. Gerald and P.O. Wheatley	Pearson Education, India
4.	*A First Course in Numerical Methods*	Uri M. Ascher and Chen Greif	PHI Learning Private Limited
5.	*Numerical Methods using Matlab*	John H. Mathews and Kurtis D. Fink	PHI Learning Private Limited

Course	**B.Sc {Hons. Maths}, 4th Semester**
Course Code	**MAT222-18**
Course Title	**Riemann Integration and Series of Functions**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	Students will become knowledgeable about definite integral is the infinite accumulation (i.e. sum) of some quantity.and Become able to decode/encode Riemann sum notation. Acquire the skills to calculate definite integrals, determine convergence (or radii of convergence) for series and Power Series. They will solve problem related to improper integral, Beta and Gamma functions.

Unit-I

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-II

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-II

Pointwise 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-IV

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

Sr. No.	Name	Author(s)	Publisher
1.	*Elementary Analysis, The Theory of Calculus,*	K.A. Ross	Springer
2.	*Introduction to Real Analysis*	R.G. Bartle D.R. Sherbert	John Wiley and Sons (Asia)
3.	*Elements of Real Analysis*	Charles G. Denlinger	Jones & Bartlett

Course	**B.Sc {Hons. Maths}, 4th Semester**
Course Code	**MAT224-18**
Course Title	**Ring Theory and Linear Algebra-I**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of the subjects that students will be able to describe Concepts of Ring Theory and to understand the theory of Vector space and Linear Transformations.

Unit-I

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-II

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

Unit-III

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

Unit-IV

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

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*A First Course in Abstract Algebra*	John B. Fraleigh	Pearson
2.	*Abstract Algebra*	M. Artin	Pearson
3.	*Linear Algebra*	Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence	Prentice-Hall of India Pvt. Ltd., New Delhi
4.	*Contemporary Abstract Algebra*,	Joseph A. Gallian	Narosa Publishing House, NewDelhi
5.	*Introduction to Linear Algebra*	S. Lang	Springer
6.	*Linear Algebra and its Applications*	Gilbert Strang	Thomson
7.	*Linear Algebra- A Geometric Approach*	S. Kumaresan	Prentice Hall of India
8.	*Linear Algebra*	Kenneth Hoffman, Ray Alden Kunze	Prentice-Hall of India Pvt. Ltd.
9.	*Groups, Rings and Fields*	D.A.R. Wallace	Springer Verlag London Ltd

Course	**B.Sc {Hons. Maths}, 4th Semester**
Course Code	**MAT226-18**
Course Title	**Graph Theory**
Type of course	**SEC**
L T P	2 0 0
Credits	2
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The student will be able to understand with the most fundamental Graph Theory topics and results and Be exposed to the techniques of proofs and analysis.

Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*Introduction to Lattices and Order*	B.A. Davey and H.A. Priestley	Cambridge University Press, Cambridge
2.	*Discrete Mathematics with Graph Theory*	Edgar G. Goodaire and Michael M. Parmenter	Pearson Education (Singapore) P. Ltd
3.	*Applied Abstract Algebra*	Rudolf Lidl and Gunter Pilz	

Course	**B.Sc {Hons. Maths}, 4th Semester**
Course Code	**CSE 234-18**
Course Title	**Operating System: Linux**
Type of course	**SEC**
L T P	2 0 0
Credits	2
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to impart knowledge to the students Linux – The Operating System. .

Operating System: Linux

Linux – The Operating System: Linux history, Linux features, Linux distributions, Linux's relationship to Unix, Overview of Linux architecture, Installation, Start up scripts, system processes (an overview), Linux Security, The Ext2 and Ext3 File systems: General Characteristics of, The Ext3 File system, file permissions. User Management: Types of users, the powers of Root, managing users (adding and deleting): using the command line and GUI tools.

