

# **CAREER POINT**

# **UNIVERSITY**

## **KOTA (RAJASTHAN)**

**School of Basic and Applied Science**

**Syllabus and Course Scheme**  
**(Annual Scheme)**

**Bachelor of Science**  
**(Mathematics)**

**Session – 2021-22**

**Duration of the Course- Three Years**

**University Campus:** Alaniya, Kota 325 003, Rajasthan Ph: +91-80941-62999

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## Course Scheme of B.Sc. Part-I

Annual Course Scheme of B.Sc. Part-I				
Branch-Mathematics				
S.No.	Paper Code	Paper Name	Marks	
			Min. Marks	Max. Marks
1	HUL011	General English*	36	100
2	HIN011	General Hindi*	36	100
3	CSL011	Elementary Computer Application*	36	100
4	ENL011	Environmental Studies*	36	100
5	CHL011-I	Inorganic Chemistry	18	50
6	CHL011-II	Organic Chemistry	18	50
7	CHL011-III	Physical Chemistry	18	50
8	CHP011	Chemistry Practical	27	75
9	MAL011-I	Abstract Algebra	18	50
10	MAL011-II	Differential Calculus	27	75
11	MAL011-III	Vector Calculus	27	75
12	MAP011	Maths Practical	9	25
13	PHL011-I	Mechanics	18	50
14	PHL011-II	Electromagnetism	18	50
15	PHL011-III	Optics	18	50
16	PHP011	Physics Practical	27	75
				G.T.
				675
*Eligibility Criteria on passing marks only, marks shall not be included in division				

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# Syllabus of B.Sc. Maths Part - I

## HUL011: General English

### Objectives

An essentially language-based course that aims at making students study English Prose with a view to enlarge their comprehension of the language and develop all the four skills. It also aims at giving them basic skills in grammar, widening their vocabulary and teaching them to write simple and correct English. The question paper will have 100 multiple choice questions.

**1) Comprehension and vocabulary Prose:** Indian Voices: A course in English literature and language; ed. By Kshamta Chaudhary and Sanjay Chawla. Published by Orient Blackswan, Hyderabad. The following chapters from the text have been prescribed:

- 1.The Child: Premchand
- 2.The mark of Vishnu: Khushwant Singh
- 3.Brain Bhowmik's Ailment: Satyajit Ray
- 4.Drought: Sarat Chand Chatterjee
- 5.A vision for 2020: A.P.J. Abdul Kalam
- 6.Elixir of Life:C.V. Raman
- 7.Photographs: Shama Futehally
- 8.The death of a Hero:Jai Nimbkar

- Questions based on the content from the prescribed text
- Objective/Multiple choice questions based on the content from the prescribed text
- Short answered questions from the same text

**2) Basic language skills:** Parts of speech, Determiners, Voice, Reported-Speech, Correct Verbs, Form of Modals, Phrasal Verbs, Prepositions

& Question Tags.

**3) Writing Skills:** Paragraph writing/C.V. Curriculum-Vitae, Letter Writing/ E-Mail/ Report Writing.

### Book Suggested:

1. A Practical English Grammar by A.J. Thomson & A.V. Martinet
2. Oxford English Grammar Course by Michael Swan & Catherine Walter
3. Fundamentals of English Grammar by Betty Azar
4. Advanced English Grammar by Martin Hewings
5. Practical English Writing Skills by Mona Scheraga
6. CVs and Job Applications by Judith Leigh
7. How to Write a CV that Works by Paul McGee
8. Writing Effective Email by Nancy Flynn & Tom Flynn

## HIN011: General Hindi

### पद्ध भाग

- 1.नर हो ना निराश करो मन को दृ मैथिलीशरण गुप्त
- 2.हिमालय के आंगन में. जय शंकर प्रसाद
3. जागो फिर एक बार (भाग 2). निराला
- 4.दिल्ली दिनकर
- 5.हम अनिकेत. बाल कृष्ण शर्मा नवीन
- 6 झांसी की रानी.सुभद्रा कुमारी चौहान
- 7 गीत फरोश. भवानी प्रसाद मिश्र
- 8 बादल को घिरते देखा है. नागार्जुन
- 9 पंद्रह अगस्त. गिरिजा कुमार माथुर

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10. मैं हार नहीं मानूँगा. श्री अटल बिहारी वाजपेयी

