Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001

FACULTY OF SCIENCES

SYLLABUS

FOR

INTEGRATED/DUAL DEGREE B.SC.-M.SC. (FORENSIC SCIENCE)

2023 BATCH ONWARDS

SCHEME

1st Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
BHSMC0-042	English	2	0	0	40	60	100	2
BMFSS1-101	General Forensic Science and Criminal Law	3	0	0	40	60	100	3
BMFSS1-102	Elements of Questioned Document Examination	3	0	0	40	60	100	3
BSNMS1-103	Inorganic Chemistry-I	3	0	0	40	60	100	3
BSNMS1-104	Organic Chemistry-I	3	0	0	40	60	100	3
BSNMS1-108	Chemistry Lab- I	0	0	4	60	40	100	2
Group - I								
BMFSS1-103	Biodiversity (Microbes, Algae, Fungi &Archegoniate)	4	0	0	40	60	100	4
BMFSS1-104	Botany Lab. I	0	0	4	60	40	100	2
BMFSS1-105	Diversity of Animals-I	4	0	0	40	60	100	4
BMFSS1-106	Zoology Lab. I	0	0	4	60	40	100	2
Group - II								
BSNMS1-105	Differential Calculus-I	3	0	0	40	60	100	3
BSNMS1-106	Differential Calculus-II	3	0	0	40	60	100	3
BSNMS1-102	Mechanics	4	0	0	40	60	100	4
BSNMS1-107	Mechanics Lab	0	0	4	60	40	100	2
Total		**22/24**	**0**	**12/8**	**460/440**	**540/560**	**1000**	**28**

Type of Courses: Ability Enhancement Compulsory Course (AECC), Core Course (CC), Skill Enhancement Course (SEC), Discipline Specific Elective (DSE)
* Students can choose group of subjects among Group I and Group II.
Note: Exit policy is available as per UGC norms

2nd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
BMNCC0-041	Drug abuse: problem, management and prevention	2	0	0	100	00	100	0
BSNMS1-203	Physical Chemistry-I	3	0	0	40	60	100	3
BSNMS1-204	Organic Chemistry-II	3	0	0	40	60	100	3
BMFSS1-201	Fingerprints Examination and Forensic Photography	3	0	0	40	60	100	3
BMFSS1-202	Questioned Document and Fingerprint Laboratory	0	0	2	60	40	100	1
BSNMS1-208	Chemistry Lab-II	0	0	4	60	40	100	2
Group - I								
BMFSS1-203	Plant Ecology &Taxonomy	4	0	0	40	60	100	4
BMFSS1-204	Botany Lab. II	0	0	4	60	40	100	2
BMFSS1-205	Diversity of Animals-II	4	0	0	40	60	100	4
BMFSS1-206	Zoology Lab. II	0	0	4	60	40	100	2
Group - II								
BSNMS1-202	Electricity, Magnetism and EMT	4	0	0	40	60	100	4
BSNMS1-205	Differential Equations-I	3	0	0	40	60	100	3
BSNMS1-206	Differential Equations-II	3	0	0	40	60	100	3
BSNMS1-207	Electricity, Magnetism and EMT Lab	0	0	4	60	40	100	2
Total		**19/21**	**0**	**14/10**	**540/520**	**460/480**	**1000**	**24**

3rd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
BSNMS1-303	Inorganic Chemistry-II	3	0	0	40	60	100	3
BSNMS1-304	Physical Chemistry-II	3	0	0	40	60	100	3
BMFSS1-301	Criminalistics	3	0	0	40	60	100	3
BMFSS1-302	Criminalistics Laboratory	0	0	2	60	40	100	1
BSNMS1-305	Chemistry Lab III	0	0	4	60	40	100	2
Group - I								
BMFSS1-303	Plant Anatomy &Embryology	4	0	0	40	60	100	4
BMFSS1-304	Botany Lab. III	0	0	4	60	40	100	2
BMFSS1-305	Physiology & Biochemistry	4	0	0	40	60	100	4
BMFSS1-306	Zoology Lab. III	0	0	4	60	40	100	2
Group - II								
BSNMS1-306	Real Analysis-I	3	0	0	40	60	100	3
BSNMS1-307	Real Analysis-II	3	0	0	40	60	100	3
BSNMS1-301	Thermal Physics and Statistical Mechanics	4	0	0	40	60	100	4
BSNMS1-302	Thermal Physics and Statistical Mechanics Lab	0	0	4	60	40	100	2
Total		**17/19**	**0**	**14/10**	**440/420**	**460/480**	**900**	**24**

4th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
BHSMC0-041	Environmental Science	3	0	0	40	60	100	3
BSNMS1-403	Organic Chemistry-III	3	0	0	40	60	100	3
BSNMS1-404	Physical Chemistry-III	3	0	0	40	60	100	3
BSNMS1-405	Chemistry Lab-IV	0	0	4	60	40	100	2
BMFSS1-401	Forensic Psychology	3	0	0	60	40	100	3
Group - I								
BMFSS1-402	Plant Physiology & Metabolism	4	0	0	40	60	100	4
BMFSS1-403	Botany Lab. IV	0	0	4	60	40	100	2
BMFSS1-404	Genetics & Evolutionary Biology	4	0	0	40	60	100	4
BMFSS1-405	Zoology Lab. IV	0	0	4	60	40	100	2
Group - II								
BSNMS1-401	Waves and Optics	4	0	0	40	60	100	4
BSNMS1-402	Waves and Optics Lab	0	0	4	60	40	100	2
BSNMS1-406	Algebra-I	3	0	0	40	60	100	3
BSNMS1-407	Algebra-II	3	0	0	40	60	100	3
Total		**20/22**	**0**	**12/8**	**440/420**	**460/480**	**900**	**26**

5th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
BSNMD1-521	Chemistry of Main group elements	4	0	0	40	60	100	4
BSNMD1-522	Chemistry of Main group elements Lab	0	0	4	60	40	100	2
BMFSS1-501	Fundamentals of Computer Forensics	3	0	0	40	60	100	3
BMFSS1-502	Computer Forensics Laboratory	0	0	2	60	40	100	1
Group - I								
BMFSS1-503	Botany-I Cell and Molecular Biology	4	0	0	40	60	100	4
BMFSS1-504	Botany Lab. V	0	0	4	60	40	100	2
BMFSS1-505	Comparative Anatomy & Vertebrates	4	0	0	40	60	100	4
BMFSS1-506	Zoology Lab. V	0	0	4	60	40	100	2
Group - II								
BSNMD1-531	Matrices	3	0	0	40	60	100	3
BSNMD1-532	Linear Algebra	3	0	0	40	60	100	3
BSNMD1-511	Digital Analog and Instrumentation	4	0	0	40	60	100	4
BSNMD1-512	Digital Analog and Instrumentation Lab	0	0	4	60	40	100	2
Total		**15/17**	**0**	**14/10**	**400/380**	**400/420**	**800**	**22**

6th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**	
BSNMD1-621	Comprehensive Chemistry	4	0	0	40	60	100	4
BSNMD1-622	Comprehensive Chemistry Lab	0	0	4	60	40	100	2
BMFSS1-601	Forensic Audio Video Examination	3	0	0	40	60	100	3
BMFSS1-602	Forensic Audio Video Examination Laboratory	0	0	2	60	40	100	1
Group - I								
BMFSS1-603	Economic Botany and Biotechnology	4	0	0	40	60	100	4
BMFSS1-604	Developmental Biology	0	0	4	40	60	100	2
BMFSS1-605	Botany Lab. VI	4	0	0	60	40	100	4
BMFSS1-606	Zoology Lab.VI	0	0	4	60	40	100	2
Group - II								
BSNMD1-611	Elements of Modern Physics	4	0	0	40	60	100	4
BSNMD1-612	Elements of Modern Physics Lab	0	0	4	60	40	100	2
BSNMD1-631	Numerical Methods	3	0	0	40	60	100	3
BSNMD1-632	Complex Analysis	3	0	0	40	60	100	3
Total		**15/17**	**0**	**14/10**	**400/380**	**400/420**	**800**	**22**

FIRST SEMESTER

ENGLISH

Subject Code: BHSMC0-042 **L T P C** **Duration:30 Hrs.**
2 0 0 2

Course Objective: To improve the communication skills of students.
Course Outcome: To make student capable for attending interviews and for presenting their research in conferences.

UNIT-I (8 Hours)

Communication Skills: Introduction, Definition, the Importance of Communication,
The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

UNIT-II (7 Hours)

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.
Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

UNIT-III (7 Hours)

Communication Styles: Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.
Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

UNIT-IV (8 Hours)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview
Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

Recommended Books:

1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education, 2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press, 2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson, 2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life, 2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquette for Success', 5th Edition, Pearson, 2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,2010.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI, 2011.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press, 2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw Hill Education, 2011.
10. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
11. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill, 1999.

GENERAL FORENSIC SCIENCE AND CRIMINAL LAW

Subject Code: BMFSS1-101 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Course Objective:
1. To familiarize with history of Forensic Science.
2. To understand the importance of Forensic Science
3. To understand the working of Forensic Science labs and Police administration in India.
4. To understand various criminal laws and its importance in Forensic Science.

Course Outcome (CO): After the completion of the course, student will be able to:
CO1: Understand the concept of Forensic Science.
CO2: Learn the present scenario of Forensic Science in India and its scope
CO3: Gain knowledge about the various types of crimes.
CO4: Understand Criminal Law.