Resource Management in Linux: file and directory management, system calls for files Process Management, Signals, IPC: Pipes, FIFOs, System V IPC, Message Queues, system calls for processes, Memory Management, library and system calls for memory.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*Linux Programming by Examples The Fundamentals*	Arnold Robbins	Pearson Education
2.	*Red Hat Linux Administrator's Guide*	Cox K	PHI
3.	*UNIX Network Programming*	R. Stevens	PHI
4.	*Unix Concepts and Applications*	Sumitabha Das	TMH
5.	*Linux in a Nutshell*	Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins	O'Reilly Media
6.	*Beginning Linux Programming*	Neil Matthew, Richard Stones, Alan Cox	

SEMESTER-V

Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT311-18**
Course Title	**Multivariate Calculus**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	To ensure the students to understand functions of several variables, directional dirivatives, concept of extrema of function of two variables and To get familiar with the double integration and triple integration.

Unit-I

Functions of several variables, limit and continuity of functions of two variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems, Definition of vector field, divergence and curl

Unit-II

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

Unit-III

Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path.

Unit-IV

Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*Calculus*	G.B. Thomas and R.L. Finney	Pearson Education, Delhi
2.	*Calculus*	M.J. Strauss, G.L. Bradley and K. J. Smith	Dorling Kindersley (India) Pvt. Ltd.
3.	*Basic Multivariable Calculus*	E. Marsden, A.J. Tromba and A. Weinstein	Springer (SIE),
4.	*Multivariable Calculus, Concepts and Contexts*	James Stewart	Thomson Learning, USA

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Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT313-18**
Course Title	**Group Theory-II**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	Students will become knowledgeable about advance concept in Group theory.

Unit-I

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-II

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-III

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

Unit-IV

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

Sr. No.	Name	Author(s)	Publisher
1.	*A First Course in Abstract Algebra*	John B. Fraleigh	Pearson
2.	*Abstract Algebra*	M. Artin	Pearson
3.	*Contemporary Abstract Algebra*	Joseph A. Gallian	Narosa Publishing House
4.	*Abstract Algebra*	David S. Dummit and Richard M. Foote	John Wiley and Sons (Asia) Pvt. Ltd., Singapore
5.	*Modern Algebra*	.R. Durbin	John Wiley & Sons, New York
6.	*Groups, Rings and Fields*	D. A. R. Wallace	Springer Verlag London Ltd

Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT315-18**
Course Title	**Portfolio Optimization**
Type of course	DSE-I(a)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS

Unit-I

Financial markets. Investment objectives. Measures of return and risk. Types of risks. Risk free assets. Mutual funds.

Unit-II

Portfolio of assets. Expected risk and return of portfolio. Diversification, Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem.

Unit-III

Risk-free assets and one fund theorem, efficient frontier. Portfolios with short sales. Capital market theory, Capital assets pricing model- the capital market line.

Unit-IV

Beta of an asset, beta of a portfolio, security market line. Index tracking optimization models. Portfolio performance evaluation measures.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*Investment Analysis and Portfolio Management*	. F. K. Reilly, Keith C. Brown	South-Western Publishers
2.	*Mean-Variance Analysis in Portfolio Choice and Capital Markets*	. H.M. Markowitz	Blackwell, New York
3.	*Portfolio Optimization*	M.J. Best	Chapman and Hall, CRC Press
4.	*Investment Science*	D.G. Luenberger	Oxford University Press

Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT317-18**
Course Title	**Number Theory**
Type of course	DSE-I(b)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	Students will become knowledgeable about the concept of Number theory.

Unit-I

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-II

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-III

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.

Unit-IV

Quadratic reciprocity, 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

Sr. No.	Name	Author(s)	Publisher
1.	*Elementary Number Theory*	.David M. Burton	6th Ed., Tata McGraw-Hill, Indian reprint, 2007
2.	*Beginning Number Theory*	Neville Robinns	2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007

Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT319-18**
Course Title	**Analytical Geometry**
Type of course	DSE-I(c)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to impart knowledge to the students about sketching of different conics

Unit-I

Techniques for sketching parabola, ellipse and hyperbola.

Unit-II

Reflection properties of parabola, ellipse and hyperbola.

Unit-III

Classification of quadratic equations representing lines, parabola, ellipse and hyperbola, Spheres, Cylindrical surfaces.