11. शहीद की माँ. रघुराज सिंह हाड़ा

#### गद्य भाग

1 नाखून क्यों बड़ते हैं. हजारी प्रसाद द्विवेदी

2 राष्ट्र का स्वरूप. वासुदेव शरण अग्रवाल

3 गेंडू बनाम गुनाब. रामकृष्णबेनीपुरी

4. भवानी शंकरोवन्देदू कुबरे नाथ राय

5 बड़े घर की बेटी. प्रेमचंद

6 अदम्य जीवन. रंगेय राघव

7 उत्सर्ग. राम कुमार वर्मा

8 गांधी जी से भेंट (आत्म कथा) दृ राजेंद्र प्रसाद

9 महाराजपुर से ग्वारीघाट(सौंदर्य की नदी नर्मदा से). अमृत लाल बेगड

10 भक्तिन. महादेवी वर्मा

11 हिंदी हमारी मातृ भाषा है. मनहरचौहान

#### व्याकरण भाग

1 संधि

2 समास

3 उपसर्ग

4 प्रत्यय

5 विलोम

6 पर्यायवाची

7 शुद्धिकरण शब्द एवं वाक्य

8 वाक्यांश

9 मुहावरे

10 कहावते

11 शब्द युग्म

12 अनेकाथी

13 परिभाषित शब्दावली

14 तत्सम

15 तदभव

16 देश

सहायक ग्रंथ आधार पुस्तक गद्य साहित्य और पद्य साहित्य

1 हिंदी व्याकरण कामना प्रसाद गुरुकिताब घर दिल्ली

2 हिंदी व्याकरण: डा. नरेंद्र भानावत

3 हिंदी व्याकरण: डा. वैकट

## ENL011: Environmental Studies

### Unit-I

**Introduction:** the multidisciplinary nature of environmental, studies: Definition, scope and important need for public awareness

### Unit-II

**Natural Resources:** Renewable and non-renewable resources, natural resources and associated problems. **Forest resources:** use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest, and tribal people

**Water resources:** use and overutilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems.

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**Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, case studies.

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

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

**Land resources:** land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural sources. Equitable use of resources for sustainable lifestyles.

#### Unit-III

**Concept of an ecosystem:** Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem Ecological succession Food chains, food webs and ecological pyramids Introduction, type, characteristic, features, structure and function of the following ecosystem: a. Forest ecosystem grassland ecosystem desert ecosystem Aquatic ecosystems (ponds, streams, lakes)

#### Unit- IV

**Bio diversity and its conservation Introduction definition:** genetic, species and ecosystem diversity. Bio Geographically classification of India. Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values Biodiversity at global, National and local levels. India as a megadiversity nation Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts Endangered and endemic species of India Conservation of biodiversity: in-situ and Ex-situ conservation of biodiversity.

#### Unit-V

**Disaster Management & Environmental Pollution Disaster:** Types – Natural and Manmade; Detailed study of the following – Earthquakes, Volcanic eruption, Landslides, Flood, Drought, Fire, Nuclear and Chemical disaster and their management. Causes, effects and control measures of Air pollution Water pollution Soil Pollution Marine pollution Noise pollution Thermal pollution Radioactive Pollution

#### Unit- VI

**Social Issues and the Environment** from Unsustainable to sustainable development Urban problems related to energy Water conservation, rainwater harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns, case studies.

**Environmental ethics:** issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies Wasteland reclamation. Consumerism and waste products. Environmental protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wild life protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Road and safety measures.

#### Unit-VII

**Human Population and the Environment** Population growth, variation among nations. Population explosion family welfare programme. Environment and human health Human rights Value education. HIV/AIDS. Women and child welfare. Role of information technology in environment and human health Case studies

### CSL011: Computer Fundamentals

**1. Introduction to Information Technology:** evolution and generation of computers, types of computers, micro, mini, mainframe and super computer, Architecture of a computer system: CPU, ALU, Memory (RAM, ROM families), cache memory, input/output devices, pointing devices. Development of Super Computers in India "PARAM": History, Characteristics, Strength, Weakness and basic Architecture.