UNIT-I (15 Hrs)

Basic concepts of Forensic Science-I: Definition of Forensic Science by different authors, History of Forensic Science, Seven principles of Forensic Science, Nature, need, scope and functions of Forensic Science, Tools and techniques in forensic science, Ethics in Forensic Science, Subjective and objective observation, Qualitative and quantitative analysis, Preliminary and confirmatory tests, Positive control, negative control and blank samples.
Basic concepts of Forensic Science-II:, Modus operandi and its role in crime records, Corpus delicti, Prima facie, Admissibility of scientific evidence in the courtroom, Frye and Daubert standards.

UNIT-II (10Hrs)

Forensic Science Laboratories in India: Forensic science laboratories (FSLs) in India and its types- Central, State, Regional and Mobile FSLs, Branches of FSLs, Setup of FSLs, Hierarchy of experts in Forensic Science Laboratories, Services provided by FSLs, Functioning of FSLs, roles and responsibilities of forensic scientist, the Laboratory Information Management System(LIMS).
Report writing and Court testimony: FIR, Report writing and evidence evaluation, Components of report, Report format in respect of crime scene and laboratory findings, Court trial and testimony, Pre- Court Preparation and Court appearance

UNIT-III (13Hrs)

Criminal Law:
Definitions: Actus rues, Mens rea and its types, Bailable/non-bailable offences, Cognizable/non-cognizable, Summon cases and warrant cases.
Special Forms of Crime: Organized Crime: Gangs/Criminal Networks, Socio-Economic Crime, Custodial Crime, White-Collar Crime, Crime against Women/Children, Sex Offences. Correctional Therapy: Probation, Parole, Furlough, Remission and Pardon
Code of Criminal Procedure (CrPC): Sections- 291,292,293.
Indian Evidence Act (IEA): Sections-32, 45, 46, 47, 57, 58, 60, 73, 135,136, 137, 138,141.
Indian Penal Code (IPC): Sections (Offences against the person) -299,300,302,304B, 307, 309, 319, 320,324,326,351,354,359,362,375,376,377 and Sections (Offences against property)-378, 383,390,391,420, 463, 497,499, 503and 511.

UNIT-IV (07 Hrs)

Indian Constitution: Article 20 and 21.

Recent amendments in above mentioned sections of all laws.

Police Administration: History and development of police administration, Duties, roles, responsibilities and power of Police, Organizational structure of police, Relationship between police and forensic scientist with respect to crime investigation

People and society: Custodial deaths, Police and Human Rights.

Recommended Books:

1. Siegel J. A. and Mirakovits K: Forensic Science: The Basics, CRC Press, 3rd Edition, 2016.
2. Siegel J. A. and Saukko P. J.: Encyclopedia of Forensic Sciences, Academic Press, 2ndEdition, 2013.
3. Saferstein R: Forensic Science Hand Book, Vol I, CRC Press, 3rd Edition.2020.
4. Saferstein R: Forensic Science Hand Book, Vol II, Pearson, 2nd Edition.2005.
5. Saferstein R: Forensic Science Hand Book, Vol III, Pearson, 2nd Edition.2010.
6. Saferstein, R: Criminalistics: An Introduction to Forensic Science, Pearson, 12thEdition, 2018.
7. Sharma B.R.: Forensic Science in Criminal Investigation & Trials, Universal Law Publishing, 6thEdition, 2020.
8. The Constitution of India by Legislative Department, Ministry of Law and Justice, Govt. of India.
9. TheIndianEvidenceAct,1872 by Legislative Department, Ministry of Law and Justice, Govt. of India.

ELEMENTS OF QUESTIONED DOCUMENT EXAMINATION

Subject Code: BMFSS1-102 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Course Objectives:

1. To understand the importance of Questioned Document as an evidence.
2. To understand the principles of handwriting.
3. To acquire the knowledge of comparison of type written and printed matter.
4. To acquire knowledge of Standards for comparison.

Course Outcome (CO): After the completion of the course, student will be able to:

CO1: Understand the concept of Questioned Documents.
CO2: Gain knowledge regarding forgery, its type and examination.
CO3: Gain knowledge of cases which fall under purview of digital crimes.
CO4: Understand the elements involved in investigation of digital crimes.

UNIT-I (15 Hrs)

Documents in general: Importance, Classification and Preliminary Examination. **Elements of Handwriting:** Elements of Execution and Style Development of Individuality in Handwriting and Principles of handwriting identification.

UNIT-II (10Hrs)

Natural Variations in handwriting: Definition and nature, Determination of range of variations (consistency) and its importance. **Fundamental divergence sin handwriting:** Its interpretation in relation to identification of handwriting, consideration of various writing instruments used in writing.

UNIT-III (12Hrs)

Standards for comparison: Requested and Collected Standards **Alterations in the document:** Erasures, Additions, Overwriting and Obliterations: their examination **Forgery:** Definitions, types and characteristics **Disguise:** Definition and Characteristics **Indented and Invisible Writings:** Introduction and Methods of examination.

UNIT-IV (08Hrs)

Comparison of typewritten and Printed matter: Working and Types, Printing and Machine Defects, alterations in Printed and typed text. Photostat Machines and Fax machines: Examination of printouts from them. Working and Principle of Projectina /video- spectral comparator (VSC), ESDA, Docucenter Examination of Currency. Comparison of digitally manipulated documents.

Recommended Books:

1. Huber, A. R. and Headrike, A.M. (1999), Handwriting identification: facts and fundamental, CRC LLC.
2. Ellen, D (Edition 2nd) (1997), The scientific examination of Documents, Methods and techniques, Taylor & Francis Ltd.
3. Morris (Edition 1st) (2000), Forensic Handwriting Identification (fundamental concepts and Principals), Academic Press Inc.
4. Harrison, W.R (1966), Suspect Documents & their Scientific Examination, Sweet & Maxwell Ltd., London.
5. Hilton, O (1982), The Scientific Examination of Questioned Document, Elsevier North Holland Inc., New York.
6. Sulner, H.F. (1966), Disputed Document, Oceana Publications Inc., New York.

7. Saxena B.L. (1968), Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabad (Ed. A.K. Singla).
8. Quirke, A.J. (1930), Forged, Anonymous &Suspet Documents, ReorgeRontledge& Sons Ltd., London.
9. Osborn, A. S. (1929), Questioned Documents, Boyd Printing Co., Chicago.
10. Levinson, J (2000), Questioned Documents, Academic Press, Tokyo.
11. Kelly, J.S and Lindblom, B.S (2006), Scientific Examination of Questioned Documents, Taylor & Francis, New York.
12. Brunelle, R.L. and Reed, R.W. (1984), Forensic Examination of Ink and Paper, Charles C Thomas Publisher, U.S.A.
13. Baker, J.N. (1955), Law of Disputed and Forged Documents, The Michie Company, Virginia

INORGANIC CHEMISTRY-I

Subject Code: BSNMS1-103 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Course Objectives

1. To familiarize with atomic structure, quantum numbers and shapes of orbitals
2. To understand periodic table and periodic properties of elements
3. To understand the concept of crystal structure of molecules
4. To understand the concept of various bonding theories

Course Outcomes: The completion of this course will make student to acquire the knowledge of:

CO1: Wave mechanics, atomic theories and shapes of orbitals
CO2: Periodic table and various periodic properties
CO3: Ionic bond and crystal structure of molecules
CO4: Covalent bond, metallic bond and various weak chemical forces

UNIT-I (8 Hrs.)

Atomic Structure:

De-Broglie equation, Heisenberg's Uncertainty Principle and its significance. Schrödinger's wave equation and its derivation, significance of ψ and ψ2. Quantum numbers. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions and distribution curves. Shapes of s, p, d and f orbitals.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations.

UNIT-II (7 Hrs.)

Chemical Periodicity:

Effective nuclear charge, shielding or screening effect (Slater rules), variation of effective nuclear charge in periodic table.

Atomic and ionic radii, Ionization enthalpy, Electron gain enthalpy and their trend in groups and periods.

Electronegativity and various scales. Variation of electronegativity with bond order, partial charge, hybridization, group electro negativity.

UNIT-III (15 Hrs.)

Chemical Bonding-I:

Ionic bond: General characteristics of ionic compounds, size effects, radius ratio rule and its limitations. 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, Pervoskite, Rhenium oxide, Calcium carbide, The calcite and aragonite structures.

Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

UNIT-IV (15 Hrs.)

Chemical Bonding-II:

Covalent bond: Lewis structure, Valence Bond theory, VSEPR theory (Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory), Hybridization, Molecular orbital theory (LCAO method). Molecular orbital diagrams of diatomic and simple polyatomic molecules (Be2, N2, O2, F2, LiH, NO, CO, HCl, NO2,

BeH2, NO2-), Formal charge, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds (Bond moment, dipole moment, Percentage ionic character)
Metallic Bond: Valence bond and band theories. Semiconductors and insulators, defects in solids. Weak Interactions: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, Hydrogen bonding.

Recommended Books:
Latest edition of:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', ELBS Oxford.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, 'Inorganic Chemistry',Pearson Education, Singapore.
3. J.D. Lee, 'Concise Inorganic Chemistry', ELBS, Oxford.

