UNIVERSITY OF NORTH BENGAL

Accredited by NAAC with grade A

Raja Rammohunpur, Dist: Darjeeling, Pin: 734013.

CHOICE BASED CREDIT SYSTEM

B.Sc. Honours & Program Course with CHEMISTRY

Revised Syllabus

(First, Third & Fifth Semester)

CBCS

ODD SEMESTERS – 1, 3, 5

SEMESTER-I [H] & [Prog]	COURSE NAME
CC-I	Inorganic Chemistry
CC- II	Physical Chemistry
GE- 1	Sec-A: Inorganic Chemistry Sec-B: Organic Chemistry
DSC-1	Sec-A: Inorganic Chemistry Sec-B: Organic Chemistry
SEMESTER -3 [H] & [Prog]	COURSE NAME
CC-V	Inorganic Chemistry
CC-VI	Organic Chemistry
CC-VII	Physical Chemistry
SEC- 1 [H]	Pharmaceutical Chemistry
GE-3	Sec A: Physical Chemistry Sec B : Organic Chemistry
DSC-3	Sec A: Physical Chemistry Sec B : Organic Chemistry
SEC- 1(DSC)	Pharmaceutical Chemistry
SEMESTER-5 [H] & [Prog]	COURSE NAME
CC-XI	Organic Chemistry
CC-XII	Physical Chemistry
DSE-1	Analytical Methods in Chemistry
DSE-2	Inorganic Materials of Industrial Importance
SEC- 3 (DSC)	Pesticide Chemistry
DSE- 1 (DSC)	Inorganic Materials of Industrial Importance

CHEMISTRY

SYLLABUS (CBCS)

(B.Sc. HONOURS)

1st, 3rd, 5th SEMESTER

SCHEME for B.Sc. (HONOURS) 1st SEMESTER

YEAR	SEMESTER	CORE COURSE [CC]
1st	1st	CC-I : INORGANIC CHEMISTRY
		CC-II : PHYSICAL CHEMISTRY

SCHEME for B.Sc. (HONOURS) 3rd SEMESTER

YEAR	SEMESTER	CORE COURSE [CC]	SKILL ENHANCEMENT COURSE [SEC]
2nd	3rd	CC-V : INORGANIC CHEMISTRY	SEC-1 : Pharmaceutical Chemistry
		CC-VI: ORGANIC CHEMISTRY	
		CC-VII: PHYSICAL CHEMISTRY	

SCHEME for B.Sc. (HONOURS) 5th SEMESTER

YEAR	SEMESTER	CORE COURSE [CC]	DISCIPLINE SPECIFIC ELECTIVE [DSE]
3rd	5th	CC- XI : ORGANIC CHEMISTRY	DSE -I : Analytical Methods in Chemistry
		CC -XII : PHYSICAL CHEMISTRY	DSE -2 : Inorganic Materials of Industrial Importance

SCHEME for B.Sc. Students of Honours with other Disciplines (GENERIC ELECTIVE)

YEAR	SEMESTER	GENERIC ELECTIVE	
1st	1st	GE-I	Section -A : Inorganic Chemistry Section – B : Organic chemistry
2nd	3rd	GE-3	Section -A : Physical Chemistry Section -B : Organic Chemistry

B.Sc. Program Course in CHEMISTRY

SCHEME for B.Sc. Program Course 1st SEMESTER

Year	Semester	DISCIPLINE SPECIFIC COURSE	
1st	1st	DSC-I	Section -A: Inorganic Chemistry
			Section- B: Organic Chemistry

SCHEME for B.Sc. Program Course 3rd SEMESTER

Year	Semester	DISCIPLINE SPECIFIC CORE	SKILL ENHANCEMENT COURSE
2nd	3rd	DSC-3 Section-A: Physical Chemistry Section -B :Organic Chemistry	SEC-1 (DSC) : Pharmaceutical Chemistry

SCHEME for B.Sc. Program Course 5th SEMESTER

Year	Semester	DISCIPLINE SPECIFIC ELECTIVE	SKILL ENHANCEMENT COURSE
3rd	5th	DSE-I(DSC) : Inorganic Materials of Industrial Importance	SEC-3 (DSC) Pesticide Chemistry

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Semester 1

HONOURS IN CHEMISTRY

CC-I: INORGANIC CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: Atomic Structure:

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.   **(14 Lectures)**

UNIT II: Periodicity of Elements:

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block.

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

(b) Atomic radii (van der Waals)

(c) Ionic and crystal radii.

(d) Covalent radii (octahedral and tetrahedral)

(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(f) Electron gain enthalpy, trends of electron gain enthalpy.

(g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. **(16 Lectures)**

UNIT III: Chemical Bonding:

(i) *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) *Covalent bond:* Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.

Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.

Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

(iii) *Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and insulators.

(iv) *Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points. **(26 Lectures)**

UNIT IV: Oxidation-Reduction:

Redox equations, Standard Electrode Potential and its application to inorganic reactions.

Principles involved in volumetric analysis to be carried out in class. **(4 Lectures)**

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970
- Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
- Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.

CHEMISTRY PRACTICAL: CC-I: LAB

60 Lectures

(A) Titrimetric Analysis

(i) Calibration and use of apparatus

(ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ solution.

(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Reference text:

1. Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.

CHEMISTRY CC- II: PHYSICAL CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: Gaseous state:

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietirici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.   **(18 Lectures)**

UNIT II: Liquid state:

Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.   **(6 Lectures)**

UNIT III: 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, and KCl.   **(16 Lectures)**

UNIT IV: Ionic equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, and buffer action.

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.   **(20 Lectures)**

Reference Books:

- Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 10th Ed., Oxford UniversityPress (2014).
- Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
- Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).
- Mortimer, R. G. *Physical Chemistry* 3rd Ed. Elsevier: NOIDA, UP (2009).
- Engel, T. & Reid, P. *Physical Chemistry* 3rd Ed. Pearson (2013).

CHEMISTRY PRACTICAL: CC- II LAB

60 Lectures

(Any three)

1. Surface tension measurements.

(a) Determine the surface tension by drop number method.

(b) Study the variation of surface tension of detergent solutions with concentration.

2. Viscosity measurement using Ostwald's viscometer.

(a) Determination of viscosity of aqueous solutions of polymer / ethanol / sugar at room temperature.

(b) Study the variation of viscosity of sucrose solution with the concentration of solute.

3. Indexing of a given powder diffraction pattern of a cubic crystalline system.

4. pH metry

(a) Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.

(b) Preparation of buffer solutions of different pH

(i) Sodium acetate-acetic acid

(ii) Ammonium chloride-ammonium hydroxide

(c) pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.

(d) Determination of dissociation constant of a weak acid.

Reference Books:

- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
- Halpern, A. M. & Mc Bane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

Semester 3

CHEMISTRY: CC -V: INORGANIC CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkle-de Boer process and Mond's process, Zone refining. **(6 Lectures)**

UNIT II: Acids and Bases

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle. **(8 Lectures)**

UNIT III: Chemistry of *s* and *p* Block Elements:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of *s* and *p* block elements.

Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.

Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens. **(30 Lectures)**

UNIT IV: Noble Gases:

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF_2, XeF_4 and XeF_6; Nature of bonding in noble gas compounds (Valence bond

treatment and MO treatment for XeF_2). Molecular shapes of noble gas compounds (VSEPR theory).   **(8 Lectures)**

UNIT V: Inorganic Polymers:

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes.

Borazines, silicates and phosphazenes and polysulphates.   **(8 Lectures)**

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry*, ELBS, 1991.
- Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. *Concepts & Models of Inorganic Chemistry 3rd Ed.*, John Wiley Sons, N.Y. 1994.
- Greenwood, N.N. & Earnshaw. *Chemistry of the Elements*, Butterworth-Heinemann. 1997.
- Cotton, F.A. & Wilkinson, G. *Advanced Inorganic Chemistry*, Wiley, VCH, 1999.
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- Miessler, G. L. & Donald, A. Tarr. *Inorganic Chemistry* 4th Ed., Pearson, 2010.
- Atkin, P. *Shriver & Atkins' Inorganic Chemistry* 5th Ed. Oxford University Press (2010).

CHEMISTRY PRACTICAL: CC- V LAB

60 Lectures

(A) Iodo / Iodimetry Titrations

(i)   Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically).

(ii)   Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically

(iii)   Estimation of available chlorine in bleaching powder iodometrically.

(B)   Quantitative Estimation of

   (i) Fe^{3+} and Cu^{2+}

   (ii) Fe^{3+} and Cr^{3+}

   (iii) Fe^{3+} and Ca^{2+}

Reference Books:

- Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6thEd.,* Pearson, 2009.

CHEMISTRY CC-VI: ORGANIC CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: Chemistry of Halogenated Hydrocarbons:

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNimechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromaticsubstitution; SNAr, Benzyne mechanism.

Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg and Li – Use in synthesis of organic compounds. **(16 Lectures)**

UNIT II: Alcohols, Phenols, Ethers and Epoxides:

Alcohols: preparation, properties and relative reactivity of $1^{°}$, $2^{°}$, $3^{°}$ alcohols, Bouvaelt-BlancReduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitutionreactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism;

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides withalcohols, ammonia derivatives and LiAlH4 **(16 Lectures)**

UNIT III: Carbonyl Compounds:

Structure, reactivity and preparation;

Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemensen, Wolff-Kishner, LiAlH4, NaBH4, MPV, PDC and PGC);

Addition reactions of unsaturated carbonyl compounds: Michael addition.

Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate. **(14 Lectures)**

UNIT IV: Carboxylic Acids and their Derivatives:

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids;

Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann-bromamide degradation and Curtius rearrangement. **(10 Lectures)**

UNIT V: Sulphur containing compounds:

Preparation and reactions of thiols, thioethers and sulphonic acids. **(4 Lectures)**

Reference Books:

- Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Graham Solomons, T.W. *Organic Chemistry,* John Wiley & Sons, Inc.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.

CHEMISTRY PRACTICAL: CC-VI LAB

60 Lectures

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
2. Organic preparations: (Any Five)
(i)   Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*-toluidine and *o*-, *m*-, *p*-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:
        a. Using conventional method.
        b. Using green approach

(ii)   Benzoylation of one of the following amines (aniline, *o*-, *m*-, *p*- toluidine's and *o*-, *m*-, *p*-anisidine) and one of the following phenols (β-naphthol, resorcinol, p-cresol) by Schotten-Baumann reaction.

(iii) Oxidation of ethanol/ isopropanol (Iodoform reaction).

(iv)   Bromination of any one of the following:
          (a) Acetanilide by conventional methods
          (b) Acetanilide using green approach (Bromate-bromide method)

(v)   Nitration of any one of the following:
          (a) Acetanilide/nitrobenzene by conventional method
          (b) Salicylic acid by green approach (using ceric ammonium nitrate).

(vi)   Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline.

(vii) Reduction of *p*-nitrobenzaldehyde by sodium borohydride.

(viii) Hydrolysis of amides and esters.

(ix)   Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.

(x) *S*-Benzylisothiouronium salt of one each of water soluble and water insoluble acids(benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).

(xi)   Aldol condensation using either conventional or green method.

(xii) Benzil-Benzilic acid rearrangement.

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

Reference Books

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education (2009)
- Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.* Pearson (2012)
- Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis,* University Press (2000).
- Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis,* University Press (2000).

CHEMISTRY: CC-VII: PHYSICAL CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: Phase Equilibria:

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes.

Nernst distribution law: its derivation and applications. **(28 Lectures)**

UNIT II: Chemical Kinetics

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates. **(18 Lectures)**

UNIT III: Catalysis:

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis. **(8 Lectures)**

UNIT IV: Surface chemistry:

Physical adsorption, chemisorption, adsorption isotherms (Freundlich and Langmuir), nature of adsorbed state. **(6 Lectures)**

Reference Books:

- Peter Atkins & Julio De Paula, *Physical Chemistry* 10th Ed., Oxford University Press (2014).
- Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa (2004).
- Mc Quarrie, D. A. & Simon, J. D., *Molecular Thermodynamics*, Viva Books Pvt. Ltd.: New Delhi (2004).
- Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.,* Prentice-Hall (2012).
- Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. *Commonly Asked Questions in Thermodynamics.* CRC Press: NY (2011).
- Zundhal, S.S. *Chemistry concepts and applications* Cengage India (2011).
- Ball, D. W. *Physical Chemistry* Cengage India (2012).
- Mortimer, R. G. *Physical Chemistry 3rd Ed.,* Elsevier: NOIDA, UP (2009).
- Levine, I. N. *Physical Chemistry 6th Ed.,* Tata McGraw-Hill (2011).
- Metz, C. R. *Physical Chemistry 2nd Ed.,* Tata McGraw-Hill (2009).

CHEMISTRY PRACTICAL: CC-VII LAB

60   Lectures

I.   Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

II.   Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:

(a) simple eutectic and

(b) congruently melting systems.

III. Distribution of acetic / benzoic acid between water and cyclohexane.

IV: Study the equilibrium of at least one of the following reactions by the distribution method:

(i) $I_2(aq) + I^- \rightarrow I_3^-(aq)^{2+}$

(ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$

V.   Study the kinetics of the following reactions. (Any One)

1. Initial rate method: Iodide-persulphate reaction

2. Integrated rate method (Any ONE)

    a. Acid hydrolysis of methyl acetate with hydrochloric acid.

    b. Saponification of ethyl acetate.

3. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate.

VI. Adsorption:

Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Reference Books:

- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).

- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).

- Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

SKILL ENHANCEMENT COURSE for Honours and Program Course

SEC-1 [Honours] and SEC-1 (DSC)

PHARMACEUTICAL CHEMISTRY

(Credits: 02)

Theory: 30 Lectures

Drugs & Pharmaceuticals

Classification, Structure and drug discovery, design and development and therapeutic uses; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, ibuprofen); Antimalarials: Chloroquine (with synthesis). antibiotics (detailed study of Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

Fermentation

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Practicals (any two)

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium disilicates (Antacid).
3. Preparation of methyl salicylate (oil of wintergreen).
4. Any other Practical as desired.

Reference Books:

- Patrick, G. L. Introduction to Medicinal Chemistry, Oxford University Press, UK, 2013.
- Singh, H. & Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi, 2012.
- Foye, W.O., Lemke, T.L. & William, D.A.: Principles of Medicinal Chemistry, 4th ed., B.I. Waverly Pvt. Ltd. New Delhi.

Semester 5

CHEMISTRY: CC-XI: ORGANIC CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: Pericyclic Reactions:

Introduction to Pericyclic Reactions and their classification; Molecular orbitals of conjugated π-systems (Ethane, 1,3-Butadiene, 1,3,5-Hexatriene and Benzene) and their symmetry properties; HOMO and LUMO. Electrocyclic reactions– Introduction, Classification, Disrotation and Conrotation, Woodward Hoffmann rules, Stereochemical aspects. Cycloaddition reactions– Introduction, Classification, Examples of thermal and photochemical cycloaddition reactions, Activated Dienes and Dienophiles, Regioselectivity, Atomic orbital coefficient, Stereospecificity, Endo-addition rules. Secondary orbital interactions. Sigmatropic rearrangements – Introduction, Classification, Claisen and Cope rearrangements. **(20 Lectures)**

UNIT II: Nucleic Acids

Components of nucleic acids, Nucleosides and nucleotides;

Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides. **(5 Lectures)**

UNIT III: Amino Acids, Peptides and Proteins

Amino acids, Peptides and their classification.

α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis;

Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups - Solid-phase synthesis **(14 Lectures)**

UNIT IV: Enzymes

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.

Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance.   **(8 Lectures)**

UNIT V: Lipids

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.   **(5 Lectures)**

UNIT VI: Concept of Energy in Biosystems

Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD^+, FAD.   **(8 Lectures)**

Reference Books:

- Berg, J.M., Tymoczko, J.L. & Stryer, L. (2006) *Biochemistry*. 6th Ed. W.H. Freeman and Co.
- Nelson, D.L., Cox, M.M. & Lehninger, A.L. (2009) *Principles of Biochemistry. IVEdition.* W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. & Rodwell, V.W. (2009) *Harper'sIllustrated Biochemistry.* XXVIII edition. Lange Medical Books/ McGraw-Hill.

CHEMISTRY PRACTICAL: CC- XI LAB

60   Lectures (Any Five)

1. Estimation of glycine by Sorenson's formalin method.

2. Study of the titration curve of glycine.

3. Estimation of proteins by Lowry's method.

4. Study of the action of salivary amylase on starch at optimum conditions.

5. Effect of temperature on the action of salivary amylase.

6. Saponification value of an oil or a fat.

7. Determination of Iodine number of an oil/ fat.

8. Isolation and characterization of DNA from onion/ cauliflower/peas.

Reference Books:

- Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
- Arthur, I. V. *Quantitative Organic Analysis,* Pearson.

CHEMISTRY: CC-XII: PHYSICAL CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

UNIT I: Quantum Chemistry

Black body radiation, Photoelectric effect, Compton effect, Planck's quantum theory, Wave particle duality, Heisenberg Uncertainty principle, Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy and wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution.

(16 Lectures)

UNIT II: Molecular Spectroscopy:

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states,

(16 Lectures)

UNIT III: Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. fluorescence and phosphorescence, chemiluminescence. **(12 Lectures)**

UNIT IV: Colloids

Classification, Preparation, Purification, Stability of colloids, Properties of colloids (optical, kinetic and electrical properties), Schulze Hardy rule, Gold number, Determination of Avogadro's number, Colloidal electrolytes and their properties, Isoelectric point, Electrical double layer and Zeta potential, Micelles. **(8 Lectures)**

UNIT V: Statistical Thermodynamics:

Concepts of permutation, combination, factorials and probability, Thermodynamic probability and entropy, Boltzmann distribution, Partition function (translational, rotational, vibrational and electronic), Thermodynamic functions and equilibrium constant in terms of partition function.