**2. Number system:** Binary, octal, decimal and hexadecimal) and their inter-conversions, character codes (ASCII, EBCDIC and Unicode). Logic gates. Boolean Algebra, machine, assembly and high level language including 3 GL and 4GL

**3. Concept of Operating system:** types of operating systems, need of OS, batch processing, multiprocessing, Single user & Multi user OS, distributed and time sharing operating systems, Process and memory management concept, Introduction to Unix, Linux, Windows, Windows NT systems and their simple commands.

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**4. Internet:** Concepts, email services, world wide web, web browsers, search engines. Exploring various Citizen-centric services of Govt. of India such as Income Tax Services, Passport Seva, ticket Booking (IRCTC & RSRTC), National Voters Service Portal, LPG service.

**5. Word processing packages:**

standard features like tool bar, word wrap, text formatting, paragraph formatting. Effects to text, Mail-merge.

**6. Presentation packages:** Slide creation, slide shows, adding graphics, formatting, customizing and printing custom and animation.

**7. Computer networking:** Type of networks, LAN, MAN and WAN, concept of bridges and routers, gateways and modems. ISDN and leased lines, Teleconferencing and videoconferencing.

**8. Multimedia Technology:** Introduction, framework for multimedia devices, image compression standards, JPEG, MPEG and MIDI formats.

**9. Database Management Systems:** Data, field and records, information database, creation of a database file, insertion, deletion and updating of records, modifying structure, editing and browsing of records, searching, sorting and indexing of records, retrieving of records and report generation. Data processing in government organizations.

**10. E-commerce:** Concept of e-commerce, benefits and growth of e-commerce, security considerations and hazards of virus and other security risks, antivirus software, electronic payment system. E-Commerce: An Indian perspective, Digi locker, attendance gov.in, mygov.in, Swachh Bharat Mission, E-Hospital, National Scholarship portal, E-Sampark, UID, various modes of Digital payment of gov. of India

## CHL011-I: Inorganic Chemistry

### Unit-I Atomic Structure

**Idea of De Broglie matter waves,** Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of  $\psi$  and  $\psi^2$ , quantum numbers, radial and angular wave function and probability distribution curves, shapes of s, p, d, orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, Effective nuclear charge. Periodic Properties Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition, methods of determination or evaluation, trends in periodic table and application in predicting and explaining the chemical behaviour.

### Unit –II Chemical Bonding

**Covalent Bond-** Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2$  and  $\text{H}_2\text{O}$ .

**MO Theory:** Homonuclear and heteronuclear (CO and NO) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

### Unit -III

**Ionic Solids-** Ionic Structures: radius ratio effect and coordination number, limitations of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber Cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule. Metallic bond - free electron, valence bond and bond theories. Weak Interactions - Hydrogen bonding, van der Waals forces

### Unit -IV

s-Block Elements Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls. Chemistry of Noble Gases Chemistry of the noble gases. Chemistry of xenon. Structure and bonding in xenon compounds. p-Block Elements Comparative study (including diagonal relationship) of groups, 13-17 elements compounds like hydrides, oxides, oxyacids and halides of groups 13-16.

### Unit -V

**Chemistry of the following compounds:**

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Hydrides of Boron -diborane and higher boranes, borazine, borazoles, fullerenes, carbides, fluorocarbons, silicates, structure principle, tetra sulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

**Book Suggested:**

1. Concise Inorganic Chemistry: J.D. Lee
2. General Inorganic Chemistry: J.A. Duffy, Longman (2<sup>nd</sup> Ed.)
3. Principles of Inorganic Chemistry: B.R. Puri and L.R. Sharma
4. Basic Inorganic Chemistry: F.A. Cotton and G. Wilkinson, Wiley Eastern
5. Molecular Geometry: R.J. Gillespie, Van Nostrand Reinhold

## CHL011-II: Organic Chemistry

### Unit –I

#### Structure and Bonding

Hybridization, bond lengths and bond angles. bond energy, localized and delocalized chemical bond, vander waals interactions, inclusion compounds, clathrates, 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 arrow, 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 (With examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects Kinetic and stereochemical studies.)

### Unit-II

#### Stereochemistry of Organic Compounds

Concept of isomerism, types of isomerism. Optical isomerism: elements of symmetry, molecular chirality enantiomers. stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers. meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration: sequence rules, D&L and R&S systems of nomenclature.

**Geometric isomerism:** determination of configuration of geometric isomers, E&Z systems of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism: conformational analysis of ethane and n-butane. conformations of cyclohexane, axial and equatorial bond, conformation of mono substituted cyclohexane derivatives. Newmann projection and sawhorse formulae, Difference between configuration and conformation.