Unit-IV

Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*Calculus*	G.B. Thomas and R.L. Finney	9th Ed., Pearson Education, Delhi, 2005
2.	*Calculus*	H. Anton, I. Bivens and S. Davis	John Wiley and Sons (Asia) Pvt. Ltd. 2002
3	*The Elements of Coordinate Geometry*	S.L. Loney	McMillan and Company, London
4	*Elementary Treatise on Coordinate Geometry of Three Dimensions*	. R.J.T. Bill	, McMillan India Ltd., 1994

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Course	B.Sc {Hons. Maths}, 5th Semester
Course Code	**MAT321-18**
Course Title	**Industrial Mathematics**
Type of course	DSE-II(a)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS

Unit-I

Medical Imaging and Inverse Problems. The content is based on Mathematics of X-ray and CT scan based on the knowledge of calculus, elementary differential equations, complex numbers and matrices.

Unit-II

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. Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.

Unit-III

X-ray: Introduction, X-ray behavior and Beers Law (The fundament question of image construction) Lines in the place, Radon Transform: Definition and Examples, Linearity, Phantom (Shepp - Logan Phantom -Mathematical phantoms), Back Projection: Definition, properties and examples.

Unit-IV

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

Sr. No.	Name	Author(s)	Publisher
1.	*The Mathematics of Medical Imaging, A Beginners Guide*	Timothy G. Feeman	Springer Under graduate Text in Mathematics and Technology, Springer, 2010
2.	*Inverse Problems*	C.W. Groetsch	Activities for Undergraduates, The Mathematical Association of America, 1999
3	*An Introduction to the Mathematical Theory of Inverse Problems*	Andreas Kirsch	2nd Ed., Springer, 2011

Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT323-18**
Course Title	**Boolean Algebra and Automata Theory**
Type of course	DSE-II(b)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	

Unit-I

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, lattices as ordered sets, lattices as algebraic structures, sublattices, products and homomorphisms, Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal forms of Boolean polynomials.

Unit-II

Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits. Introduction: Alphabets, strings, and languages. Finite Automata and Regular Languages: deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages.

Unit-III

Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

Unit-IV

Turing Machines: Turing machine as a model of computation, programming with a Turing machine, variants of Turing machine and their equivalence, Undecidability: Recursively enumerable and recursive languages, undecidable problems about Turing machines: halting problem, Post Correspondence Problem, and undecidability problems about CFGs.

Books Recommended

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge University Press, Cambridge, 1990.
2. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*, (2nd Ed.), Pearson Education (Singapore) P.Ltd., Indian Reprint 2003.
3. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
4. J. E. Hopcroft, R. Motwani and J. D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, 2nd Ed., Addison-Wesley, 2001.
5. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, *Elements of the Theory of Computation*, 2nd Ed., Prentice-Hall, NJ, 1997.

Course	**B.Sc {Hons. Maths}, 5th Semester**
Course Code	**MAT325-18**
Course Title	**Probability and Statistics**
Type of course	DSE-II(c)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS

Unit-I

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.

Unit-II

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations.

Unit-III

Independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.

Unit-IV

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, Markov Chains, Chapman-Kolmogorov equations, classification of states.

Books Recommended

Sr. No.	Name	Author(s)	Publisher
1.	*Introduction to Mathematical Statistics*	Robert V. Hogg, Joseph W. McKean and Allen T. Craig	Pearson Education, Asia, 2007
2.	*Mathematical Statistics with Applications*	Irwin Miller and Marylees Miller, John E. Freund	7th Ed., Pearson Education, Asia, 2006
3	*Introduction to Probability Models*	Sheldon Ross,	9th Ed., Academic Press, Indian Reprint, 2007
4	*Introduction to the Theory of Statistics*	Alexander M. Mood, Franklin A. Graybill and Duane C. Boes	3rd Ed., Tata McGraw- Hill, Reprint 2007

SEMESTER-VI

Course	**B.Sc {Hons. Maths}, 6th Semester**
Course Code	**MAT314-18**
Course Title	**Metric Spaces and Complex Analysis**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	Students will become knowledgeable about basic concept of metric space and complex analysis.