ORGANIC CHEMISTRY-I

Subject Code: BSNMS1-104 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Course Objectives:

1. To familiarize with the concepts of basics of organic chemistry
2. To understand the concept of mechanisms of organic reactions
3. To familiarize with the chemistry of alkanes and cycloalkanes
4. To understand chemistry of alkenes and alkynes
5. To know the chemistry behind aromatic hydrocarbons

Course outcomes: After the completion of course students will acquire the knowledge of:
CO1: Concepts of basics of structure and bonding
CO2: Mechanisms of organic reactions
CO3: Chemistry of aliphatic hydrocarbons
CO4: Chemistry behind aromatic hydrocarbons

UNIT-I (15 Hrs.)

Structure and Bonding:
Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.
Mechanism of Organic Reactions:
Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrenes). Assigning formal charges on intermediates and other ionic species.
Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereo chemical studies).

UNIT-II (10 Hrs.)

Alkanes and Cycloalkanes:
Introduction, IUPAC nomenclature, Isomerism and classification of carbon atoms of alkanes. Sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey- House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes.
Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring; banana bonds.

UNIT-III (14 Hrs.)

Alkenes, Cycloalkenes, Dienes and Alkynes:
Alkenes Nomenclature, methods of synthesis (mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination), physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Cycloalkenes Methods of formation, conformation and Chemical reactions of cycloalkenes.
Dienes Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2 and 1,4 additions, Diels-Alder reaction.
Alkynes Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal-ammonia reductions, oxidation and polymerization.

UNIT-IV (6 Hrs.)

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).

Recommended Books:
Latest edition of:
1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', JohnWiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

CHEMISTRY LAB- I

Subject Code: BSNMS1-108 **L T P C** **Duration: 60Hrs.**
0 0 4 2

Course Objectives:

1. To develop basic understanding of various lab practices including safety measures.
2. To understand qualitative semi micro analysis of mixtures.
3. To analyze unknown functional group in organic molecules.
4. To understand various chromatographic techniques used for separation of dyes.

Course Outcomes: The students will acquire knowledge of

CO1: Different safety measures in lab
CO2: Analysis of mixture for cations and anions
CO3: Analysis of unknown functional group in organic molecules
CO4: chromatographic techniques used for separation of dyes

Inorganic Chemistry:

Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

Organic Chemistry Laboratory Techniques:

Detection of various functional groups in organic compounds (containing upto two extra elements)

Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
Identify and separate the components of a given mixture of two dyes (red and blue ink, fluorescent and methylene blue) by paper chromatography

Recommended Books:

Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis',Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

GROUP-1

BIODIVERSITY (MICROBES, ALGAE, FUNGI &ARCHEGONIATE)

Subject Code: BMFSS1-103 **L T P C** **Duration: 60Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of biodiversity of microbes, algae, fungi and archegoniate.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Microbes, algae, Fungi.
CO2: Archegoniate, Bryophytes.
CO3: Pteridophytes and Gymnosperms.

UNIT-I (15 Hours)

Microbes: Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria–Discovery,Generalcharacteristicsandcellstructure;Reproduction–vegetative, asexual and recombination (conjugation, transformation and transduction);Economic importance.
Algae: General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Economic importance of algae

UNIT-II (15 Hours)

Fungi: Introduction- General characteristics, ecology and significance, range of thallusorganization,cellwallcomposition,nutrition,reproductionandclassification;TrueFungi-Generalcharacteristics,ecologyandsignificance,lifecycleofRhizopus(Zygomycota),Puccinia,Agaricus(Basidiomycota);SymbioticAssociations-
Lichens: Generalaccount,reproductionandsignificance;Mycorrhiza:ectomycorrhizaandendomycorrhiza and their significance, Fungi like organisms Albugo, Phytophthora and slime molds

UNIT-III (15 Hours)

Introduction to Archegoniate: Unifying features of archegoniates, Transition to land habit, Alternation of generations
Bryophytes: General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (upto family), morphology, anatomy andre production of Marchantia and Funaria. (Developmental details not to be included).Ecology and economic importance of bryophytes with special mention of Sphagnum.

UNIT-IV (15 Hours)

Pteridophytes: General characteristics, classification, Early land plants (Cooksonia and Rhynia). Classification (uptofamily), morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.
Gymnosperms: General characteristics, classification. Classification (upto family), morphology, anatomy and reproduction of Cycas and Pinus. (Developmental details not to be included). Ecological and economical importance.

Recommended Books:

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi.2ndedition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi,I.K.andWalia,S.K.(2011).TextbookofFungi&TheirAllies,MacMillanPublishersPvt.Ltd., Delhi.
4. B.R.Vashishta,(2016) Botany For Degree Students Fungi.S Chand &Company.
5. Geeta Sumbali,(2011)The Fungi. Alpha science Intl Ltd Second Edition.
6. KRAneja&RSMehrotra(2015)AnIntroductiontoMycology.NewAgeInternationalPublishers Second Edition.

BOTANY LAB-1

Subject Code: BMFSS1-104 **L T P C** **Duration: 60Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the vegetative and reproductive structures of Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Fucus.
3. To analyse the type of bacteria from slides.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the vegetative and reproductive structures.
CO3: Analysis of Pteridophytes and Gymnosperms

1. EMs/Models of viruses– T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron Micrographs), Oedogonium, Vaucheria, Fucus*and Polysiphonia through permanent slides.
5. Rhizopus and Penicillium: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. Alternaria: Specimens/photographs and tease mounts.
7. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and in fected Barberry leaves
8. Agaricus: Specimens of button stage and full grown mushroom
9. Lichens: Study of growth forms of lichens(crustose, foliose and fruticose)
10. Mycorrhiza: ectomycorrhiza and endomycorrhiza (Photographs)
11. Marchantia- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemmacup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. Funaria- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing anther dial and archegonialheads, l.s. capsule and protonema.
13. Selaginella-morphology, w.m. leafwithligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. Equisetum-morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry) (temporary slides); t. srhizome (permanent slide).
15. Pteris- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
16. Cycas- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
17. Pinus- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, l.s./t.s. malecone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. femalecone, t.l.s. & r.l.s. stem (permanent slide).

Recommended Books:

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi.2ndedition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010).Microbiology: An Introduction,PearsonBenjaminCummings, U.S.A. 10th edition.
3. Sethi,I.K.andWalia,S.K.(2011).TextbookofFungi&TheirAllies,MacMillanPublishersPvt. Ltd., Delhi.
4. B.R.Vashishta,(2016) BotanyForDegreeStudentsFungi.S Chand&Company.
5. GeetaSumbali,(2011)TheFungi.Alphascience IntlLtdSecondEdition.
6. KRAneja&RSMehrotra(2015)AnIntroductiontoMycology.NewAgeInternationalPublishers Second Edition.

DIVERSITY OF ANIMALS-1

Subject Code: BMFSS1-105 **L T P C** **Duration: 60Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of biodiversity of animals.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Kingdom Protista
CO2: Importance of Arthropodain in Forensic Sciences.
CO3: Importance of knowledge of Diversity of Animals in Forensic Science.

UNIT-I (15 Hours)

Kingdom Protista
General characters and classification upto classes; Locomotory Organelles and locomotion in Protozoa-Ameoba, Paramecium, Euglena

UNIT-II (15 Hours)

Phylum Porifera
General characters and classification up to classes; Canal Systemin Sycon
Phylum Cnidaria
General characters and classification up to classes; Polymorphismin Hydrozoa, coral & coral reefs

UNIT-III (15Hours)

Phylum Platyhelminthes
General characters and classification up to classes; Life history of Taeniasolium and Fasciola Hepatica
Phylum Ashelminthes
General characters and classification up to class, Life Cycle of Ascaris, Parasitic adaptation in Helminthes
Phylum Annelida
General characters and classification up to classes; Metamerism in Annelida

UNIT-IV (15 Hours)

Phylum Arthropoda
General characters and classification upto classes; Vision in Arthropoda, MetamorphosisinInsects, Importance of Arthropoda in Forensic Sciences
Phylum Mollusca
General characters and classification upto classes; Torsioningastropods

Recommended Books:

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002).
3. Invertebrates: A New Synthesis, III Edition, Blackwell Science Young, J. Z. (2004).
4. The Life of Vertebrates. III Edition. Oxford university press.
5. Pough H. Vertebrate life, VIII Edition, Pearson International.
6. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

ZOOLOGY LAB-1

Subject Code: BMFSS1-106 **L T P C** **Duration: 60Hrs.**
0 0 4 2

Course Objectives

1. To understand basic understanding of lab practices including safety measures.
2. To analyse pond water collected from different places.
3. To analyze the Obelia, Physalia, Millepora etc.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the Ascarislumbricoides and its life stages (Slides/micro-photographs)
CO3: Analysis of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla

Experiments:

1. StudyofwholemountofEuglena,AmoebaandParamecium,BinaryfissionandConjugation in Paramecium
2. Examination of pond water collected from different places for diversity in protista
3. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
4. Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora
5. Onespecimen/ slide of anyctenophore
6. Study of adult Fasciola hepatica, Taenia solium and their life cycles (Slides/ microphotographs)
7. Study of adult Ascarislumbricoides and its life stages (Slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

Recommended Books:

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Black well Science
3. Young, J.Z.(2004).The Life of Vertebrates. III Edition. Oxford university press.
4. Pough H. Vertebrate life, VIII Edition, Pearson International.
5. HallB.K.andHallgrimssonB.(2008).Strickberger'sEvolution.IVEdition.JonesandBartlettPublishersInc.