### Unit-III

#### Alkanes and Cycloalkanes

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

### Unit-IV

#### Alkenes, Cycloalkenes, Dienes and alkynes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halide, regioselectivity in alcohol dehydration The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikof's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO<sub>4</sub> Polymerization of alkenes. Substitution at the allylic and vinylic-positions of alkenes. Industrial applications of ethylene and propene. Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods

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of formation, polymerization. Chemical reactions-1,2- and 1,4- additions, Diels-alderreaction. 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 polymerizations.

#### Unit-V

##### **Arenes, Aromaticity, Alkyl & Aryl Halides**

Nomenclature of benzene derivatives. The aryl groups. Aromatic nucleus and side chain structure of benzene: molecular formula and Kekule structure Stability. Aromaticity: The Huckel's rule, aromatic ions. Aromatic electrophilic substitution-general pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes. Mechanism of nitration, halogenation, sulphonation, mercuriation and Friedel Crafts reaction, energy profile diagrams. Activating & deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanism of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Polyhalogen

**compounds:** chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition, elimination and the elimination-addition mechanism of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl vs allyl, vinyl and aryl halides. Synthesis and use of D.D.T. and B.H.C

##### **Book Suggested:**

1. A Text Book of Organic Chemistry: K.S. Tiwari, S.N. Mehrotra and N.K. Vishnoi
2. Modern Principles of Organic Chemistry: M.K. Jain and S.C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I&II) O.P. Agarwal
4. A Text Book of Organic Chemistry: P.L. Soni
5. Organic Chemistry: (Vol. I, II & III) S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd.
6. Organic Chemistry: Morrison & Boyd, Prentice Hall

## **CHL011-III: Physical Chemistry**

#### Unit-I

##### **Mathematical Concept and Computers**

###### (a) Mathematical Concepts

Logarithmic relations, curve sketching, linear graphs and calculations of slopes differentiation of functions like  $kx, ex, xn, \sin x, \log x$ ; maxima and minima, partial differentiation and reciprocity relations, integrations of some useful/relevant functions: Permutations and combinations. Factorials. Probability.

###### (b) Computers

General introduction to computers, different components of a computer, hardware and software input output devices; binary numbers and arithmetic; introduction to computer languages. Programming, operating systems.

#### Unit II

**Gaseous States** Postulates of kinetic theory of gases, deviation from ideal behaviour, vander waals equation of state. Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of vander Waals equation, relationship between critical constants and vander waals constants, the law of corresponding states, reduced equation of state. Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussions of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect.)

#### Unit III

##### **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 cholestric phases. Thermography and seven segment cell. Colloidal State Definition of colloids, classification of colloids. Solids in liquids (sols) properties- kinetic, optical and electrical, stability of colloids. Protective action, HardySchulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties inhibition, general applications of colloids.

#### Unit IV

##### **Solid State**

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Definition of space lattice, unit cell. Laws of crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's equation Determination of Crystal structure of NaCl and CsCl(Laue's method and powder method.)

## Unit V

### Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction: concentration, temperature, pressure, solvent, light, catalyst, Concentration dependence of rates, mathematical characteristics of simple chemical reactions zero-order, first order, second order, pseudo order, half-life and mean life period.

**Determination of the order of reaction:** differential method; method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon. Experimental methods of chemical kinetics: conductometric, Potentiometric, optical methods, polarimetry and spectrophotometry.

**Theories of chemical kinetics:** effect of temperature on rate of reaction, Arrhenius concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.

#### Book Suggested:

7. A Text Book of Organic Chemistry: K.S. Tiwari, S.N. Mehrotra and N.K. Vishnoi
8. Modern Principles of Organic Chemistry: M.K. Jain and S.C. Sharma
9. A Text Book of Organic Chemistry: (Vol. I&II) O.P. Agarwal
10. A Text Book of Organic Chemistry: P.L. Soni
11. Organic Chemistry: (Vol. I, II & III) S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd.
12. Organic Chemistry: Morrison & Boyd, Prentice Hall

## Chemistry Practical

### Inorganic Chemistry:

Semi-micro /macro-Analysis: Anion analysis (3 radicals).