(8 Lectures)

Reference Books:

- Banwell, C. N. & McCash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. Tata McGraw-Hill: New Delhi (2006).
- Chandra, A. K. *Introductory Quantum Chemistry* Tata McGraw-Hill (2001).
- House, J. E. *Fundamentals of Quantum Chemistry* 2nd Ed. Elsevier: USA (2004).
- Kakkar, R. *Atomic & Molecular Spectroscopy*: *Concepts & Applications*, Cambridge University Press (2015).
- Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press (2005).

CHEMISTRY PRACTICAL: CC-XII LAB

60 Lectures

1. Verify Lambert – Beer's Law and determine the concentration of $KMnO_4$ / $K_2Cr_2O_7$ in a solution of unknown concentration.

2. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$.
   (in 0.1 M H_2SO_4) and determine the λmax values. Calculate the energies of the two transitions in different units (J molecule-1, kJ mol-1, cm-1, eV).

3. Analysis of the given Vibration – Rotation Spectrum of HCl [g].

4. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

DISCIPLINE SPECIFIC ELECTIVE

CHEMISTRY-DSE-1: ANALYTICAL METHODS IN CHEMISTRY [Honours]

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Qualitative and quantitative aspects of analysis:

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.   **(5 Lectures)**

Optical methods of analysis:

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

Structural illustration through interpretation of data, Effect and importance of isotope substitution.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector), choice of flame and Burner designs. Techniques of atomization and sample introduction.   **(20 Lectures)**

Thermal methods of analysis:

Theory of thermogravimetry (TG), basic principle of instrumentation.

Techniques for quantitative estimation of Ca and Mg from their mixture.   **(5 Lectures)**

Electroanalytical methods:

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.   **(10 Lectures)**

Separation techniques:

Solvent extraction: Classification, principle, Distribution coefficient and distribution ratio, efficiency of the technique, percentage extraction, separation factor, Selection of solvent.

Mechanism of extraction: extraction by solvation and chelation.

Technique of extraction: batch and continuous extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique.

Mechanism of separation: adsorption, partition & ion exchange.

Development of chromatograms: frontal, elution and displacement methods.

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Ion-exchange: Principle, Types of ion-exchangers, Quality of resins, Swelling of resins, Action of ion-exchange resin, Ion-exchange equilibrium, Ion-exchange capacity, Deionization of water.

Role of computers in instrumental methods of analysis   **(20 Lectures)**

Reference Books:

- Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.
- Willard, H.H. *et al.*: *Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
- Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
- Harris, D.C.: *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.
- Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age International Publisher, 2009.
- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Mikes, O. *Laboratory Hand Book of Chromatographic & Allied Methods*, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
- Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.

PRACTICAL: DSE -1 LAB: ANALYTICAL METHODS IN CHEMISTRY [Honours]

60 Lectures

I. Separation Techniques (Any Two)

1. Chromatography:

(a) Separation of mixtures

(i) Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}.

(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.

(b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC.

II. Solvent Extractions: (Any One)

(i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+}-DMG complex in chloroform, and determine its concentration by spectrophotometry.

(ii) Solvent extraction of zisconium with amberliti LA-1, separation from a mixture of irons and gallium.

3. Determine the pH of the given aerated drinks /fruit juices/ shampoos and soaps.

4. Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt

(iii) Estimation of calcium, magnesium, phosphate, nitrate

5. Ion exchange: (Any One)

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.

(ii) Separation of metal ions from their binary mixture.

(iii) Separation of amino acids from organic acids by ion exchange chromatography

III. Spectrophotometry: (Any Three)

(i) Determination of pKa values of indicator using spectrophotometry.

(ii) Structural characterization of compounds by infrared spectroscopy.

(iii) Determination of dissolved oxygen in water.

(iv) Determination of chemical oxygen demand (COD).

(v) Determination of Biological oxygen demand (BOD).

(vi) Determination of the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

Reference Books:

- Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.
- Willard, H.H. *et al.*: *Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
- Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
- Harris, D.C. *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.
- Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age International Publisher, 2009.
- Skoog, D.A. Holler F.J. and Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Edition.
- Mikes, O. & Chalmes, R.A. *Laboratory Handbook of Chromatographic & Allied Methods*, Elles Harwood Ltd. London.
- Ditts, R.V. *Analytical Chemistry: Methods of separation.*

DISCIPLINE SPECIFIC ELECTIVE for Honours and Program Course

DSE - 2 [Honours]

 DSE - 1 (DSC) [Program]

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Silicate Industries

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses).Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.   **(18 Lectures)**

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.   **(8 Lectures)**

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying an anodizing.   **(12 Lectures)**

Batteries:

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.   **(6 Lectures)**

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.   **(10 Lectures)**

Catalysis:

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts.

Phase transfer catalysts, application of zeolites as catalysts.   **(6 Lectures)**

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics,* Wiley Publishers, New Delhi.
- A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- P. C. Jain, M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.

PRACTICALS: DSE-II [Honours]

DSE-I (DSC) [Program] LAB:

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

60 Lectures   (Any Five)

1. Determination of free acidity in ammonium sulphate fertilizer.

2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.

3. Estimation of phosphoric acid in superphosphate fertilizer.

4. Electroless metallic coatings on ceramic and plastic material.

5. Determination of composition of dolomite (by complexometric titration).

6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.

7. Analysis of Cement.

8. Preparation of pigment (zinc oxide).

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.

- R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.

- D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics,* Wiley Publishers, New Delhi.

- A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.

- P. C. Jain, M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.

- R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.

- Sharma, B.K. & Gaur, H. *Industrial Chemistry,* Goel Publishing House, Meerut (1996).

SKILL ENHANCEMENT COURSE [for Program Course]

SEC - 3 [DSC]

PESTICIDE CHEMISTRY

CREDIT – 2

Number of Lectures – 30

THEORY

1. General introduction to pesticides (natural and synthetic)

2. Benefits and adverse effects of pesticides

3. Changing concepts of pesticides

4. Structure activity relationship

5. Synthesis and technical manufacture and uses of representative pesticides in the following classes:

(a) Organochlorines (DDT, Gammaxene)

(b) Organophosphates (Malathion, Parathion)

(c) Carbamates (Carbofuran and carbaryl)

(d) Quinones (Chloranil)

(e) Anilides (Alachlor and Butachlor)

PRACTICAL   (Any ONE)

 1. To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.

 2. Preparation of simple organophosphates, phosphonates and thiophosphates

3. Any other practical deemed relevant.

Reference Book:

- Cremlyn, R. Pesticides. Preparation and Modes of Action, John Wiley & Sons, New York, 1978.

GE: GENERIC ELECTIVE and DSC: DISCIPLINE SPECIFIC ELECTIVE

SEMESTER-1

GE -1 and DSC -1 :

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Section A: Inorganic Chemistry (30 Periods)

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, Shapes of s, p and d atomic orbitals.

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.   **(14 Lectures)**

Chemical Bonding and Molecular Structure:

Ionic Bonding:

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

Covalent Bonding:

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

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+ . Comparison of VB and MO approaches . **(16 Lectures)**

Section B: Organic Chemistry (30 Periods)

Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pKa values. Aromaticity: Benzenoids and Hückel's rule. **(8 Lectures)**

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). **(10 Lectures)**

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation)

and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. **(12 Lectures)**

Reference Books:

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991
- Cotton, F.A., Wilkinson, G & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- Graham Solomon, T.W., Fryhle, C.B & Dnyder, S.A. Organic Chemistry, John Wiley & Sons (2014). McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

PRACTICAL: GE-I and DSC-I

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

60 Lectures

Section A: Inorganic Chemistry - Volumetric Analysis (ANY THREE)

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

2. Estimation of oxalic acid by titrating it with $KMnO_4$.

3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.

4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.

5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Section B: Organic Chemistry (ANY THREE)

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

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

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

Reference Books:

- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J & Smith, P.W.G.,
- Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- Mann, F.G & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

GE-3 and DSC-3

SOLUTIONS, PHASE EQUILIBRIA, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II
(Credits: Theory-04, Practicals-02)
Theory:
60 Lectures
Section A: Physical Chemistry (30 Lectures)
Solutions

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law, non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Nernst distribution law and its applications.   **(8 Lectures)**

Phase Equilibria

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule. Derivation of Clausius-Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component system (water).   **(6 Lectures)**

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt, conductometric titrations (only acid base).   **(8 Lectures)**

Electrochemistry

Reversible and irreversible cells. Concept of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Calculation of thermodynamic properties (of a reversible cell): ΔG, ΔH and ΔS and equilibrium constant from EMF data. Potentiometric titrations-qualitative treatment (acid-base and oxidation-reduction only).
                                                        (8 Lectures)

Section B: Organic Chemistry (30 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Carboxylic acids and their derivatives:

Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell - Vohlard - Zelinsky Reaction.

Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion. Reactions: Reformatsky Reaction, Perkin condensation. **(6 Lectures)**

Amines and Diazonium Salts

Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2

Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol. **(6 Lectures)**

Amino Acids, Peptides and Proteins

Preparation of Amino Acids: Strecker synthesis, Gabriel's phthalimide synthesis. Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

Determination of Primary structure of Peptides by degradation: Edmann degradation, (N terminal and C–terminal) (thiohydantoin and with carboxypeptidase enzyme). **(10 Lectures)**

Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of absolute configuration of Glucose. Structure of disacharrides (sucrose) and polysaccharides' (starch and cellulose) excluding their structure elucidation. **(8 Lectures)**

PRACTICAL: GE -3 and DSC-3 LAB

SOLUTIONS, PHASE EQUILIBRIA, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL ORGANIC CHEMISTRY

Section A: Physical Chemistry

Conductance

Perform the following conductometric titrations (Including theoretical background):

(a) Strong acid vs. strong base

(b) Weak acid vs. strong base

Potentiometry (ANY ONE)

1. Perform the following potentiometric titrations (Including theoretical background):

(i) Strong acid vs. strong base

(ii) Weak acid vs. strong base

(iii) Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional

Groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines)

and preparation of one derivative.

(Including the study of chemical reactions involved in the detection of functional groups and preparation of their derivatives).

CBCS SYLLABUS (TRUNCATED FOR 2021)
B.A. HONOURS/PROGRAMME
POLITICAL SCIENCE
UNIVERSITY OF NORTH BENGAL

B.A. HONOURS

1st SEMESTER

CC- 101
Understanding Political Science

1. **Politics and Political Science**
   a. Meaning of Politics, Nature and Scope of Political Science
   b. Political Science: Science or an Art, Behaviouralism and Post Behaviouralism
   c. Relationship of Political Science with History, Economics and Sociology
2. **STATE**
   a. Elements of State
   b. Difference between State and Government, State and Association.
   c. Sovereignty: Features, Kinds, Monistic and Pluralistic Theory,

3. **THEORIES OF ORIGIN OF STATE**
   a. Social Contract Theory
   b. Historical Theory
   c. Marxist Theory
4. **FUNCTIONS OF THE STATE**
   a. Liberal Theory of Functions of State
   b. Welfare Theory of Functions of State
5. **Rights, Liberty and Equality and Justice: Interrelationship**

CC- 102

PERSPECTIVES ON PUBLIC ADMINISTRATION

1. **Public Administration as a Discipline**
   a. Meaning, Dimensions and Significance of the Discipline
   b. Public and Private Administration
   c. Evolution of Public Administration
2. **Theoritical Perspectives**
   Classical Theories
   a. Scientific Management (F.W.Taylor)
   b. Ideal Type Bureaucracy(Maw Weber)

   Neo-Classical Theories

   a. Human Relations Theory(Elton Mayo)
   b. Rational Decision Making (Herbert Simon)

   Contemporary Theories

   a. Ecological Approach(Fred Riggs)
3. **Public Policy**
   a. Formulation, Implementation and Evaluation
4. **Major Approaches in Public Administration**
   a. New Public Administration
   b. New Public Management
   c. Good Governance

READING GANDHI

GE-101

1. Gandhi in its own words: A close reading to Hind Swaraj.
2. Gandhi and modern India
   a. Communal Unity
   b. Untouchability
3. Gandhi's Legacy
   a. Tolerance: Anti-Racism Movements (Anti-Apartheid and Martin Luther King)
   b. Gandhigiri: Perceptions in Popular Culture

FEMINISM

GE- 101

1. Approaches to understanding Patriarchy
   a. Understanding Patriarchy and Feminism
   b. Liberal, Socialist, Marxist, radical Feminism, New Feminist Schools/Traditions
2. History of Feminism
   a. Origins of Feminism in the West: France, Britain and USA
3. The Indian Experience
   a. Traditional Historiography and Feminist critiques. Social reforms movement and position of women in India. History of women struggle in India.
   b. Understanding Women's Work and Labour- Sexual division of Labour, Productive and Reproductive Labour, Visible work- Unpaid(reproductive and care), Underpaid and paid work- methods of computing women's work, Female headed Households

B.A. Programme

1st SEMESTER

DSC- 101
Understanding Political Science

1 **Politics and Political Science**
   a. Meaning of Politics, Nature and Scope of Political Science
   b. Relationship of Political Science with History, Economics and Sociology
2. **STATE**
   a. Elements of State
   b. Difference between State and Government, State and Association.
   c. Sovereignty: Features, Kinds, Monistic and Pluralistic Theory

3. THEORIES OF ORIGIN OF STATE
   a. Social Contract Theory
   b. Marxist Theory

4. FUNCTIONS OF THE STATE
   a. Liberal Theory of Functions of State
   b. Welfare Theory of Functions of State

5. Rights, Liberty and Equality and Justice: Interrelationship

B.A. HONOURS

<u>SEMESTER- I</u>

Course Code	Course Title	Course Topic
CC-101	Sanskrit Grammar and Composition	1)लघुसिद्धान्तकौमुदी i) माहेश्वरसूत्राणि, संज्ञा, अच्सन्धिः ii) सुबन्तप्रकरणम् (राम, रमा, ज्ञान) iii) तिङ्न्तप्रकरणम् (भू एध्) 2) वाच्यपरिवर्तनम् 3) अनुवादः
CC-102	Classical Sanskrit Literature (Poetry)	1) रघुवंशम्, सर्गः–1(Verse 1-60) 2) किरातार्जुनीयम्, सर्गः-1
AECC-1	Environmental Studies	
GE SANS-1	(For other than Sanskrit Hons Students) Basic Sanskrit Grammar, History of Sanskrit Literature, Drama	1) अच्सन्धिः, कारकविभक्तिः(Up to चतुर्थी विभक्ति), शब्दरूपाणि (अजन्तशब्दाः, गुणिन्-भवत्-वणिज्-सुहृद्-शब्दाः), धातुरूपाणि (भ्वादिः) 2) संस्कृतसाहित्येतिहासः (वैदिकसाहित्यम्) 3) अभिज्ञानशाकुन्तलम् (Act- 1, 2, 4)

B.A PROGRAMME

SEMESTER –I

Course Code	Course Title	Course Topic
DSC-101	Sanskrit Drama and general grammar	1) अभिज्ञानशकुन्तलम् (Act 1, 2, 4 only) 2) अच्सन्धिः, कारकविभक्तिः (Up to चतुर्थी विभक्ति), अव्ययीभावसमासः, कृत्प्रत्ययः
DSC-2 (Paper-1)	(From Other Subjects)	
AECC-1	Environmental studies	
LCC-1 (Paper -1)	Sanskrit Grammar and Comprehension Test	शब्दरूपाणि (अजन्तशब्दाः, गुणिन्-भवत्-वणिज्-सुहृद्-शब्दाः), धातुरूपाणि (भ्वादिः), कारकविभक्तिः(Up to चतुर्थी विभक्ति), अव्ययीभावसमासः,वाच्यपरिवर्तनम्, कृत्प्रत्ययः, बोधपरीक्षणम्

TRUNCATED SYLLABUS,
B.A (HONS), HISTORY
SEMESTER - I

PAPER I: HISTORY OF INDIA- I

I.   Reconstructing Ancient Indian History.[a] Sources and tools of historical reconstruction. Pre-historic hunter-gatherers.

II.   Early Stone Age cultures [a] Palaeolithic cultures

                                    [b] Mesolithic cultures

                                    [c] Neolithic cultures

                                    [d] Chalcolithic cultures: subsistence, and patterns of exchange.

III.   The Harappan civilization. Origins; settlement patterns and town planning, decline of Harappan civilization

IV.   The Vedic Age: [a] Aryan Debate

                                    [b] Economy, Society and Polity in the Vedic Age

   V. Cultures in transition:Settlement patterns, technological and economic developments; social stratification; political relations; religion and philosophy

[a] Tamilakam (circa 300 BCE to circa 300)

 ESSENTIAL READINGS:

R.S. Sharma, India's Ancient Past, New Delhi, OUP, 2007.

R. S. Sharma, Material Culture and Social Formations in Ancient India, 1983.

R.S. Sharma, Looking for the Aryas, Delhi, Orient Longman Publishers, 1995.

D. P. Agrawal, The Archaeology of India, 1985.

 Bridget & F. Raymond Allchin, The Rise of Civilization in India and Pakistan, 1983.