GROUP-2

DIFFERENTIAL CALCULUS-I

Subject Code: BSNMS1-105 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of differential calculus.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

1. Understand the concept of Continuity and Differentiability.
2. Extend the knowledge to the different type of series, Roll's Theorem and Lagrange Mean Value Theorem
3. Develop the skill to sketch the curves in a plane using its mathematical properties in the different coordinate systems of reference.
4. Understand the concept of Partial Differential Equation.

UNIT-I (12Hrs.)

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

UNIT-II (11Hrs.)

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sin x, cos x, ex , log(1+x), (1+x)^m, Maxima and Minima, Indeterminate forms.

UNIT-III (14 Hrs.)

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-IV (8 Hrs.)

Partial differentiation-Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative,
Differentiation of implicit functions and composite functions, Jacobians and its properties.

Recommended Books:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, Prentice Hall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

DIFFERENTIAL CALCULUS-II

Subject Code: BSNMS1-106 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of Differential Calculus.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

1. Apply the knowledge of advanced concepts of calculus in order to study theoretical development of different mathematical techniques and their applications.
2. Develop the knowledge of computing arc length, area and volume by using integration.
3. Understand the concept of integration and different kind of functions.
4. Expand the knowledge of multiple integrals and vector surface integrals.

UNIT-I (12Hrs.)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function z=f(x y), Lagrange's method of undetermined multipliers.

UNIT-II (10Hrs.)

Arc formula for the Cartesian equation y=f(x), other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves.

UNIT-III (12Hrs.)

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations.

UNIT-IV (11Hrs.)

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity, Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds.

Recommended Books:

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, Prentice Hall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006

MECHANICS

Subject Code: BSNMS1-102 **L T P C** **Duration: 60Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of mechanics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, student will be able to:

1. Understand the concepts of vector calculus and basic laws of motion
2. Gain the knowledge about gravitational motion, and global positioning system
3. Understand the concepts of harmonic oscillations.
4. Learn the concept of theory of Relativity.

UNIT-I (15Hrs)

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. 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. Work and energy.

Conservation of energy. Motion of rockets. Rotational Motion: Angular velocity and angular momentum. Torque, Conservation of angular momentum.

UNIT-II (15Hrs)

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 (15Hrs)

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, Torsional pendulum, Determination of Rigidity modulus and moment of inertia, q, η and σ by Searles method.

UNIT-IV (15 Hrs)

Special Theory of Relativity: Concept of Inertial and non-inertial frames, Concept of ether, Constancy of speed of light, Michelson-Morley Experiment, Galilean transformation, Postulates of Special Theory of Relativity, Lorentz transformation, Length contraction. Time dilation, Relativistic addition of velocities.

Recommended Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986.AddisonWesley
2. Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley.
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

MECHANICS LAB

Subject Code: BSNMS1-107 **L T P C** **Duration: 60Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To determine the modulus of elasticity.
3. To use basic measurement tools.

Course Outcomes (COs): After the completion of the course, Student will be able to

1. Use basic measurements tools like Vernier caliper, screw gauge etc.
2. Find the Moment of Inertia of a Flywheel.
3. Determine the Modulus of elasticity
4. Learn about motion of Bar Pendulum and Kater's Pendulum.

List of Experiments:

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 Fly wheel.
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 ofg

Recommended Books:

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SECOND SEMESTER

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BMNCC0-041 **L T P C** **Duration: 30Hrs.**
2 0 0 0

Course Objective: To make students aware about drug abuse and its effect on their financial and health status.

Course Outcome: To make students aware about treatment and control of drug abuse.

UNIT-I (6 Hours)

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II (8 Hours)

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

UNIT-III (8 Hours)

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV (8 Hours)

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 &2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, 2013.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, 1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, 2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, 2000.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention and Cessation', Cambridge University Press, 2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, 201

PHYSICAL CHEMISTRY-I

Subject Code: BSNMS1-203 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To develop basic understanding of different states of matter.
2. To understand concept of chemical kinetics.
3. To understand underlying processes associated with various states of matter.
4. To familiarize with relevance of matter properties for realistic applications.

Course Outcomes: Students will be able to acquire the knowledge of

CO1: Basic understanding of different states of matter
CO2: Rate of chemical reactions and related theories.
CO3: Underlying processes associated with various states of matter
CO4: Relevance of matter properties for realistic applications

Unit-I (15 Hrs.)

Gaseous State:

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases (based on Joule-Thomson effect).

Unit-II (8 Hrs.)

Liquid State:

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholesteric phases. Thermography and seven segment cell.

Unit-III (12Hrs.)

Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals.

Unit-IV (10 Hrs.)

Basics of Chemical Kinetics:

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Recommended Books:

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company.

ORGANIC CHEMISTRY-II

Subject Code: BSNMS1-204 **L T PC** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand the concepts of stereochemistry of organic compounds
2. To understand concepts behind aromaticity
3. To understand the concept of mechanisms of organic reactions
4. To familiarize with the aromatic electrophilic substitution reactions
5. To familiarize with the chemistry of alkyl and aryl halides

Course Outcomes: After the completion of course students will acquire the knowledge of

CO1: Concepts of stereochemistry of organic compounds
CO2: Concepts behind aromaticity
CO3: Mechanisms of organic reactions
CO4: Aromatic electrophilic substitution reactions
CO5: Chemistry of alkyl and aryl halides

Unit-I (15Hrs.)

Stereochemistry of Organic Compounds:

Concept of isomerism. Types of isomerism Optical isomerisin-elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & Land R & S systems of nomenclature. Geometric isomerism- determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

Unit-II (7 Hrs.)

Arenes and Aromaticity:

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram, the Huckel rule, aromatic ions.

Unit-III (11Hrs.)

Aromatic Electrophilic Substitution:

Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes. Mechanism or nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkylbenzenes alkynylbenzenes.

Unit-IV (12 Hrs.)

Alkyl and aryl halides:

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

Recommended Books:

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', John Wiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

FINGERPRINTS EXAMINATION AND FORENSIC PHOTOGRAPHY

Subject Code: BMFSS1-201 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of fingerprints and forensic photography.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, student will be able to:
CO1: Understand the concept of Fingerprints.
CO2: Understand the importance of fingerprint evidence in solving crimes.
CO3: Gain knowledge regarding classification of fingerprints.
CO4: Understand the concept of development of prints.

Unit-I (15Hrs.)

History and development of finger prints as a science for personal, identification, Finger Prints Bureau.
Classification of finger Prints: Pattern types, pattern area, Henry system of classification (Primary to tertiary and key classification) extension of Henry system searching of finger prints, classification system, single digit classification system.
Palm prints, Sole prints: Importance, classification and examination.

Unit-II (12 Hrs.)

Chance Finger Prints: Latent prints, plastic prints, causes, composition of sweat. Development of latent fingerprints: Conventional methods as fluorescent powder, magnetic powder. Fuming–methods: Iodine and cynoacrylate methods. Chemical methods: Ninhydrin and its analogue silver nitrate, enhancement of latent prints, application of laser technologies, metal deposition method. Biological methods of development of latent prints on skin.

Unit-III (10 Hrs.)

Systematic approach to latent print processing, preserving and lifting of fingerprints. Photography of Finger Prints, comparison of fingerprints: basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics.
Automatic Finger Print Identification system (AFIS) and its variants, digital Image processing of fingerprints and their enhancement.

Unit-IV (08 Hrs.)

Photography: Basic principles and techniques, Exposing, Developing and Printing, Modern Developments in Photography, Digital Photography, Videography/ High speed Photography. Crime Scene and Laboratory Photography.

Recommended Books:

1) David R. Ashbaugh (1999), **Quantitative and Qualitative Friction Ridge Analysis**, CRC Press.

2) E. Roland Menzel (Second Edition) (1999), **Fingerprint Detection with Loseres**, Marcel Dekker, Inc.

3) Cowger and James F. (1993), **Friction Ridge skin: Comparison and Identification of Fingerprints**, Elsevier New York, CRC Press London.

4) Cummins and Midlo (1943), **Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics**, The Blakiston office London.

5) Cherril, F.R. (1954), **The Finger Prints. Systemat Scotland Yard**, Her Majestuy'soffice, London.

6) Wentworth and Wilder (1957), **Personal Identification**, Richard. G. Badger. Boston.

7) Mehta, M.K. (1980), **Identification of Thumb Impression & Cross Examination of Finger Prints,** N. M. Tripathi (P) Ltd. Bombay.

8) Moenssens (1975), **Finger Prints Techniques**, Chitton Book Co., Philadelphia, New York.

9) Allison H.C. (1st Edition) (1973) **Personal Identification**, Holbrook Press.

10) Chatterjee S.K. and Hague R.V. (1988), **Fingerprints or Dactyloscopy and Ridgeoscopy.**

11) E. Ronald Menzel (1997), **Amanual of Fingerprint Identification: Finger Print Detection with Lasers.**

12) H.C. Lee, R.E. Gaensslen and S.R. Ramotowski (3rd Edition) (2013), **Advances in Fingerprint Technology**, CRC Press, Boca Raton.

13) C. Champod, C. Lennard, P. Margot, M. Stoilovic (2004), **Fingerprints and Other Ridge Skin Impression (International Forensic Science and Investigation Series)**, CRC Press, Boca Raton.