Cation analysis: Separation and identification of ions from groups I, II, III, IV, V and VI (3 radicals). (Total 6 radicals).

### Organic Chemistry:

#### Laboratory Techniques:

##### Section-A

- Determination of melting point
  - o Naphthalene 80-82°C, Benzoic acid 121.5-122°C, Urea 132.5-133°C, Succinic Acid 184.5-185°C, Cinnamic acid 132.5-133°C, Salicylic acid 157.5-158°C, Acetanilide 113.5-114°C, m-Dinitrobenzene 90°C, p-Dichlorobenzene 52°C, Aspirin 135°C.
- Determination of boiling points
  - o Ethanol 78°C, Cyclohexane 81.4°C, Toluene 110.6°C, Benzene 80°C
- Determination of mixed melting point
  - o Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)
- Distillation
  - o Simple distillation of ethanol-water, using water condenser
  - o Distillation of nitrobenzene and aniline using air condenser
- Crystallization
  - o Concept of induction of crystallization
  - o Phthalic acid from hot water (using fluted filter paper and stemless funnel)
  - o Acetanilide from boiling water.
  - o Naphthalene from Ethanol.
    - o Benzoic acid from water.
- Decolorisation and crystallization using charcoal
  - o Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
  - o Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g. of Congo Red using 1.0g decolorising carbon) from ethanol.
- Sublimation (Simple and vacuum)
  - o Camphor, Naphthalene, Phthalic acid and Succinic acid.

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## Section-B

### • Qualitative Analysis:

Detection of extra elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, ester, carbohydrates, amine, amide, nitro and anilide) in simple organic compounds.

### Physical Chemistry:

#### Chemical Kinetics

- To determine the specific reaction rate of the hydrolysis of methyl acetate / ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strengths of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of ethyl-acetate. • To study kinetically the reaction of decomposition of iodide by H<sub>2</sub>O<sub>2</sub>

#### Distribution Law

- To study the distribution of iodine between water and CCl<sub>4</sub>
- To study the distribution of benzoic acid between benzene and water.

#### Colloids

- To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions. Viscosity, Surface Tension
- To determine the percentage composition of a given, mixture (non-interacting systems) by viscosity method.
- To determine the viscosity of Amyl alcohol in water at different concentrations and calculate the viscosity of these solutions.
- To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl-ketone).

## PHL011-I: Mechanics

### Unit-I

**Physical Laws and Frame of References:** Inertial & non-inertial frames, Galilean transformations and invariance of physical laws, fictitious force, uniformly rotating frames and transformation of displacement, velocity and acceleration, Coriolis force, motion relative to earth and its time period effect of rotation of earth on 'g', Foucault's pendulum.

### Unit-II

**Conservation Laws and Dynamics of Particles:** Concept of centre of mass, Centre of mass of a system of particles, equation of motion, conservation of linear momentum, Relationship between (Lab and centre of Mass frames of in 1-D and 2-D reference) elastic and inelastic collision, Motion of a system with varying mass, Motion in a central force field, conservation of angular momentum, trajectory of a particle under gravitational force, Kepler's laws, Rutherford's formula. Rigid body dynamics, equation of motion of a rotating body, Inertial coefficient, Moments of Inertia theorems, idea of principal axes and kinetic energy of rotation. Precessional motion of spinning top, spin precession in constant magnetic field, Larmor's frequency.

### Unit-III

**Properties of Matter:** Elasticity, stress and strain, Hooke's Law, Elastic constants and their relations, theory of bending of beams and torsion of a cylinder, Cantilever, cantilever supported at both ends. Experimental determination of elastic constants by bending of beam and Searle's method, modulus of rigidity by static and dynamic method, Poisson's ratio for rubber.

### Unit-IV

**Oscillations:** Qualitative idea of Oscillations in an arbitrary potential well, simple harmonic motion, Coupled oscillator, Equation of motion of two simple harmonic coupled oscillators and energy transfer normal modes, normal coordinates of two linear coupled oscillators, Damped harmonic oscillation-example of Ballistic galvanometer, vibration of molecules, forced harmonic oscillators, phase relations, power absorption, resonance, band width and quality factor, LCR series and parallel circuits.

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#### Unit-V

**Waves:** General equation of one-dimensional wave equation and its solution, longitudinal and transverse waves, Plane progressive harmonic wave, its energy density, energy flux and intensity, pressure waves in gas. Equation of motion for one dimensional monatomic & diatomic lattice, acoustic and optical modes, dispersion relations, Concept of group & phase velocities.