Unit-I

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-II

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

Unit-III

Limits, Limits involving the point at infinity, continuity. 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-IV

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

Sr. No.	Name	Author(s)	Publisher
1.	*Metric Spaces*	Satish Shirali and Harikishan L. Vasudeva	Springer Verlag, London, 2006
2.	*Topology of Metric Spaces*	S. Kumaresan	2nd Ed., Narosa Publishing House, 2011
3	*Introduction to Topology and Modern Analysis*	G.F. Simmons	McGraw-Hill, 2004
4	*Complex Variables and Applications*	James Ward Brown and Ruel V. Churchill	8th Ed., McGraw – Hill International Edition, 2009

Course	B.Sc {Hons. Maths}, 6th Semester
Course Code	**MAT316-18**
Course Title	**Ring Theory and Linear Algebra-II**
Type of course	Core
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	Students will become knowledgeable about ring theory and Inner product spaces.

Unit-I

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

Unit-II

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

Unit-III

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-IV

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

S. No	Title	Author(S)	Publisher
1	*A First Course in Abstract Algebra*	John B. Fraleigh	7th Ed., Pearson, 2002
2	*Abstract Algebra*	M. Artin	2nd Ed., Pearson, 2011
3	*Contemporary Abstract Algebra*	Joseph A. Gallian	4th Ed., Narosa Publishing House, 1999
4	*Linear Algebra*	Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence	4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004
5	*Linear Algebra and its Applications*	Gilbert Strang	Thomson, 2007

Course	**B.Sc {Hons. Maths}, 6th Semester**
Course Code	**MAT318-18**
Course Title	**Theory of Equations**
Type of course	DSE-III(a)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to impart knowledge to the students about theory of equations. .

Unit-I

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-II

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-III

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

Unit-IV

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

Books Recommended

S. No	Title	Author(S)	Publisher
1	*The Theory of Equations*	W.S. Burnside and A.W. Panton	Dublin University Press, 1954
2	*Theory of Equations*	C. C. MacDuffee	, John Wiley & Sons Inc., 1954

Course	B.Sc {Hons. Maths}, 6th Semester
Course Code	**MAT320-18**
Course Title	**Bio-Mathematics**
Type of course	DSE-III(b)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	Students will become knowledgeable about basic concept of bio-Mathematics.

Unit-I

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).

Unit-II

Activator-Inhibitor system, Insect Outbreak Model: Spruce Budworm, Numerical solution of the models and its graphical representation. 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-III

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. Discrete Models: Overview of difference equations, steady state solution and linear stability analysis.

Unit-IV

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

S. No	Title	Author(S)	Publisher
1	*Mathematical Models in Biology*	L.E. Keshet	SIAM, 1988
2	*Mathematical Biology*	J. D. Murray	Springer, 1993
3	*Biomechanics*	Y.C. Fung	Springer-Verlag, 1990
4	*Mathematical Epidemiology*	F. Brauer, P.V.D. Driessche and J. Wu	Springer, 2008
5	*Elements of Mathematical Ecology*	M. Kot	Cambridge University Press, 2001

Course	B.Sc {Hons. Maths}, 6th Semester
Course Code	**MAT322-18**
Course Title	**Linear Programming**
Type of course	DSE-III(c)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	

Unit-I

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-II

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

Unit-III

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-IV

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

Books Recommended

S. No	Title	Author(S)	Publisher
1	*Linear Programming and Network Flows*	Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali	2nd Ed., John Wiley and Sons, India, 2004
2	*Introduction to Operations Research*	F.S. Hillier and G.J. Lieberman	9th Ed., Tata McGraw Hill, Singapore, 2009
3	*Operations Research, An Introduction*	Hamdy A. Taha	8th Ed., Prentice-Hall India, 2006
4	*Linear Programming*	G. Hadley	Narosa Publishing House, New Delhi, 2002

Course	B.Sc {Hons. Maths}, 6th Semester
Course Code	**MAT324-18**
Course Title	**Mathematical Modeling**
Type of course	DSE-IV(a)
L T P	5 0 1
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	

Unit-I

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-II

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

Unit-III

Monte Carlo Simulation Modeling: simulating deterministic behavior (area under a curve, volume under a surface), Generating Random Numbers: middle square method, linear congruence, Queuing Models: harbor system, morning rush hour.

Unit-IV

Overview of optimization modeling, Linear Programming Model: geometric solution algebraic solution, simplex method, sensitivity analysis.