A. L. Basham, The Wonder that Was India, 1971.

D. K. Chakrabarti, The Archaeology of Ancient Indian Cities, 1997, Paperback.

H. C. Raychaudhuri, Political History of Ancient India, Rev. ed. with Commentary by B. N. Mukherjee, 1996.

K. A. N. Sastri, ed., History of South India, OUP, 1966.

Upinder Singh, A History of Ancient and Early Medieval India, 2008.

Romila Thapar, Early India from the Beginnings to 1300, London, 2002.

Irfan Habib,A People's History-Vol. -1,PreHistory,2000.

Irfan Habib Vol.-2, Indus Civilization: Including Other Copper Age Cultures and the History of Language Change till 155 B.C., 2002.

PAPER II: SOCIAL FORMATIONS AND CULTURAL PATTERNS OF THE ANCIENT WORLD

I.   The Evolution of humankind; Palaeolithic and Mesolithic cultures

II.   Food production: beginnings of agriculture and animal husbandry.

III.   Bronze Age Civilizations, with reference to *any one* of the following: i) Egypt (Old Kingdom); ii) Mesopotamia (up to the Akkadian Empire); iii) China (Shang); iv) Eastern Mediterranean (Minoan) with special emphasis upon economy, state structure, religion.

IV.   Slave society in ancient Greece: causes, features and impact on Greek economy and polity.

V.   Polis in ancient Greece: Athenian democracy and Spartan oligarchy

ESSENTIAL READINGS:

Burns and Ralph. World Civilizations.

Gordon Childe, What Happened in History.

G. Clark, World Prehistory: A New Perspective.

B. Fagan, People of the Earth.

Amar Farooqui, Early Social Formations.

M. I. Finley, The Ancient Economy.

Jacquetta Hawkes, First Civilizations.

G. Roux, Ancient Iraq.

Bai Shaoyi, An Outline History of China.

H. W. F. Saggs, The Greatness that was Babylon.

B. Trigger, Ancient Egypt: A Social History. UNESCO Series: History of Mankind, Vols. I - III./ or New ed. History of Humanity.

R. J. Wenke, Patterns in Prehistory.

John Thorley, Athenian Democracy

Thomas Martin, Ancient Greece.

G. E. M. Ste Croix, Class Struggles in the Ancient Greek World.

TRUNCATED SYLLABUS
B.A (PROGRAM), HISTORY

PAPER-1: HISTORY OF INDIA FROM EARLIEST TIMES UP TO 300 CE. [DSC]

1. Sources & Interpretation
2. Harappan Civilization ; Origin, dominant features &decline,.
3. The Vedic Period: Polity, Society, Economy and Religion,
4. Territorial States and the rise of Magadha, Conditions for the rise of Mahajanpadas and the Causes of Magadha's success.
5. Rise of Heterodoxy: Jainism and Buddhism: Origin, Doctrines and Spread
6. Mauryan Age: The Emergence and Growth of Mauryan Empire; State, Economy, Ashoka's Dhamma,
7. The Sangam Age: Sangam Literature and its features.
8. The age of Shakas: Parthians & Kushanas, Aspects of Polity and Society,

REFERENCES:

D.P. Agrawal, D.P., The Archaeology of India.

A.L. Basham, The Wonder That was India.

Chakrabarti, D.K., Archaeology of Ancient Indian Cities.

Jaiswal, Suvira Caste: Origin, Function and Dimensions.

Subramanian, N. Sangam Polity.

Thapar, Romila, History of Early India.

Allchin, F.R. and B., Origins of a Civilization: The Prehistory and Early Archaeology of South Asia.

Jha, D.N., Ancient India in Historical Outline (1998 edn.).

Kosambi, D.D., Culture and Civilization of Ancient India.

Sastri, K.A.N. A History of South India.

Sharma, R.S.,India's Ancient Past.

Thapar Romila, Ashoka and the Decline of the Mauryas (1997 edn.).

G.E.: HISTORY OF INDIA I
(FROM EARLIEST TIMES UPTO 1193CE)
SYLLABUS FOR FIRST SEMESTER STUDENTS B.A.(P)

I. Sources & Interpretation

II. Harappan Civilization: Dominant features &decline.

III. The Vedic Period: Polity, Society and Economy.

IV. Sixth Century, Conditions for the rise of Mahajanpadas, Jainism and Buddhism: Origin and Doctrines.

V. Emergence and Growth of Mauryan Empire, Administration and Ashoka's Dhamma.

VI. The Rise & Growth of the Guptas: Society, Economy and Polity

ESSENTIAL READINGS:

Agrawal, D.P. The Archaeology of India
Basham, A.L. The Wonder That was India.

Chakrabarti, D.K. Archaeology of Ancient Indian Cities

Jaiswal, Suvira Caste: Origin, Function and Dimensions.

Subramanian, N. Sangam Polity.

Thapar, Romila History of Early India.

Jha, D.N. Ancient India in Historical Outline (1998 edn.)

Kosambi, D.D. Culture and Civilization of Ancient India.

Ray, H.P. Monastery and Guild India in Historical Outline.

Sastri, K.A.N. A History of South India.

Sharma, R.S. India's Ancient Past.

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Note : The syllabus for the 3rd and 5th Semesters for the current session will not be truncated. The full syllabus will be the part of the academic course.

TRUNCATED SYLLABUS OF B.A. HONOURS IN EDUCATION
SEMESTER-I

SEMESTER-I				
Course Code	Course Title	Course wise Class (L+T+P)	Credit	Marks
EDU-H-DSC-T-1	**Philosophical foundation of Education-1**	Core (75L+15T)	6(5L+1T)	75
EDU-H-DSC-T-2	**Sociological foundation of Education**	Core (75L+15T)	6(5L+1T)	75
EDU-H-GE-T-1 (any one to be chosen out of two)	A. Any Discipline other than Education B. Any Discipline other than Education	Generic Elective (75L+15T)	6(5L+1T)	75
AECC-1	Environmental Science (ENVS)	Ability enhancement compulsory (30L)	2 (2L+0T)	100
Total	4 courses	Total	20	325

B.A. Education (Honours)
SEMESTER-I
EDU-H-DSC-T-1: Philosophical Foundation of Education
Core Course; Credit-6 (75 Lectures); Full Marks-75

Course Objectives:

After completion of the course the learners will be able to:

- Discuss the meaning, nature, scope and aims of education.
- Discuss the meaning and scope of educational philosophy.
- Explain the factors of education and their relationships.
- Describe the knowledge, reality and value of different Indian schools of philosophy namely Sankhya, Nyaya, Yoga and Buddhism, Charvaka, Jain.
- Discuss the educational view of different Western schools of philosophy namely Idealism, Naturalism, Pragmatism, Marxism.
- Explain about the Philosophy of Indian Great Educators like - Swami Vivekananda, Rabindranath Tagore and Mahatma Gandhi
- Explain about the Philosophy of Western Great Educators like - Rousseau, Pestalozzi, Froebel and Montessori

Unit-I: Concept, Scope, Aim of Education & Educational Philosophy:

a) Meaning, nature and scope of Education.
b) Aims of Education: Individualistic and socialistic.
c) Report of Delor's commission (UNESCO, 1996)
d) Meaning and scope of educational Philosophy; Relation between education and philosophy.

Unit-II: Factors of Education:

a) Child: Meaning and characteristics of child centric education system.
b) Teacher: Qualities and duties of a good teacher.
c) Curriculum: Meaning and Types. Co-curricular activities.

d) School: Functions.

Unit-III: Schools of Philosophy:

a) Indian schools of Philosophy: Vedic - Sankhya, Yoga, Non-Vedic: Buddhism, Jain ; in terms of knowledge, reality and value.

b) Western School of Philosophy: Idealism, Naturalism, Pragmatism: special reference to principles, aims of education, curriculum, teaching method, teacher, discipline.

Unit-IV: Great Educators and their educational philosophy:

a) Indian: Swami Vivekananda, Rabindranath Tagore, And Western: Rousseau, Froebel, Montessori.