## PHL011-II: Electromagnetism

#### UNIT-I

**Scalar and Vector Fields:** Scalar and Vector Fields, Gradient of a scalar field, relation between conservative field and Potential, line, surface and volume integral of vector fields, concept of flux, Divergence and Curl of a vector field and their physical significance, Gauss' divergence and Stokes curl theorem with proof, Del and Laplacian operator in Cartesian, Cylindrical and Spherical coordinates.

#### UNIT-II

**Electrostatics:** Electric potential and field due to arbitrary charge distribution, Multipole Expansion, potential and field due to dipole & its interaction with electric field electrostatic energy of a uniformly charged sphere, classical radius of an electron. Atomic and molecular dipoles, induced dipole and polarizability, dielectrics and their electrical polarization, susceptibility and displacement vector, Capacity of a capacitor with partially and completely filled dielectrics, Gauss' law in integral and differential form, Lorentz local field and Clausius-Mossotti equation.

#### UNIT-III

**Electrostatic Field:** Conductors is an electric field, boundary conditions for electrostatic field and potential at dielectric surface, uniqueness theorem, method of electrical images and its application for system of point charge near a grounded conducting plane. Poisson's and Laplace equation in Cartesian, cylindrical and spherical coordinates (without proof) solution of Laplace's equation in Cartesian coordinates, boundary conditions.

#### UNIT-IV

**Circuits:** Rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, self and mutual induction, Measurement of self-induction by Rayleigh's method, AC circuits and complex numbers and their application in solving AC circuit problems, complex impedance and reactance, series and parallel resonance. Quality factor, power consumed by an AC circuit, Power factor. Biot Savart law, Amperes circuital law in differential and integral form, Magnetization vector, Magnetizing field H, relation between B, H and M. uniform magnetization and surface current. Non – uniform magnetization, orbital and spin angular momentum & magnetic moment, orbital gyro magnetic ratio and Bohr Magnetron, Magnetic susceptibility.

#### Unit-V

**Time Varying Fields:** Faraday's law of electromagnetic induction, its integral and differential form, Maxwell's equation in differential and integral form, Maxwell's displacement current, Wave equation for electric and magnetic field, Plane electromagnetic waves and their properties, transverse nature of EMW, energy density, Poynting Theorem, Poynting vector, propagation of EM Wave in conducting and isotropic dielectric medium.

## PHL011-III: Optics

#### UNIT-I

**Geometrical Optics:** Fermat's principle of extreme path, Aplanatic points of a spherical refracting surface, Cardinal points of an optical system, Newton's formula and other relations for coaxial lens system, thick lens & lens combination, Lagrange's law, Aberration in images, spherical aberration and methods of its reduction,

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chromatic aberration, achromatic combination of lenses placed in contact and placed at some distance, coma and astigmatism,

**Eye pieces:** Huygen's, Ramsden's and Gauss's eyepieces and their comparison.

#### UNIT-II

**Interference:** Young's double slit experiment, temporal and spatial coherence, coherence length and time 'effect of size of slit and purity of spectral line, Interference in thin films, colour in thin films. Wedge shaped film, Newton's rings and determination of wavelength and refractive index of liquid by Newton ring, Hadingerand Fizeau fringes, Michelson Interferometer, Measurement of wavelength, wavelength difference between two close wavelengths and thickness of thin plate. Fabry-Perot interferometer, intensity distribution, coefficient of sharpness and half width, Measurement of wavelength and resolution of two close spectral lines.

#### UNIT-III

**Diffraction:** Fraunhofer diffraction at single slit, intensity distribution and width of central maxima, and determination of slit size, two slit diffraction and its intensity distribution with missing orders. Diffraction due to N slits with intensity distributions. Plane transmission grating its formation and intensity distribution, Dispersive power of grating, Angular width of principal maximum, Absent Spectra, Rayleigh's criterion, resolving power of plane transmission grating. Fresnel class of diffraction, half period zones, zone plate, diffraction due to circular obstacle and aperture, cylindrical wave front and its effect at an external point, Diffraction at straight edge, thin and thick wire, rectangular slit.