14) B.C. Bridges, Vollmer A. and M. Monir (2002), **Criminal Investigation Practical Finger Printing, Thumb Impressions, Hand Writing, Expert Testimony, Opinion Evidence,** Allahabad University Book Agency.

15) David R. Ashbaugh (1999), **Quantitative and Qualitative Friction Ridge Analysis**, CRC Press.

16) E. Rol and Menzel (Second Edition) (1999), **Fingerprint Detection with Loseres**, Marcel Dekker, Inc.

17) Cowger and James F. (1993), **Friction Ridge skin: Comparison and**

Identification of Fingerprints, Elsevier New York, CRC Press London.

18) Cummins and Midlo (1943), **Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics**, The Blakiston office London.

19) Cherril, F.R. (1954), **The Finger Prints. Systemat Scotland Yard**, Her Majestuy's office, London.

20) Wentworth and Wilder (1957), **Personal Identification**, Richard. G. Badger. Boston.

21) Mehta, M.K. (1980), **Identification of Thumb Impression & Cross Examination of Finger Prints,** N. M. Tripathi (P) Ltd. Bombay.

22) Moenssens (1975), **Finger Prints Techniques**, Chitton Book Co., Philadelphia, New York.

23) Allison H.C. (1st Edition) (1973) **Personal Identification**, Holbrook Press.

24) Chatterjee S.K. and Hague R.V. (1988), **Fingerprints or Dactyloscopy and Ridgeoscopy.**

25) E. Ronald Menzel (1997), **Amanual of Fingerprint Identification: Finger Print Detection with Lasers.**

26) H.C. Lee, R.E. Gaensslen and S.R. Ramotowski (3rd Edition) (2013), **Advances in Fingerprint Technology**, CRC Press, Boca Raton.

27) C. Champod, C. Lennard, P. Margot, M. Stoilovic (2004), **Fingerprints and Other Ridge Skin Impression (International Forensic Science and Investigation Series)**, CRC Press, Boca Raton.

28) B.C. Bridges, Vollmer A. and M. Monir (2002), **Criminal Investigation Practical Finger Printing, Thumb Impressions, Hand Writing, Expert Testimony, Opinion Evidence,** Allahabad University Book Agency.

29) Daluz H.M (2015), **Fingerprint Analysis Laboratory Workbook**, CRC Press.

QUESTIONED DOCUMENT AND FINGERPRINT LABORATORY

Subject Code: BMFSS1-202 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To develop and analyse the different fingerprint patterns.
3. To identify core, delta and to do ridge counting and ridge tracing.
4. To use physical and chemical methods to develop latent prints

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysing the fingerprint evidence.
CO3: Development of latent print from crime scene.

1. How to procure fingerprints &method of taking fingerprints manually (rolled &plain).
2. To carry out ten digit classification of fingerprints.
3. To identify different fingerprint patterns.
4. To identify core and delta.
5. To carry out ridge tracing and ridge counting.
6. To investigate physical methods of fingerprint detection.
7. To investigate chemical methods of fingerprint detection.
8. Sole prints comparison and their lifting from the scene of crime.
9. Palm prints comparison and their lifting from the scene of crime.
10. Evaluation of Crime scene and photographs.

Recommended Books:

1. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
2. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
3. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).
4. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

CHEMISTRY LAB-II

Subject Code: BSNMS1-208 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand the concepts behind crystallization
2. To understand the determination of melting points and effect of impurities on m.p.
3. To understand various purification techniques used for purification.
4. To make students familiar with the determination of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

Course Outcomes: After completion of course students will acquire the knowledge and practical hands on training of

CO1: Purification of organic compound using various solvent combinations
CO2: Determination of melting and boiling points of various organic compound
CO3: Chromatographic techniques
CO4: Calculation of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

Laboratory Techniques:

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
   a. Water
   b. Alcohol
   c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)

Physical Chemistry: Experimental Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To determine the viscosity and surface tension of C_2H_5OH and glycerine solution in water
4. Calculation of the enthalpy of ionization of ethanoic acid.

Recommended Books:

Latest edition of:

1. H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.
3. G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.

GROUP-1

PLANT ECOLOGY& TAXONOMY

Subject Code: BMFSS1-203 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of plant ecology & Taxonomy.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Plant communities and their characteristics.
CO2: Ecosystem and its structure.
CO3: Pollution and ecological footprints

Unit-1 (15 Hours)

Introduction Ecological factors: Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.
Plant communities: Characters; Ecotone and edge effect; Succession; Processes and types.
Ecosystem: Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous
Pollution: Types, control and prevention
Ecological Footprints: Carbon footprint, Carbon dating

Unit-2 (15 Hours)

Introduction to plant taxonomy: Identification, Classification, Nomenclature.
Identification: Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access
Botanical nomenclature: Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Unit-3 (15 Hours)

Classification: Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (up to series).

Unit-4 (15 Hours)

Complete description of families: Brassicaceae (Brassica, Iberis), Asteraceae (Sonchus, Ageratum), Solanaceae (Solanum, Withania), Lamiaceae (Salvia, Ocimum), Liliaceae, (Asphodelus), Ranunculus (Ranunculus), Gramineae (Triticum, Oryza)

Suggested Readings:

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
5. J.S. Singh, S.P. Singh, S.R. Gupta (2015) Ecology, Environmental Science & Conservation S. Chand Publisher.

BOTANY LAB-II

Subject Code: BMFSS1-204 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse soil samples
3. To analyse the morphological adaptations of hydrophytes and xerophytes.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the soil
CO3: Analysis of microclimatic variables

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b)Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method (Species to be listed).
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):Brassicaceae -Brassica, Alyssum / Iberis; Asteraceae -Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax; Solanaceae -Solanum nigrum, Withania; Lamiaceae -Salvia, Ocimum; Liliaceae -Asphodelus / Lilium / Allium.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings:

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
5. J.S. Singh, S.P. Singh, S.R. Gupta (2015) Ecology, Environmental Science & Conservation S. Chand Publisher.

DIVERSITY OF ANIMALS-II

Subject Code: BMFSS1-205 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of diversity of animals.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: General characteristics and classification of chordates.
CO2: Agnatha, Pisces, Aves.
CO3: Reptilia, Mammals and Zoogeography.

Unit 1 (15 Hours)

Introduction to Chordates General characteristics and outline classification
Protochordata General Characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Unit-2 (15 Hours)

Origin of Chordata Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata
AgnathaGeneral characteristics and classification of cyclostomes up to class

Unit-3 (15 Hours)

Pisces General Characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes
Amphibia Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians.

Unit-4 (15 Hours)

Reptilia General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes.
Aves General characteristics and classification up to order Archaeopteryx-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds
Mammals General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages
Zoogeography Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different.

Recommended Books:

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002).
3. Invertebrates: A New Synthesis, III Edition, Blackwell Science Young, J. Z. (2004).
4. The Life of Vertebrates. III Edition. Oxford university press.
5. Pough H. Vertebrate life, VIII Edition, Pearson International.
6. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

ZOOLOGY LAB-II

Subject Code: BMFSS1-206 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the slides prepared
3. To analyse the photographs of various fishes.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the identification marks of poisonous and non-poisonous snakes.
CO3: Analysis of Amphibia.

1. Protochordata Balanoglossus, Herdmania, Branchiostoma, Colonial UrochordataSections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules
2. Agnatha,Petromyzon, Myxine
3. Fishes: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish
4. Amphibia: Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
5. Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes
6. Aves:Study of six common birds from different orders. Types of beaks and claws
7. Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous.

SUGGESTED READINGS

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

GROUP-2

ELECTRICITY, MAGNETISM AND EMT

Subject Code: BSNMS1-202 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of electricity, magnetism and emt.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Understand the concepts of vector Algebra.
CO2: Understand the basic concepts of electrostatics
CO3: Gain the knowledge about the basic concepts of magneto-statics
CO4: Learn the concept of Maxwell equation and electromagnetic waves.

UNIT-I (13 Hrs)

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 (16 Hrs)

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, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

UNIT-III (16 Hrs)

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. 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.

UNIT-IV (15 Hrs)

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.

Recommended Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

DIFFERENTIAL EQUATIONS-I

Subject Code: BSNMS1-205 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of differential equations.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

CO1: Understand the concept of ordinary differential equation, its formation, order and degree.
CO2: Apply various methods to solve first order non-linear differential equation.
CO3: Solve linear differential equations of higher order by using various methods.
CO4: Apply differential equations to significant applied and theoretical problems.

Unit-I (12Hrs.)

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 (11Hrs.)

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 (12Hrs.)

General solution of homogeneous equation of second order, principle of superposition for a 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, solutions of simultaneous equations.

Unit-IV (10Hrs.)

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

Recommended Books:

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover,1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

DIFFERENTIAL EQUATIONS-II

Subject Code: BSNMS1-206 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of differential equations.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

CO1: Understand the concept of first order and linear partial differential equation.
CO2: Apply various power series methods to find series solution of differential equation.
CO3: Recognize the major classification of PDEs and the qualitative differences between the classes of equations.
CO4: Understand the formation and solution of some significant PDEs like wave and heat equation.

Unit-I (10Hrs.)

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-II (13Hrs.)

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Bessel equation and Legendre equation, its properties and their recurrence relations, Hyper geometric equation, Bessel function and their recurrence relations, Strum liouville boundary values.