Suggested Reading:

1. J. C. Aggarwal- Theory and Principles of Education
2. J. C. Aggarwal - Philosophical and Sociological Bases of Education
3. S. P. Chaube& A. Chaube – Foundations of Education
4. K. K. Shrivastava- Philosophical Foundations of Education
5. S. S. Ravi – A Comprehensive Study of Education
6. M. Sharma – Educational Practices of Classical Indian Philosophies
7. S. S. Chandra & R. K. Sharma- Philosophy of Education
8. M. K. Goswami- Educational Thinkers: Oriental and Occidental, Thoughts and Essays.
9. B.R. Purkait – Great Educator.
10. Dash, B.N. (1994) Foundation of Educational Thought and Practice, New Delhi: Kalyani Publishers
11. Gupta, S. (2009) Education in Emerging India, Delhi: Shipra Publications
12. Hiriyanna, M. Outlines of Indian Philosophy, Delhi: Motilal Banarsidass Publishers Private Limited.
13. Nayak, B. K. (2006) Foundation of Education, Cuttack, Kitab Mahal
14. Pathak, R. P. (2012). Philosophical and sociological principles of education. Delhi: Pearson.
15. Safaya, R.N. & Shaida, B.D. (2010), Modern theory and principles of education. New Delhi: Dhanpati Publising Company Pvt. Ltd.
16. Sharma, S. N. (1995). Philosophical and Sociological Foundations of Education, New Delhi: Kanishka Publishers Distributors.
17. Taneja, V.R. (2000). Educational thought and practice, New Delhi: Sterling Publishers Pvt. Limited

Bengali Reading:

18. S. Roy- Sikshatatto o Siksha Darshan
19. Archana Banerjee - Shikshatotto o Shikshaniti
20. Dibendu Bhattacharjee – Siksha o Darshan
21. Bibhuranjan Guha – Shikshai pathikrit
22. Gour Das Haldar o Prasanto Sharma - Shikshatotto o Shikshaniti
23. Jagadindra Mandal- Shiksha Darshan o Shiksha Biggyan
24. Babi Dutta, Debika Guha - Shiksha Darshan o Darsonikder Abodan

25. p¤¤n£m l¡u - ¢n¤j¡ašÄ J ¢n¤j¡cnÑe

26. AQÑe¡ h-¾c¡f¡dÉ¡u - ¢nr¡cnÑe J ¢nr¡e£¢a
27. ¢c-hɾc¥ iVÊ¡Q¡kÑÉ - ¢nr¡ J cnÑe
28. ¢hi¥l"e ...q - ¢nr¡uf¢bL«v
29. Al¦e -O¡o- ¢nr¡ ¢h'¡-el cnÑe J j§mašÄ
30. -N±lc¡p q¡mc¡l J fËn¡¿¹ nÑji- ¢nr¡ašÄ J ¢nr¡e£¢a
31. SN¢c¾cÊ jäm - ¢nr¡cnÑe J ¢nr¡¢h'¡e
32. ¢hi¥l"e ...q-¢nr¡u f¢bL«v
33. -hh£ cš, -c¢hL¡ ...q- ¢nr¡ cnÑe J c¡nÑ¢¢eL-cl Ahc¡e)

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B.A. Education (Honours)
SEMESTER-I
EDU-H- DSC -T-2: Sociological Foundation of Education
Core Course; Credit-6. (75 Lectures), Full Marks-75

Course Objectives:
After completion of the course the learners will be able to-
- Discuss the meaning, nature and scope of Educational sociology and Relation between Education and Sociology.
- Describe the Social factor and their relation to Education.
- Define social groups, socialization and Social Institution and Agencies of Education.
- Explain the Social change and its impact on Education.

Unit-I: Educational Sociology
    a) Meaning, nature and scope of Educational sociology.
    b) Relation between education and sociology.
    c) Concept of Educational sociology and sociology of education.

Unit-II: Social factors, issues and Education
    a) Culture: Concept, role of education in culture, cultural lag.
    b) Meaning of Human Resource Development and its significance in the present society.
    c) Social issues: Education of socially and economically backward classes (SC, ST and OBC).
    d) Education and State- Concept of Democracy, Interrelationship of state and education, Role of education in Nation Building,

Unit-III: Social groups and Education
    a) Social groups- meaning and types (Primary, Secondary and Tertiary)
    b) Socialization: Meaning, process and factors of socialization, role of the family and school.

Unit-IV: Social change and Education
    a) Social change: definition, characteristics, factors, constraints and education as an instrument of social change.
    b) Social change in India (Privatization and Globalization)
    c) Education and social stratification: Definition and characteristics
    d) Education and Social Mobility

Suggested Reading:

1. Y. K. Sharma – Sociological Philosophy of Education
2. Ravi, S. S. (2015)– A Comprehensive Study of Education
3. Aggarwal, J. C. (2012)- Philosophical and Sociological Bases of Education
4. Aggrawal, J.C.(2013). Theory and principle of education. New Delh: Vikash Publishing House Pvt Ltd.
5. Aggarwal, J. C. (2010). Psychological Philosophical and Sociological Foundations of Education (1st Edition). Shipra Publication, New Delhi.
6. Bhat, Manzoor Ahmad (2014). Philosophical and Sociological Foundations of Education. APH.
7. Chand, Jagdish (2010). Sociological Foundations of Education. Shipra Publication, New Delhi.
8. Dash, B.N. (2011) Foundation of education, New Delhi; Kalyani Publishers.
9. Mohanty, J. (1982) Indian Education in Emergency Society, New Delhi: Sterling Publishers.
10. Mathur, S. S. (2000). A sociological Approach to Indian Education. Agra : Vinod Pustak Mandir.
11. Pathak, R. P. (2009). Philosophical and Sociological Foundations of Education. Kanishka Publishers, New Delhi.
12. Safaya, R.N. & Shaida, B.D. (2010), Modern theory and principles of education. New Delhi: Dhanpati Publishing Company Pvt. Ltd.
13. Sharma, Anita (2011). Philosophical and Sociological Foundation of Education. New Delhi: Global Publication.
14. Sharma, S. N. (1995). Philosophical and Sociological Foundations of Education. New Delhi: Kanishka Publishers Distributors.
15. Sharma, Sita Ram (2003). Sociological Foundations of Education. New Delhi: Shri Sai Printographers Pub. & Print.

Bengali Reading:

16. S. Roy- Sikshatatto o Siksha Darshan
17. Archana Banerjee - Shikshatotto o Shikshaniti
18. Dibendu Bhattacharjee – Siksha o Samajtatto
19. Sonali Chakraborty – Shikshar Samaj Baigganikvitti
20. Bishnupada Nanda – Shikshashroyee Samajtatto
21. Anadi Kumar Mahapatra – Samajtatto
22. Manjusha Tarafder - Shikshashroyee Samajbiggyan
23. Shyama Prasad Chattaraj – Shikshamukhi biggyan
24. Parimal Bhushan - Samajtatto

25. (p¤¤n£ml¡u - ¢nr¡ašÄ J ¢nr¡cnÑe
26. AQÑe¡ h-¾c¡f¡dÉ¡u - ¢nr¡cnÑe J ¢nr¡e£¢a
27. ¢c-hÉ¾c¥ iVÊ¡Q¡kÑÉ - ¢nr¡ J pj¡SašÄ
28. -p¡e¡m£ Qœ²haÑÑ£-¢nr¡lpj¡S °h‘¡¢eL ¢i¢š
29. ¢ho¤fc e¾c - ¢nr¡Ëu£ pj¡SašÄ
30. Ae¡¢c L¥j¡l jq¡f¡œ - ¢hou pj¡SašÄ
31. j"¥o¡ alg¢l - ¢nr¡Ëu£ pj¡S ¢h‘¡e
32. nÉ¡j¡fËp¡c Q–l¡S - ¢nr¡j¤M£ pj¡S¢h‘¡e
33. f¢ljm i¨oe - pj¡SašÄ)

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SEMESTER – 1

(Revised Truncated Syllabus and Question pattern for Hons Course in English under University of North Bengal for the session 2021-2022)

HONOURS: CORE COURSES:

Core Course I: English Language: Overview& Usage; Literary Types

- Three questions to be answered from five asked serially from Unit 1 and Unit 3 combined. [10x3=30]
- Two short questions to be answered from five asked serially from Unit 1. [5x2=10]

Unit I:

Topics:
1. General Features of English
2. Influence of Christianity
3. Scandinavian Elements
4. French Elements
5. Classical (Latin and Greek) Elements

Unit II: Rhetoric and Prosody [12+8=20]

Rhetoric: Simile, Metaphor, Metonymy, Synecdoche, Epigram, Personification, Hyperbole, Irony, Alliteration, Chiasmus

Prosody: Iambus, Trochee and their variants

Unit III: Literary Types:

Tragedy: i) Classical concept of Tragedy, ii) Shakespearean Tragedy
Comedy: i) Comedy of Humours, ii) Comedy of Manners
The Lyric & its variants: Sonnet

Suggested Topics and Background Prose Readings for Class Presentation:

- Language and English Society
- Usage of English
- Foreign Influence on English Language

Reading:

1. Otto Jespersen, *Growth and Structure of the English Language* (Charleston: Nabu Press, 2010)
2. Albert C. Baugh, *A History of English Language* (London: Routledge, 2002)
3. Randolph Quirk, *English in Use* (London: Longman, 1990)
4. David Crystal, *The English Language: A Guided Tour of the Language* (London: Penguin, 2002)
5. Jonathan Culpeper,*History of English* (London: Routledge, 2005)
6. J.A.Cuddon& M.A.R. Habib,*The Penguin Dictionary of Literary Terms and Literary Theory*: Fifth Edition (London: Penguin, 2015)
7. Bose & Sterling,*Elements of English Rhetoric and Prosody* (Calcutta: Chuckerverty, Chatterjee& Co. Ltd, 1960)

Core Course2: European Classical Literature

- Four questions to be answered from six questions asked serially and covering all the three texts equally.   [10x4=40]
- Four short questions to be answered from nine questions asked serially and covering all the three texts equally.   [5x4=20]

1. Sophocles: *Oedipus the King*
2. Plautus: *Pot of Gold*
3. Aeschylus: *Agamemnon*

Suggested Topics and Background Prose Readings for Class Presentation:

- The Epic
- Comedy & Tragedy in Classical Drama
- The Athenian City State
- Catharsis and Mimesis
- Literary Cultures in Augustan Rome

Readings:

1. Aristotle, *Poetics*, translated with an introduction and notes by Malcolm Heath, (London: Penguin, 1996) chaps. 6–17, 23, 24, and26.
2. Plato, *The Republic*, Book X, tr. Desmond Lee (London: Penguin,2007).
3. Horace, *Ars Poetica*, tr. H. Rushton Fairclough, Horace: *Satires, Epistles and Ars Poetica*(Cambridge Mass.: Harvard University Press, 2005) pp.451–73.