List of Practicals (using any software)

(i) Plotting of Legendre polynomial for n = 1 to 5 in the interval [0,1]. Verifying graphically that all the roots of Pn (x) lie in the interval [0,1].
(ii) Automatic computation of coefficients in the series solution near ordinary points.
(iii) Plotting of the Bessel's function of first kind of order 0 to 3.
(iv) Automating the Frobenius Series Method.
(v) Random number generation and then use it for one of the following (a) Simulate area under a curve (b) Simulate volume under a surface.
(vi) Programming of either one of the queuing model (a) Single server queue (e.g. Harbor system) (b) Multiple server queue (e.g. Rush hour).
(vii) Programming of the Simplex method for 2/3 variables.

Books Recommended

S. No	Title	Author(S)	Publisher
1	*Linear Partial Differential Equation for Scientists and Engineers*	Tyn Myint-U and Lokenath Debnath	Springer, Indian reprint, 2006
2	*A First Course in Mathematical Modeling*	Frank R. Giordano, Maurice D. Weir and William P. Fox	Thomson Learning, London and New York, 2003

Course	**B.Sc {Hons. Maths}, 6th Semester**
Course Code	**MAT326-18**
Course Title	**Mechanics**
Type of course	DSE-IV(b)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to provide knowledge about the basic concept of Mechanics.

Unit-I

Moment of a force about a point and an axis, couple and couple moment, Moment of a couple about a line, resultant of a force system, distributed force system, free body diagram, free body involving interior sections, general equations of equilibrium, two point equivalent loading, problems arising from structures, static indeterminacy.

Unit-II

Laws of Coulomb friction, application to simple and complex surface contact friction problems, transmission of power through belts, screw jack, wedge, first moment of an area and the centroid, other centers, Theorem of Pappus-Guldinus, second moments and the product of area of a plane area, transfer theorems, relation between second moments and products of area, polar moment of area, principal axes.

Unit-III

Conservative force field, conservation for mechanical energy, work energy equation, kinetic energy and work kinetic energy expression based on center of mass, moment of momentum equation for a single particle and a system of particles, translation and rotation of rigid bodies.

Unit-IV

Chasles' theorem, general relationship between time derivatives of a vector for different references, relationship between velocities of a particle for different references, acceleration of particle for different references.

Books Recommended

S. No	Title	Author(S)	Publisher
1	*Engineering Mechanics: Statics and Dynamics*,	I.H. Shames and G. Krishna Mohan Rao	(4th Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009
2	*Engineering Mechanics: Statics and Dynamics*	R.C. Hibbeler and Ashok Gupta	11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

Course	**B.Sc {Hons. Maths}, 6th Semester**
Course Code	**MAT328-18**
Course Title	**Differential Geometry**
Type of course	DSE-IV(c)
L T P	5 1 0
Credits	6
Course prerequisite	10+ 2 MATHEMATICS
Course Objective (CO)	The aim of this course is to provide knowledge about the Space Curves and Geodesics, Tensor.

Unit-I

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, Theory of Surfaces: Parametric curves on surfaces, Direction coefficients.

Unit-II

First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem, Rodrigue's formula, Conjugate and Asymptotic lines, Developables: Developable associated with space curves and curves on surfaces, Minimal surfaces.

Unit-III

Geodesics: Canonical geodesic equations. Nature of geodesics on a surface of revolution. Clairaut's theorem. Normal property of geodesics. Torsion of a geodesic. Geodesic curvature. Gauss-Bonnet theorem. Surfaces of constant curvature. Conformal mapping. Geodesic mapping. Tissot's theorem.

Unit-IV

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

S. No	Title	Author(S)	Publisher
1	*An Introduction to Differential Geometry*	T.J. Willmore	Dover Publications, 2012.
2	*Elementary Differential Geometry*	B. O'Neill	2nd Ed., Academic Press, 2006
3	*Differential Geometry of Three Dimensions*	C.E. Weatherburn	Cambridge University Press 2003
4	*Lectures on Classical Differential Geometry*	D.J. Struik	Dover Publications, 1988
	Fundamentals of Differential Geometry	S. Lang	Springer, 1999