Unit-III (12Hrs.)

Separation of variables in a PDE, Laplace equation: mean value property, Weak and strong maximum principle, Green's function, Poisson's formula, Dirichlet's principle, Existence of solution using Perron's method (without proof).

Unit-IV (10Hrs.)

Heat equation: Initial value problem, Fundamental solution, Weak and strong maximum principle and uniqueness results, Wave equation: uniqueness, D'Alembert's method, method of spherical means and Duhamel's principle.

Recommended Books:

1. W.E.Boyce and P.C.Diprima: Elementary Differential Equations and Boundary value problems, John Wiley, 1986.
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, 2003.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover,1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

ELECTRICITY, MAGNETISM AND EMT LAB

Subject Code: BSNMS1-207 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of electricity, magnetism and emt.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Take measurements by using Multimeter.
CO2: Learn the measurement of charge, current and resistance using Method.
CO3: Determine resonance in LCR circuit.
CO4: Verify the Thevenin, Norton theorem and Maximum Power Transfer Theorem

List of Experiments:

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 (Determined B/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.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Nortontheorem
10. To verify the Superposition, and Maximum Power Transfer theorem.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S. Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

THIRD SEMESTER

INORGANIC CHEMISTRY-II

Subject Code: BSNMS1-303 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand chemistry of s block element
2. To familiarize with the concepts of acids and bases
3. To understand the concepts behind chemistry of s & p block elements
4. To understand the chemistry of various transition elements.

Course Outcomes: After the completion of course students will acquire the knowledge of:

CO1: Concepts behind acids and bases
CO2: Chemistry of s and p block elements
CO3: Concepts of chemistry of various transition elements

Unit-I (6 Hrs.)

s-Block Elements: Comparative studies, diagonal relationship, salient features of hydrides, solvation and complexation tendencies.

Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

Unit-II (12 Hrs.)

p–Block Elements–I: Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–17, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes. VBT, VSPER theory, MOT.

Unit-III (12 Hrs.)

p–Block Elements-II: Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide ,Silicones and phosphazenes as examples of inorganicpolymers, nature of bonding in triphosphazenes.

Unit-IV (15 Hrs.)

Chemistry of Transition Elements:

Characteristic properties of d–block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behaviour. CFT and CFSE for Octahedral/Tetrahedral complexes.

Recommended Books:

Latest edition of:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; Pubs: John Wiley and Sons.
2. Lee, J.D., Concise Inorganic Chemistry;Pubs: Chapman & Hall Ltd.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; Pubs: Oxford University Press.

4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; Pubs: John Wiley and Sons Inc.
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; Pubs: Pearson Education Inc.
7. Jolly, W.L., Modern Inorganic Chemistry; Pubs: Tata McGraw-Hill Publishing Company Limited.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; Pubs: Milestones Publisher.

PHYSICAL CHEMISTRY-II

Subject Code: BSNMS1-304 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand energy exchange processes
2. To familiarize with the system of variable compositions.
3. To understand the concepts of thermodynamics.
4. To understand the concept of chemical equilibrium.

Course Outcomes: On completion of this course, students will be able to:

CO1: Identify and describe energy exchange processes.
CO2: Manipulate physical parameters to favour a particular process.
CO3: Compare the system properties with variation in composition.
CO4: Identify and analyze uni/multicomponent system.

Unit-I (14 Hrs.)

Thermodynamics-I:

Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature, Calculation of w,q,dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Unit-II (15 Hrs.)

Thermodynamics-II & III:

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T.

Unit-III (6 Hrs.)

Chemical Equilibrium:

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of Kp, Kc, Ka and their relationship, Clausius-Clapeyron equation, applications.

Unit-IV (10 Hrs.)

Introduction to Phase Equilibrium:

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H_2O), $FeCl_3$-H_2O) and $CuSO_4$-H_2O) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-H_2O and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

Recommended Books:

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry;Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book company.

CRIMINALISTICS

Subject Code: BMFSS1-301 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of criminalistics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, student will be able to:
CO1: Gain knowledge of Crime scene investigation.
CO2: Gain knowledge regarding physical evidences recovered at crime scene and its importance.
CO3: Understand the concept of Voice analysis.
CO4: Understand the importance of trace evidences and its examination.

Unit-I (15 Hrs.)

Crime Scene Investigation: Definition, Types of crime scene (Primary and Secondary, Indoor, Outdoor and Mobile, other specific types of Crime Scene), Purpose of crime scene examination, First responding officers, Protection of the crime Scene, Documentation of Crime scene, Methods of search for physical clue materials, Plan of Action, Note Taking, Reconstruction of Crime scene, Crime scene sketching, Photography of crime scene, Legal Implications for Crime Scene Searches.
Physical Evidences: Definition, their classification, collection, preservation, packing, labelling, sealing, forwarding and transportation, Chain of custody.

Unit-II (10 Hrs.)

Tool marks: Types, Importance, location, nature, collection and evaluation.
Restoration of Erased /Obliterated Marks.
Track marks: Types, Importance, nature, location, collection and evaluation.
Glass: Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence.
Density, Refractive Index; Other Optical Properties of Crystalline Material.
Paints: Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence.

Unit-III (08 Hrs.)

Soil: Types of soil, Composition and colour of soil, Forensic examination of soil, Interpretation of soil evidence.
Fibre: Introduction, morphology of fibre, types, Synthetic fibre analysis, microscopy, optical properties, refractive index, fluorescence, dye analysis, Birefringence, difference between man-made fibres and natural fibres.

Unit-IV (12 Hrs.)

Building Materials: Types of cement and their composition, Determination of adulterants, Analysis of Bitumen and road material, Analysis of cement mortar and cement concrete and stones.

Voice Identification: Introduction, Significance, Theory of generation of voice, Characteristics, Voice Spectrography, Analysis of Audio-Video Signal for Authenticity.

Forensic examination of electrical appliances/installations.

Miscellaneous Clue Materials: Examination of strings/ropes, Fibers, Threads and fabrics, Wires/cables, Seals, Counterfeit coins.

Recommended Books:

1) Horswell J.(2016). The Practice of Crime Scene Investigation. New York, CRC Press.
2) James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
3) Saferstein R. (8th Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
4) Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.
5) Siegel J. A. & Mirakovits K.(2006). Forensic Science: The Basics. New York, CRC Press.
6) Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law House.
7) Nordby, James, S.H. & J.J. (2003). Forensic Science: an Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8) Rose P. (2001). Forensic Speaker Identification; Forensic Science Series. London, Taylor and Francis.
9) Bengold & Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
10) Gilbert N. (3rd Edition) (1993), Criminal Investigation, Macmillan Publishing company.
11) Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.

CRIMINALISTICS LABORATORY

Subject Code: BMFSS1-302 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To anaylse the comparison of soil, glass, cloth, bangles, threads.
3. To analyse the biological fluids

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Collection of various types of samples from the crime scene
CO3: Analysis of paint samples, tyre marks etc.

1. Collection, Packing, Labelling &Forwarding of the Following Physical Evidences:
(A) Biological Fluids (B) Soil/Dust (C) Wet Exhibits (D) Hair/ Fibre (E) Glass Material (F) Liquids (G) Pharmaceutical Products/Drugs of Abuse (H) Botanical Material (I) Shell Case/Cartridge/Bullet/Pellets, (J) Charred Documents etc.
2. Comparison of Soil samples.
3. Comparison of glass pieces.
4. Comparison of Miscellaneous material like Cloth, Bangles, threads etc.
5. To prepare a cast of Shoe prints and their comparison.
6. Examination of Paint samples.
7. Examination of Tyre marks (Digital Matching of Suspected Tyre/Foot Wear Impressions)
8. Detection of adulterants in food.
12. Restoration of Erased Punched Mark on Metal Piece by Chemical Treatment.
13. Identification of Glass Fractures.
14. Comparison of Tool Marks and Fired Cartridge/ Bullet Using Comparison Microscope.

Recommended Books:

1) Horswell J. (2016). The Practice of Crime Scene Investigation. New York, CRC Press.
2) James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
3) Saferstein R. (8th Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
4) Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.
5) Siegel J. A. & Mirakovits K. (2006). Forensic Science: The Basics. New York, CRC Press.
6) Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law House.
7) Nordby, James, S.H. & J.J. (2003). Forensic Science: an Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8) Rose P. (2001). Forensic Speaker Identification; Forensic Science Series. London, Taylor and Francis.
9) Bengold & Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
10) Gilbert N. (3rd Edition) (1993), Criminal Investigation, Macmillan Publishing company.
11) Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.

CHEMISTRY LAB - III

Subject Code: BSNMS1-305 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand the concepts behind Estimation of metals.
2. To synthesis and separation of various inorganic compounds

Course Outcomes: After completion of course students will gain the knowledge of:

CO1: Obtaining precise results of estimation by titrations
CO2: Preparation separations of organic compounds.

Quantitative Analysis:

i. Volumetric Analysis

a) Determination of acetic acid in commercial vinegar using NaOH.
b) Determination of alkali content-antacid tablet using HCI.
c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
d) Estimation of hardness of water by EDTA.
e) Estimation of ferrous and ferric by dichromate method.
f) Estimation of copper using sodiumthiosulphate.

ii. Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

Organic Chemistry Laboratory Techniques

Thin Layer Chromatography

a) Determination of R_f values and identification of organic compounds.
b) Separation of green leaf pigments (spinach leaves may be used).
c) Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
d) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

Recommended Books:

Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.
   J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis, Pearson Education.
4. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education6.
5. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,Textbook of Practical Organic Chemistry, Prentice-Hall.