#### UNIT-IV

**Polarization:** Polarization states of electromagnetic waves, Plane, Circularly and Elliptically Polarized Light, quarter and half wave plates, methods of production & detection of polarized light, Huygen's theory of double refraction using Fresnel's ellipsoidal surface, Crystal Optics, Optical activity, Specific rotation, Fresnel's law of optical rotation, Biquartz and Laurent's half shade polarimeters, Reflection and refraction of plane EMW at plane dielectric surface, boundary conditions, Fresnel's relations.

#### UNIT-V

**Lasers and Holography:** Stimulated and spontaneous emission, stimulated absorption, Einstein's A and B coefficients, population inversion, conditions for laser action, meta stable states, Types of lasers, construction, working and energy level schemes of He-Ne and Ruby laser, Applications of Lasers, Basic concepts of holography, construction of a hologram and reconstruction of the image, important features of hologram and uses of holography

#### Book Suggested:

1. Mechanics by M.P.Saxena, S.S. Rawat and P.R. Singh College Book House. (Medium: Hindi/English)
2. Electromagnetism by M.P.Saxena, S.S. Rawat and P.R. Singh College Book House. (Medium: Hindi/English)
3. Optics by M.P.Saxena, S.S. Rawat and P.R. Singh College Book House. (Medium: Hindi/English)

### Physics Practical

#### Section –A

1. Study of bending of a beam and determination of Young's modulus.
2. Modulus of rigidity by statical method and dynamical method.
3. Elastic constant by Searle's method.
4. Study of frequency of energy transfer as a function of coupling strength using coupled oscillator.
5. Determination of dispersive power of material of a prism using spectrometer.
6. Measurement of wavelength of monochromatic source of light by Newton's rings.
7. Measurement of wavelength of monochromatic source of light by plane transmission grating.

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8. Measurement of wavelength of monochromatic source of light by biprism.
9. Study of specific rotation by polarimeter.
10. Determination of resolving power of a plane transmission grating.
11. Determination of resolving power of telescope.
12. Determination of the Poisson's ratio of rubber tube.

#### Section-B

1. Study of temperature variation of surface tension by Jeagger's method.
2. Low resistance by Carey-Foster' bridge.
3. Variation of magnetic field along the axis of circular coil and hence determine the radius of coil.
4. To study the variation of charge and current in RC circuit for different time constants (using DC source).
5. To study the behaviour of RC circuit with varying resistance and capacitance using AC Mains as a power source and also determine the impedance and phase relations.
6. To study the rise and decay of current in LR circuit with a source of constant emf.
7. To study the voltage and current behaviour of LR circuit with a AC power source also determine power factor, impedance and phase relation.
8. To study resonance in a series LCR circuit and determine Q of the circuit.
9. Conversion of Galvanometer into Ammeter/Voltmeter.
10. To determine the polarizing angle for the glass prism surface and
11. To determine the refractive index of the material of prism using Brewster's law  $\mu = \tan(ip)$  .

### MAL011-I: Abstract Algebra

#### Unit –I

**Divisibility theory:** Division algorithm, Greatest Common divisor(GCD) and its algorithm, Linear diophantine equations of two variables (using Euclid algorithm and Bhaskaracharya's Kuttaka method) Fundamental theorem of arithmetic, congruences, Chinese Remainder Theorem, Euler's  $\phi$ -function, primitive roots. Binary operation. Addition and multiplication modulo operations. Definition of a group with examples and simple properties.

#### Unit –II

Permutation group, cycle, transpositions, even and odd permutations and alternating group. Order of an element of a group and its properties. Subgroups of a group with its properties, Cyclic groups and their properties, Cosets. Index of a subgroup, Lagrange's theorem and its applications.

#### Unit-III

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Normal subgroups with properties. Simple groups, Quotient groups. Group homomorphism with its kernel and properties. Isomorphism, Cayle's theorem automorphism, Fundamental theorem of homomorphism.

#### **Unit IV**

Rings, Zero divisors, integral domains and fields. Characteristic of a ring, Subrings, subfield, prime field, ring homomorphism and isomorphism. Ideals and their properties.

#### **Unit-V**

Principal ideals and principal ideal ring. Prime ideal. Maximal ideal. Fundamental theorem of ring homomorphism. Euclidean ring and its properties. Polynomial over a ring. Polynomial ring. Polynomial over an integral domain and over a field.