SUBJECT: PHILOSOPHY

**ADDITIONAL TOPIC(S) TO BE INCLUDED WITH EXISTING
TRUNCATED SYLLABUS FOR FIRST SEMESTER**

CORE COURSE : I

UNIT IV: BUDDHISM
NON-SOUL THEORY

UNIT VI: ADVAITA VEDANTA OF SAMKARA
NATURE OF BRAHMAN

CORE COURSE : II

UNIT I: BASIC LOGICAL CONCEPTS
DEDUCTION AND INDUCTION

SEMESTER-1

Subject Course No.	Syllabus Code	Alpha Numeric Code	Course	Credit
MATH 15 AE-I	AE-I		Eng. Com./Env. Sc.	2
MATH 11 HCC-I	HCC-I	MATHCC1	Cal, Geo & D.E.	5 + 1
MATH 11 HCC-II	HCC-II	MATHCC2	Algebra	5 + 1
MATH 13 GE-I	GE-I	MATHGE1 (GE1 - GE5)	Other Department	5 + 1

MATH 11 HCC-I (MATHCC1): Calculus, Geometry and Differential Equation

6 Credits

Unit 1

Higher order derivatives, Leibnitz rule and its applications to the problems of the type $e^{ax+b} \sin x$, $e^{ax+b} \cos x$, $(ax + b)^n \sin x$, $(ax + b)^n \cos x$, convexity, concavity and inflection points, envelopes, asymptotes, pedal equation, L' Hospital's rule and its applications.

Unit 2

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx$ dx, $\int \cos nx$ dx , $\int \tan nx$ dx, $\int (log x)^n$dx, $\int sin^n x \, sin^m x$ dx, parameterizing a curve, arc length of a curve (Cartesian & parametric forms), area between two curves, area and volume of revolution.

Unit 3

Second degree equations, classification of conics using the discriminant, polar equations of conics.

Spheres, Cylindrical surfaces, Conicoids (paraboloids, ellipsoids, hyperboloids), plane sections of conicoids, generating lines, classification of quadrics.

Unit 4

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

Reference Books

- G. B. Thomas and R. L. Finney, Calculus, 9th Ed., Pearson education, Delhi, 2005.
- H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
- R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
- S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
- Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
- G. F. Simmons, Differential Equations, Tata Mcgraw Hill.
- T. Apostol, Calculus, Volumes I and II.
- S. Goldberg, Calculus and mathematical analysis.

MATH 11 HCC-II (MATHCC2): Algebra   6 Credits

Unit 1

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

Relation between roots and coefficients, transformation of equations, Descartes rule of signs, cubic and biquadratic equations.

Inequality, $AM \geq GM \geq HM$, Cauchy-Schwartz inequality and related problems.

Unit 2

Functions, Invertible functions, one to one correspondence, cardinality of a set, Well-ordering property of positive integers, divisibility and Euclidean algorithms. Congruence relation between integers. Principles of mathematical induction, statement of Fundamental Theorem of Arithmetic and related problems.

Unit 3

Matrix, inverse of a matrix, characterizations of invertible matrices, row and column reduction, echelon forms, normal form, rank of a matrix, finding a non-singular matrix P such that $P^t A P$ is the normal form of a real square matrix A under congruence.

Eigen values, eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

Systems of linear equations, matrix representation $AX = B$ of a system of linear equations and its solution using elementary row operations.

Reference Books

- S. H. Friedberg, A. J. Insel and L. E. Spence, Linear Algebra, Pearson, Indian edition, 2019.
- S. K. Mapa, Higher Algebra: Abstract and Linear, Levant Books, Kolkata, India, Reprint, 2016.
- S. K. Mapa, Higher Algebra: Classical, Levant Books, Kolkata, India, Reprint, 2016.
- K. B. Dutta, Matrix and linear algebra, 3rd Ed., PHI Pvt. Ltd., India, 2017.
- K. Hoffman and R. Kunze, Linear algebra, Pearson, Indian edition, 2018.
- W. S. Burnstine and A. W. Panton, Theory of equations.
- D. C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

For Generic Elective (GE) Course taken by students of Honours other than Mathematics Honours

MATH 13 GE-I (MATHGE1 (GE1)): Calculus, Geometry and D.E.

6 Credits

Unit 1

Higher order derivatives, Leibnitz rule and its applications to the problems of the type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, convexity, concavity and inflection points, envelopes, asymptotes, L' Hospital's rule.

Derivations and illustrations of reduction formulae of the type $\int sin^m x \, cos^n x \, dx$, $\int x^m (logx)^n dx$, $\int sin^n x \, sin^m x \, dx$, parameterizing a curve, arc length of a curve, area and volume of revolution with respect to coordinate axes only.

Unit 2

Properties of conics, classification of conics using the discriminant (without reduction process), polar equations of conics, Spheres.

Unit 3

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

Reference Books

- ➢ G. B. Thomas and R. L. Finney, Calculus, 9th Ed., Pearson education, Delhi, 2005.
- ➢ R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
- ➢ S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
- ➢ Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
- ➢ G. F. Simmons, Differential Equations, Tata Mcgraw Hill.
- ➢ T. Apostol, Calculus, Volumes I and II.
- ➢ S. Goldberg, Calculus and mathematical analysis.

MATH 13 GE-I (MATHGE1 (GE2)): Algebra

6 Credits

Unit 1

Polar form of complex numbers, nth roots of unity, De Moivre's theorem (statement only) and its applications.

Theory of equations: Relation between roots and coefficients, transformation of equation, Descartes rule of signs, cubic and biquadratic equation.

Unit 2

Eigen values, eigen vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

Systems of linear equations, matrix representation $AX = B$ of a system of linear equations and its solution using elementary row operations.

Reference Books

- ➢ Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006
- ➢ Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.

- David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
- K. B. Dutta, Matrix and linear algebra.
- K. Hoffman, R. Kunze, Linear algebra.
- W. S. Burnstine and A. W. Panton, Theory of equations.

MATH 13 GE-I (MATHGE1 (GE3)): Differential Equation and Vector Calculus

6 Credits

Unit 1

Lipschitz condition and Picard's Theorem (Statement only), General solution of homogeneous equation of second order, Wronskian: its properties, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, Method of undetermined coefficients, Method of variation of parameters.

Unit 2

Systems of linear differential equations, Types of linear systems, Differential operators, Homogeneous linear systems with constant coefficients (Two Equations in two unknown functions).

Unit 3

Introduction to vector functions, Operations with vector-valued functions, Limits and continuity of vector functions and related simple problems.

Reference Books

- Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
- C. H. Edwards and D. E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.
- S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
- Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
- Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
- Boyce and Diprima, Elementary Differential equations and boundary Value problems, Wiley.
- G. F. Simmons, Differential Equations, Tata McGraw Hill.
- Marsden, J., and Tromba, Vector Calculus, McGraw Hill.
- Maity, K. C. and Ghosh, R. K. Vector Analysis, New Central Book Agency (P) Ltd. Kolkata.
- M. R. Speigel, Schaum's outline of Vector Analysis.

MATH 13 GE-I (MATHGE1 (GE4)): Group Theory   6 Credits

Unit 1

Definition and example of groups ($\mathbb{Z}_n, M_n(\mathbb{R}), GL(n,\mathbb{R})$ etc.), Basic properties of groups, Subgroups, Union and intersection of two subgroups, Necessary and sufficient condition.

Unit 2

Cyclic groups, Cosets, Lagrange's theorem, Normal subgroups, Factor groups. Group homomorphisms and isomorphisms and related simple problems.

\Reference Books

- John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
- Joseph J. Rotman, An Itroduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
- I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
- D. S. Malik, John M. Mordeson and M. K. Sen, Fundamentals of abstract algebra.