GROUP-1

PLANT ANATOMY & EMBRYOLOGY

Subject Code: BMFSS1-303 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of plant anatomy and embryology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Tissues and organs
CO2: Secondary growth, adaptive and protective systems
CO3: Structural organization of flowers.

Unit-1 (15 Hours)

- **Tissues and Organs:** Root and shoot apical meristems; Simple and complex tissues. Structure of dicot and monocot root stem and leaf.
- **Secondary Growth:** Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood).

Unit-2 (15 Hours)

- **Adaptive and protective systems:** Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.
- **Structural organization of flower:** Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Unit-3 (15 Hours)

Pollination and fertilization: Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit-4 (15 Hours)

- **Embryo and endosperm :** Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship
- **Apomixis and polyembryony:** Definition, types and practical applications

Suggested Readings

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin / Cummings Publisher, USA.
3. J.P. Goyal & Aruna Saini (2016) Angiosperms: Structure, Development & Reproduction Trueman
4. PC Vasishta (2003). Plant Anatomy. Pradeep Publications.

BOTANY LAB - III

Subject Code: BMFSS1-304 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse slides prepared.
3. To analyse the adaptative anatomy.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the structure of anther
CO3: Analysis of Tissues

1. Study of meristems through permanent slides and photographs
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent Slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Calculation of percentage of germinated pollen in a given medium.

Recommended Books:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
2. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition
4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan

Publishers Pvt. Ltd., Delhi.

7. Thakur, A.K. and Bassi, S.K. (2008). Diversity of Microbes and Cryptogams. S. Chand & Co., Delhi.
8. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
9. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.

PHYSIOLOGY & BIOCHEMISTRY

Subject Code: BMFSS1-305 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of physiology and biochemistry.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Digestion and absorption of food.
CO2: Respiratory Physiology and renal physiology
CO3: Endocrine and reproductive physiology.

Unit-1(15 Hours)

Digestion and Absorption of Food Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (in brief)

Unit-2 (15 Hours)

Functioning of Excitable Tissue (Nerve and Muscle) Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction

Respiratory Physiology Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases.

Unit- 3 (15 Hours)

Renal Physiology Functional anatomy of kidney, Mechanism and regulation of urine formation **Cardiovascular Physiology** Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG.

Unit-4 (15 Hours)

Endocrine and Reproductive Physiology Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle.

Recommended Books:

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill
3. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
5. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
6. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

ZOOLOGY LAB - III

Subject Code: BMFSS1-306 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse temporary mounts.
3. To estimate haemoglobin.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the permanent histological sections of mammalian oesophagus.
CO3: Preparation of haemin and haemochromogen crystals.

1. Preparation of temporary mounts: Neurons and Blood film.
2. Preparation of haemin and haemochromogen crystals.
3. Estimation of haemoglobin using Sahli's haemoglobinometer.
4. Examination of permanent histological sections of mammalian oesophagus, stomach, duodenum, rectum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.

SUGGESTED READINGS

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley and Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, XI Edition, McGraw Hill.
4. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
5. Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley. Kesar, S. and Vashisht, N. (2007). Experimental Physiology, Heritage Publishers.
6. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Company Ltd.

GROUP-2

REAL ANALYSIS-I

Subject Code: BSNMS1-306 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of real analysis.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

CO1: Understand the various properties of the real line $\mathbb{R}$.
CO2: Understand the concept of different kinds of sequences, their convergence, squeeze theorem and Cauchy's theorem on limit.
CO3: Apply the various tests for convergence and absolute convergence of an infinite series of real numbers
CO4: Understand the concept of sequence in series function, M-test and power series methods.

Unit-I (12Hrs.)

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 (11Hrs.)

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 (12Hrs.)

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 (10 Hrs.)

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.

Recommended Books:

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5) ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
7) S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.

REAL ANALYSIS-II

Subject Code: BSNMS1-307 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of real analysis.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

CO1: Understand properties of Riemann integral and related theorems.
CO2: Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.
CO3: Examine the point wise and uniform convergence using various tests
CO4: To understand basic topology of metric spaces.

Unit-I (11 Hrs.)

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem.

Unit-II (12 Hrs.)

Pointwise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic and trigonometric functions.

Unit-III (10 Hrs.)

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weirstrass M-test.

Unit-IV (12 Hrs.)

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

Recommended Books:

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. ROBERT G. Bartle and Donald R. Sherbert,
5) Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.

THERMAL PHYSICS AND STATISTICAL MECHANICS

Subject Code: BSNMS1-301 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of thermal physics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Understand the concepts of laws of thermodynamics, entropy.
CO2: Learn about the concepts of Maxwell's thermodynamic relations.
CO3: Gain knowledge of Laws associated with thermal radiations and kinetic theory of gases.
CO4: Understand the concepts of thermodynamic probability, phase space

UNIT-I (16 Hrs)

Laws of Thermodynamics: Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT-II (16 Hrs)

Thermodynamic Potential and Theory of Radiation: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

UNIT-III (14 Hrs)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT-IV (14 Hrs)

Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.

Recommended Books:

1. Statistical Physics, thermodynamics and kinetic theory by V.S. Bhatia
2. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
3. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
4. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
5. Heat and Thermodynamics, M.W. Zemasky and R. Dittman, 1981, McGraw Hill 14
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W. Sears & G.L. Salinger. 1988, Narosa
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

THERMAL PHYSICS AND STATISTICAL MECHANICS LAB

Subject Code: BSNMS1-302 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the cooling temperature using thermocouple.
3. To calibrate Resistance Temperature device.

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Perform Mechanical Equivalent of Heat and thermal conductivity of related experiments.

CO2: Learn about the variation of thermo emf across two junctions of a thermocouple with temperature.

CO3: Record and analyze the cooling temperature using a thermocouple and suitable data acquisition system.

CO4: Calibrate Resistance Temperature Device (RTD

List of Experiments:

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

FOURTH SEMESTER

ENVIRONMENTAL SCIENCE

Subject Code: BHSMC0-041 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To familiarize the student with the basic concept of Environmental and Environmental Chemistry.
2. To elaborate the ecosystem and their properties.
3. To understand the concept of Environmental Pollution and its diverse effect of pollution.
4. To understand the concept of sustainable and unsustainable development and its importance.

Course Outcomes: On completion of this course, students will be able to:

CO1: Understand the basics of Environment chemistry
CO2: Analyze the general concept of ecosystem and their components.
CO3: Comprehend the applicability of social issues and Environment.
CO4: Recognize the Environment Pollution and control measures of urban and industrial wastes.

Unit-I (08 Hours)

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

Unit-II (15 Hours)

Natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit-III (12 Hours)

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- IV (10 Hours)

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books:

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clark R.S., Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment.

ORGANIC CHEMISTRY-III

Subject Code: BSNMS1-403 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To understand the chemistry of carboxylic acids and their derivatives
2. To understand the mechanisms of organic reactions
3. To understand ethers epoxides and nitrogen based organic compounds
4. To familiarize with the chemistry of organometallic compounds
5. To understand the chemistry behind heterocyclic compounds

Course Outcomes: After the completion of course students will acquire the knowledge of:

CO1: Chemistry behind carboxylic acids and their derivatives
CO2: Mechanisms of organic reactions
CO3: Chemistry of heteroatom based organic molecules.
CO4: Chemistry of organometallic compounds

Unit-I (12 Hrs.)

Carboxylic Acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Carboxylic Acids Derivatives: Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

Unit-II (20 Hrs.)

Ethers and Epoxides:

Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Organic Compounds of Nitrogen: preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilc substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.

Unit-III (5 Hrs.)

Organometallic Compounds:

Organomagnesium Compounds: The Grignard reagents formation, structure and chemical reactions. Organolithium Compounds: Formation and chemical reactions.

Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

Unit-IV (8 Hrs.)

Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Recommended Books:

Latest edition of:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry;Pubs: Prentice-Hall.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; Pubs: Pearson Education.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; Pubs: Wiley India.
5. Carey, F.A., Organic Chemistry; Pubs: McGraw-Hill.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; Pubs: Macmillan Publishing Company.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

PHYSICAL CHEMISTRY-III

Subject Code: BSNMS1-404 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course objectives:

1. To understand the redox perspective of various processes.
2. To familiarize with various nuclear and electronic phenomenon.
3. To understand concepts of electrochemistry.
4. To familiarize with basic concept of spectroscopy.

Course outcomes: On completion of this course, students will be able to:

CO1: Understand the redox perspective of various processes.
CO2: Understand various nuclear and electronic phenomenon.
CO3: Apply electrochemical concepts and analyse outcomes of different conditions.
CO4: Assign the reasoning for various physical phenomenon.

Unit-I (12 Hrs.)

Electrochemistry-I:

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit-II (12 Hrs.)

Electrochemistry – II:

Types of reversible electrodes-gas metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and Single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreverisible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions (ΔG ΔH and K), polarization, over potential and hydrogen overvoltage.

Concentration cells with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

Unit III (10 Hrs.)

Nuclear Chemistry:

Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding

Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.

Unit-IV (11 Hrs.)