### **MAL011-II: Advanced Calculus**

#### **Unit-I**

Polar coordinates, angle between radius vector and tangent, polar sub tangent and subnormal. Perpendicular from pole on tangent. Pedal equation of a curve. Derivative of length of an arc in cartesian and polar coordinates. Curvature, Radius of curvature and its formula in various forms. Centre of curvature, chord of curvature.

#### **Unit-II**

Partial differential coefficients of a function of two or more variables. Total differential coefficient. Composite function, Euler's theorem on homogeneous functions of two, three and m-variables. First and second differential coefficients of an implicit function. Taylor's theorem for a function of two variables. Jacobians with properties. Maxima, minima and saddle points of functions of two and three variables. Lagrange's method of undetermined multipliers.

#### **Unit- III**

Asymptotes, envelopes and evolutes. Test for points of inflexion and multiple points. Test for concavity and convexity. Tracing of curves in cartesian and polar coordinates.

#### **Unit-IV**

Quadrature, Rectification, Volumes and surfaces of solids of revolution. Differentiation under the sign of integration.

#### **Unit V**

Beta and Gamma functions. Double integrals and their evaluation by change of order and changing into polar coordinates. Triple integrals, Dirichlet's double and triple integrals with their Liouville's extension.

### **MAL011-III: Vector Calculus and Coordinate Geometry**

#### **Unit-I**

Vector differentiation and integration, Problems based on Gradient, divergence and curl. Vector identities, Line and surface integrals. Theorems of Gauss, Green, Stokes (without proof) and problems based on these.

#### **Unit- II**

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**Parabola:** Standard equation, parametric co-ordinates, length of chord, tangent, normal and its properties, two tangents from a point, chord of contact, polar, pole, chord with a given middle point, diameter and three normals from a point.

**Ellipse:** standard equation, auxiliary circle, eccentric angle, tangent, normal, two tangents from point, chord of contact, pole, polar, chord whose mid-point given, diameter, conjugate diameters and four normals from a point.

### Unit III

**Hyperbola:** Standard equation, parametric co-ordinates, asymptotes, equation referred to asymptotes as axes, conjugate diameters and rectangular hyperbola.

**Polar Equation:** Standard equation, directrix, tangent, normal, polar and asymptotes.

### Unit –IV

**Sphere:** standard equations in various forms, plane section, sphere through the circle of intersection of two spheres, power of a point, tangent plane, polar plane, polar line, angle of intersection of two spheres, length of tangent, radical plane, radical axis, co-axial system of spheres and limiting points.

**Cone:** Homogeneous equation in  $x, y, z$ , cone with a given vertex and given base, enveloping cone, condition for the general equation to represent a cone, tangent plane, reciprocal cone, angle between the two lines, in which a plane cuts a cone, three mutually perpendicular generators and right circular cone. Cylinder : Right circular cylinder and enveloping cylinder.

### Unit-V

**Central Conicoids:** Standard equation, tangent plane, condition of tangency, director sphere, polar plane, polar lines, section with a given center, enveloping cone, enveloping cylinder.

**Ellipsoid:** Normal, six normals from a point, cone through six normals, conjugate diameters and their properties.

#### Book Suggested:

1. Shanti Narain, A Test Book of vector calculus, S. Chand and Co., New Delhi.
2. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
3. J.N. Sharma & A.R. Vasishtha, Vector Calculus, Krishna Prakashan Mandir, Meerut.
4. S.L. Loney, the elements of Coordinate Geometry, Macmillan and Company, London.
5. Gorakh Prasad and H.C. Gupta, Text Book of Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad.
6. R.J.T. Bell, Elementary Treatise on Coordinate Geometry of Three Dimensions Macmillan India Ltd., 1994
7. Shanti Narayan, Solid Geometry, S. Chand and Company, New Delhi
8. M. Ray & S.S. Seth, Differential calculus, Students, friends & Co. Agra.

### Mathematics Practical

1. form graph of polynomials of four or more degree
2. simplification of logical circuits using Boolean algebra
3. formation of truth table of Boolean functions.
4. Curve tracing of plane curves including polar curves.
5. Application of fundamental theorem on morphism of groups.
6. To form construction table of given Algebraic structure and prove it group.

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7. Find roots of algebraic equation by graphical method.
8. Application of Lagrange's theorem
9. Problems related to permutations and permutation groups.
10. Problems related to ring.

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