MATH 13 GE-I (MATHGE1 (GE5)): Numerical Methods   6 Credits

Unit 1

Relative, absolute, percentage, round off and truncation errors and relevant problems, rate of convergence.

Transcendental and polynomial equations: Bisection method, fixed point iteration, Newton-Raphson method.

Unit 2

System of linear algebraic equations: Gaussian elimination, Gauss-Seidel method.

Interpolation: Finite difference operators, Newton's forward and backward interpolation formula, Lagrange interpolation formula.

Unit 3

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule.

Ordinary differential equations: Euler's method, R-K methods of orders two.

Reference Books

- Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
- M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.
- C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
- Atkinson, K. E., An Introduction to Numerical Analysis, John Wiley and Sons, 1978.
- Yashavant Kanetkar, Let Us C, BPB Publications.

Dr. Paltu Sarkar
Chairman
UG Board of Studies in Mathematics
North Bengal University

CBCS SYLLABUS FOR UNDERGRADUATE COURSE IN GEOGRAPHY

UNIVERSITY OF NORTH BENGAL
RAJA RAMMOHUNPUR
DISTRICT: DARJEELING – 734013

ACADEMIC SESSION: 2021

(Important Note: The modified syllabus is to be implemented only from the Academic Session 2021. The students who are already enrolled in the previous academic sessions will continue to follow the previous syllabus)

TRUNCATED SYLLABUS
FOR
FIRST SEMESTER, 2021

DEPARTMENT OF GEOGRAPHY

COURSE CODE: GEOH-CCHL-101   **Credit: 04**
GEOTECTONIC
1. Earth's tectonic and structural evolution with reference to geological timescale;
2. Earth: Interior structure and theory of Isostasy (Airy, Pratt and Bowie);
3. Earth Movements: Mountain building theories (Kober and Holmes);
4. Concept & Theory: Continental Drift Theory; Plate Tectonics.

PRACTICAL   **Credit: 02**
1. Scales: Concepts, applications, merits and demerits; graphical construction of plain, comparative and diagonal scales;
2. Map Projection: Classification, properties, uses and limitations; Mathematical/Graphical construction of Polar Zenithal Stereographic Projection, Bonne's Projection, Sinusoidal Projection and Mercator's Projections.

   Practical Record: A project file covering all practical topics must be prepared.

COURSECODE: GEOH-CCHL-102   **Credit: 04**
GEOMORPHOLOGY
1. Geomorphology: Fundamental concepts of geomorphology;
2. Geomorphic processes: Cycle of erosion (Davis and Penck);
3. Evolution of erosional and depositional landforms: fluvial, aeolian and glacial;
4. Slope: Forms and processes; Theories of slope development (Penck and King).

PRACTICAL   **Credit: 02**
1. Topographical Map: Interpretation of the physical and cultural features of a topographical map (plateau/mountain); Slope Analysis after Wentworth; Relative Relief after Smith; Drainage density; Transect chart.
2. Megascopic identification of rocks and minerals: granite, basalt, gneiss, pegmatite, limestone, shale, sandstone, phyllite, slate, marble, schist, quartzite, bauxite, calcite, chalcopyrite, feldspar, galena, haematite, magnetite, mica, quartz and talc.

   Practical Record: A project file covering all practical topics must be prepared.

Reading List

1. Bloom A. L., 2003: Geomorphology: A Systematic Analysis of Late Cenozoic Landforms, Prentice-Hall of India, New Delhi
2. Bridges E. M., 1990: World Geomorphology, Cambridge University Press, Cambridge.
3. Christopherson, Robert W., (2011), Geosystems: An Introduction to Physical Geography, 8 Ed., Macmillan Publishing Company
4. Kale V. S. and Gupta A., 2001: Introduction to Geomorphology, Orient Longman, Hyderabad.
5. Knighton A. D., 1984: Fluvial Forms and Processes, Edward Arnold Publishers, London
6. Richards K. S., 1982: Rivers: Form and Processes in Alluvial Channels, Methuen, London.
7. Selby, M.J., (2005), Earth's Changing Surface, Indian Edition, OUP
8. Skinner, Brian J. and Stephen C. Porter (2000), The Dynamic Earth: An Introduction to physical Geology, 4th Edition, John Wiley and Sons
9. Thornbury W. D., 1968: Principles of Geomorphology, Wiley.
10. Anson R. and Ormelling F. J., 1994: International Cartographic Association: Basic
11. Gupta K.K. and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi
12. Mishra R.P. and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi.
13. Monkhouse F. J. and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London.
14. Rhind D. W. and Taylor D. R. F., (eds.), 1989: Cartography: Past, Present and Future, Elsevier, International Cartographic Association.
15. Robinson A. H., 2009: Elements of Cartography, John Wiley and Sons, New York.
16. Singh R. L. and Singh R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers.
17. Sarkar, A. (2015) Practical Geography: A Systematic Approach. Orient Black Swan Private Ltd., New Delhi
18. Wooldridge S.W., Morgan, R.S. An Outline of Geomorphology: The Physical Basis of Geography, Orient Longman

Important Note: Continuing evaluation will be as follows:
COURSE CODE: GEOH-CCHL-101: Class Test
COURSE CODE: GEOH-CCHL-102: Class Test

GEOGRAPHY HONOURS COURSE
GENERIC ELECTIVE

COURSE CODE: GEOH-GE1L-103   **Credit: 04**
PHYSICAL GEOGRAPHY

1. Geotectonic: Interior structure of the earth; Wegener's Continental Drift theory and Plate Tectonic theory;
2. Rocks: Major types of rocks and their characteristics;
3. Geomorphic processes: Weathering and mass wasting;
4. Geomorphology: Erosional and depositional features of river and wind.

PRACTICAL   **Credit: 02**

1. Scale: Definition, classification, merits and demerits; construction of comparative scale;
2. Map Projection: Definition, classification and graphical construction of Zenithal Gnomonic Projection (Polar Case); Simple Conical Projection with one Standard Parallel.

Reading List

1. Kale V. S. and Gupta A., 2001: Introduction to Geomorphology, Orient Longman, Hyderabad.
2. Thornbury W. D., 1968: Principles of Geomorphology, Wiley.
3. Gupta K.K. and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi.
4. Mishra R.P. and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi.
5. Monkhouse F. J. and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London.
6. Singh R. L. and Singh R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers.
7. Sarkar, A. (2015) Practical geography: A Systematic Approach. Orient Black Swan Private Ltd., New Delhi

Important Note: Continuing evaluation will be as follows:
COURSE CODE GEOH-GE1L-103: Class Test

COURSE CODE: GEOP-DSCL-104   **Credits: 04**
PHYSICAL GEOGRAPHY
  1. Earth's interior with special reference to seismology;
  2. Plate Tectonics as a theory of global tectonics;
  3. Folds and faults: Classification;
  4. Principal geomorphic agents; Classification and evolution of fluvial and glacial landforms.

PRACTICAL   **Credits: 02**
  1. Scale: definition, merits and demerits; construction of scale; plain (linear and comparative);

  2. Map Projection: Zenithal Gnomonic Projection (Polar Case), Cylindrical Equal Area Projection, Simple Conical Projection with one standard parallel.

  P*ractical Record: A project file covering all practical topics must be prepared.*

Reading list
  1. Billings, M.P. 1971. Structural Geology, Pearson.
  2. Goudie, A.S. (Ed) 2004. Encyclopedia of Geomorphology, vol. 1 & 2, Routledge.
  3. Gregory, K.J., Lewin, J. 2014. The Basics of Geomorphology: Key Concepts, Sage.
  4. Harvey, A. 2012. Introducing Geomorphology: A Guide to Landforms and Processes, Dunedin Academic Press.
  5. Kale, V.S., Gupta, A. 2001. Introduction to Geomorphology, Orient Longman.
  6. Kearey, P., Klepeis, K.A., Vine, F.J. 2011. Global Tectonics, 3rd ed, Wiley-India.
  7. Monkhouse, F.J. 1974. Principles of Physical Geography (2009-reprint), PlatinumPublishers.
  8. Selby, M.J. 1986. Earth's Changing Surface, Oxford University Press.
  9. Strahler, A. 2016. Introducing Physical Geography, 6th ed, Wiley.
  10. Summerfield, M.J. 2003. Global Geomorphology: An Introduction to the Study of landforms, Longman.
  11. Farndon, J. 2012. The Illustrated Guide to Rocks & Minerals, Southwater.
  12. Pillent, C. 2002. Smithsonian Handbooks: Rocks & Minerals, Dorling Kindersley.
  13. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.
  14. Sen, P.K. 1989. Geomorphological Analysis of Drainage Basin: An Introductionto Morphometric and Hydrological Parameters, University of Burdwan
  15. Sorrell, C.A. Rocks and Minerals: A Guide to Field Identification, St. Martin's Press.

Important Note: Continuing evaluation will be as follows:
COURSE CODE: GEOP-DSCL-104: Class test