Spectroscopy: Introduction, Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of s, p, and n M.O., their energy levels and the respective transitions

Recommended Books:

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Companies Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry, Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
9. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book Company.
10. Friedlander, Kennedy, Miller and Macias Nuclear and Radio Chemistry: John Wiley & Sons Inc.
11. Choppin, Lijenzin, Rydberg and Ekberg Radio Chemistry and Nuclear Chemistry Pubs Elsevier.

CHEMISTRY LAB-IV

Subject Code: BSNMS1-405 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course objectives:

1. To understand the principle and application of conductometric titrations.
2. To understand various physical processes and their principle.
3. To understand synthesis and analysis of inorganic complexes

Course outcomes: On completion of this course, students will be able to:

CO1: Understand the principle and application of conductometric titrations.
CO2: Understand various physical phenomenon and their principle.
CO3: Synthesis and analysis of inorganic complexes.

I. Synthesis and Analysis

a) Preparation of Sodium trioxalatoferrate (III)
b) Preparation of Ni-DMG Complex
c) Preparation of Copper tetrammine complex
d) Preparation of cis-bisoxalatodiaquachromate (III) ion

II. Physical Chemistry

a) Conductometric Titrations:

i. Determine the end point of the following titrations by the conductometric methods.
   - Strong acid-Strong base
   - Strong acid-Weak base
   - Weak acid-Strong base
   - Weak acid-Weak base

ii. Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.

b) Weight Determination

i. Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent (Rast's methods).
ii. To determine the molecular weight of a polymer by viscosity measurements.

c) Adsorption

i. To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.

d) Phase Equilibria to determine the distribution coefficient of iodine between CCl_4 and water.

e) Refractometry

i. Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.
ii. To determine the composition of unknown mixture of two liquids by refractive index measurements.

f) Determining the half-life of radio isotope using GEIGER-MULLER COUNTER.

Recommended Books:

Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry, University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry, Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

FORENSIC PSYCHOLOGY

Subject Code: BMFSS1-401 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of Forensic Psychology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, student will be able to:
CO1: Understand the concept of Forensic psychology and Forensic Psychiatry.
CO2: Gain knowledge regarding assessment of mental competency.
CO3: Gain knowledge of psychology behind criminal behavior
CO4: Understand the methods of detection of deception.

Unit-I (10 Hrs.)

Basics of Forensic Psychology. Definition and fundamental concepts of forensic psychology and forensic psychiatry.
Psychology and law. Ethical issues in forensic psychology. Assessment of mental competency. Mental disorders and forensic psychology. Psychology of evidence – eyewitness testimony, confession evidence.

Unit-II (10 Hrs.)

Criminal profiling. Psychology in the courtroom, with special reference to Section 84 IPC.
Psychology and Criminal Behavior Psychopathology and personality disorder. Psychological assessment and its importance. Serial murderers. Psychology of terrorism.

Unit III (10 Hrs.)

Biological factors and crime – social learning theories, psycho-social factors, abuse. Juvenile delinquency – theories of offending (social cognition, moral reasoning), Child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies.

Unit-IV (15 Hrs.)

Detection of Deception Tools for detection of deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis. Polygraphy – operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test. Narco analysis and brain electrical oscillation signatures – principle and theory, ethical and legal issues.

Recommended Books:

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
2. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice,

Wiley, Chichester (1997).
5. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon (2014).
6. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).
7. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
8. J.C. De Ladurantey and D.R. Sullivan, Criminal Investigation Standards, Harper & Row, New York (1980).
9. J. Niehaus, Investigative Forensic Hypnosis, CRC Press, Boca Raton (1999).
10. E. Elaadin Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

GROUP-1

PLANT PHYSIOLOGY & METABOLISM

Subject Code: BMFSS1-402 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of Plant physiology and metabolism.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Importance of water and its components.
CO2: Essential elements and its role.
CO3: Composition of phloem.

Unit-1 (15 Hours)

Plant-water relations: Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Mineral nutrition : Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Translocation in phloem: Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

Unit-2 (15 Hours)

Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reactioncenter, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

Respiration: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit-3 (15 Hours)

Enzymes: Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition

Nitrogen metabolism: Biological nitrogen fixation; Nitrate and ammonia assimilation.

Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Unit-4 (15 Hours)

Plant response to light and temperature: Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization. Biological nitrogen fixation; Nitrate and ammonia assimilation.

Plant growth regulators Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Plant response to light and temperature

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), redvand far red light responses on photomorphogenesis; Vernalization.

Suggested Readings

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. A.N. Parashar (1985), Plant Physiology. Trueman Book Company.

BOTANY LAB-IV

Subject Code: BMFSS1-403 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To determine osmotic potential of plant cell.
3. To demonstrate the hill reaction.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Calculation of stomatal index.
CO3: Study the effect of ligt intensity.

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O2 evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

Demonstration experiments (any four)

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration
4. R.Q.
5. Respiration in roots.

Recommended Books:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
2. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan

Publishers Pvt. Ltd., Delhi.

7. Thakur, A.K. and Bassi, S.K. (2008). Diversity of Microbes and Cryptogams. S. Chand & Co., Delhi.
8. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
9. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.

GENETICS & EVOLUTIONARY BIOLOGY

Subject Code: BMFSS1-404 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of genetics and evolutionary biology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes (CO): The completion of the course will make student to acquire the knowledge of:

CO1: Mendelian Genetics and its importance in Forensic Science.
CO2: Mutation and its types.
CO3: Sex determination and how it is used in paternity disputes.

Unit-1 (15 Hours)

Mendelian Genetics and its Extension Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance.

Linkage Crossing Over and Chromosomal Mapping Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Unit-2 (15 Hours)

Mutations Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB methods, attached X method.

Sex Determination Chromosomal mechanisms of sex determination in Drosophila and Man

Unit-3 (15 Hours)

Extra-chromosomal Inheritance Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effects.

Polygenic Inheritance Polygenic inheritance with suitable examples; simple numericals based on it.

Unit-4 (15 Hours)

Recombination in Bacteria and Viruses Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Transposable Genetic Elements Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in human.

Recommended Books:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers.

ZOOLOGY LAB-IV

Subject Code: BMFSS1-405 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To study the mendelian laws
3. To analyse chi-square using seeds.

Course Outcomes (CO): The completion of the practical will make student to acquire the knowledge of:

CO1: Different Safety measures in lab.
CO2: Analysis of the linkage maps
CO3: Study of human karyotype.

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/Drosophila.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on data from Drosophila crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings
4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co
6. Fletcher H. and Hickey I. (2015). Genetics. IV Edition. G

GROUP-2

WAVES AND OPTICS

Subject Code: BSNMS1-401 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of waves and optics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Understand the concepts of harmonic oscillations and wave motion.
CO2: Gain knowledge of simple harmonic motion and its applications.
CO3: Learn about the concepts of Interference.
CO4: Understand the concepts polarization and diffraction.

UNIT-I (15 Hrs)

Harmonic oscillators and Wave Motion:

Superposition of two collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity

UNIT-II (15 Hrs)

Simple Harmonic motion and applications:

Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria

UNIT-II (16 Hrs)

Wave optics and Interference:

Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes.

UNIT-IV (14 Hrs)

Diffraction and Polarization:

Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

Recommended Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young1986. Addison-Wesley.

WAVES AND OPTICS LAB

Subject Code: BSNMS1-402 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the motion of coupled oscillation.
3. To determiine refractive index and its importance in forensic science.

Course Outcome (CO): After the completion of the course, Student will be able to

CO1: Learn about the motion of coupled oscillators and Lissajous Figures
CO2: Understand various diffraction phenomenon using prism and biprism
CO3: Determine the Refractive Index, dispersive Power of the Material, and Resolving Power of prism using various methods
CO4: Understand Schuster`s focusing and photo sensor

List of Experiments:

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda 2$ – T Law.
3. To study Lissajous Figures.
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
8. To determine the value of Cauchy Constants of a material of a prism.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Recommended Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

ALGEBRA-I

Subject Code: BSNMS1-406 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of algebra.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

CO1: Understand the concept of groups and its properties.
CO2: Understand the concept of permutation group and groups of symmetries.
CO3: Analyze & demonstrate different types of algebraic structures such as subgroups, cosets and their properties.
CO4: Understand the concept of normal subgroup and Lagrange's theorem.

Unit-I (11 Hrs.)

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

Unit-II (10 Hrs.)

circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

Unit-III (12 Hrs.)

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets.

Unit-IV (12 Hrs.)

Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Recommended Books:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
5. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,1993.
6. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, 1976.

ALGEBRA-II

Subject Code: BSNMS1-407 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To ensure students can achieve an up-to-date level of understanding of algebra.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
3. To provide knowledge of latest published findings.

Course Outcomes:

CO1: Understand the concept of Ring and their properties.
CO2: Apply the concepts of isomorphism, homomorphism, ideal and integral domain for rings to solve different types of problems.
CO3: Access the idea of inner product space and determine its orthogonality on vector space.
CO4: Understand the basic concepts of linear transformations, algebra of transformations, eigenvalues and corresponding eigenvectors.

Unit-I (12 Hrs.)

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

Unit-II (11 Hrs.)

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem.

Unit-III (12 Hrs.)

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

Unit-IV (10 Hrs.)

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non-singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

Recommended Books:

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, 2004.
2. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,1993.
3. Herstein, I.N., 'Topics in Algebra'2nd Ed., Vikas Publishing House, 1976.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.