STRUCTURE & MARKS DISTRIBUTION FOR THE NEW B.Sc. PROGRAMME IN CHEMISTRY (NEHU)

(ONLY CHEMISTRY PAPERS MENTIONED)

First Semester — ***Total: 100 Marks***

Chem EH 101: *Part A* Theory (Inorganic-I, Organic-I & Physical-I) – 75 marks
Part B Practical (Organic LC-I) – 25 marks
Chem H 101 : Practical (Organic LC-I) – 25 marks

(**Chem EH 101** is both *Honours and Elective*: **Chem H 101** is purely *Honours*)

Second Semester — ***Total: 100 Marks***

Chem EH 201: *Part A* Theory (Inorganic-II, Organic-II & Physical-II) – 75 marks
Part B Practical (Physical LC-I) – 25 marks

Third Semester — ***Total: 100 Marks***

Chem EH 301 *Part A* Theory (Inorganic-III, Organic-III & Physical-III) – 75 marks
Part B Practical (Inorganic LC-I) – 25 marks

Fourth Semester — ***Total: 100 Marks***

Chem EH 401: *Part A* Theory (Inorganic-IV, Organic-IV & Physical-IV) – 75 marks
Part B Practical (Inorganic LC-II) – 25 marks

Fifth Semester — ***Total: 200 Marks***

Chem H 501: Inorganic Chemistry-V – 50 marks
Chem H 502: Organic Chemistry-V – 50 marks
Chem H 503: Physical Chemistry-V – 50 marks
Chem H 504: *Part A* Practical (Organic LC-II) – 25 marks
Part B Practical (Physical LC-II) – 25 marks

Sixth Semester — ***Total: 200 Marks***

Chem H 601: Inorganic Chemistry-VI – 50 marks
Chem H 602: Organic Chemistry-VI – 50 marks
Chem H 603: Physical Chemistry-VI – 50 marks
Chem H 604: *Part A* Practical (Inorganic LC-III) – 25 marks
Part B Dissertation – 25 marks

Note. H stands for Honours alone; **E** stands for Elective alone; **EH** stands for Elective & Honours together. The above assignments of Course Numbers (e.g. **Chem EH 201**) is only tentative.

***** Internal Marks Distribution (Test 10 Marks + Assignments 9 marks)**

First Semester **Total: 100 Marks**

Chem EH 101: ***75 (19:56)* Marks**

PART A: Theory

Section I (Inorganic –I) **25 (6:19) Marks**

Unit I ***9½ marks***

(a) Structure of Atom: Limitations of Bohr's atomic model; idea of the de Broglie matter waves, Heisenberg's uncertainty principle; Schrodinger's wave equation and its importance; quantum numbers; concept of wave function; physical concepts of Ψ and Ψ^2; radial and angular wave functions; shapes of s, p and d-orbitals, Aufbau principle, Pauli's Exclusion Principle, Hund's rule, electronic configurations of atoms, screening effect and effective nuclear charge, Slater's rule (no numerical), extra stability of half-filled and completely filled orbitals.

(b) Nucleus and Radioactivity-I: Nuclear particles (neutrons, protons and qualitative idea of mesons and pisons), mass defect and nuclear binding energy (including numerical), packing fraction, natural and artificial radioactivity; radioactive disintegration series; first order rate equation of radioactive disintegration; half life and average life period, group displacement law , unit of radioactivity; neutron-proton ratio and its implications, importance of radioactive isotopes, elementary concepts of fusion and fission.

(c) Chemical Periodicity: Long form of periodic table, modern periodic law, types of elements on the basis of electronic configuration; periodic variation in properties – atomic and ionic radii, ionization enthalpy, electro gain enthalpy and electro negativity (Pauling's Mulliken's and Alfred-Rochow scale), diagonal relationship.

Unit II ***9½ marks***

(a) Covalent Bonding: Basic idea of valence bond theory and its limitations; Concept of hybridization of orbitals; valence shell electron pair repulsion (VSEPR) theory and shapes of molecules and ions: BeF_2, BF_3, H_3O^+, NH_3, H_2O, H_2SO_3, CO_2, BO_3^{3-}, PCl_3, PCl_5, SF_4, SF_6; polarity of covalent bonds and dipole moment. LCAO-MO theory and its application to homonuclear diatomic molecules (H_2, N_2, O_2, O_2^{2-}, O_2^-, O_2^+, Ne).

(b) Ionic Bonding: Ionic structures; radius ratio effect; limitation of radius ratio rule; concept of lattice energy and Born-Haber cycle; polarizing power; polarizability of ions and Fajan's rule.

***(c) Bonding in Metals, Semiconductors and Hydrogen Bond*:** Qualitative idea of free electron theory and band theory in solids; elementary ideas on semiconductors (n and p types); hydrogen bonding – concept and types of H-bonding – application to inorganic molecules.

Section 2 (Organic-I) **25 (6:19) Marks**

Unit III ***9½ marks***

***(a) Structure, Bonding & Properties*:** Hybridisation of orbitals, implications of hybridisation on the concept of bond length, bond energy, bond angles, shape of the molecules with following examples:
(i) CH_4, H_3O^+, CH_3^-, RNH_2 ;
(ii) C_2H_4, CH_3^+, BF_3, $AlCl_3$, carbonyl compounds, and
(iii) C_2H_2, R-CN, allene, ketene.
Nature of covalent bond and its orbital representation in molecules listed above.
Bronsted-Lowry and Lewis concepts of acids and bases, pK_a and pK_b concept, electronegativity, inductive effect and its role in substituted aliphatic carboxylic acids, effect of H-bonding on boiling point and solubility of organic compounds.
Conjugation, resonance, hyper-conjugation (propene and toluene), homolytic and heterolytic bond cleavage, Curly arrow rules. Types of reagents – electrophiles and nucleophiles. Reactive intermediates: carbocatons, carbonions, free radicals, carbenes - stability and examples.
***(b) Organic Stereochemistry-I*:** Concept of isomerism, types of isomerism - configuratonal and conformational isomerism (ethane and butane). Fischer, Newman and sawhorse projections with suitable examples, geometrical isomerism, configuration of geometrical isomers, E and Z nomenclature, geometric isomers of oximes; optical isomerism – optical activity, chiral carbon atom, enantiomers, diastereomers, meso compounds, racemic mixture, resolution of racemic mixtures.

Unit IV ***9½ marks***
(a) Alkanes and Cycloalkanes: Nomenclature, methods of formation (with special reference to mechanism of Kolbe, Wurtz, Wurtz-Fittig, Corey-House reactions), chemical reactivity (oxidation, cracking, aromatization). Mechanism of chlorination, relative reactivity of halogens towards different types of alkanes.
General method of preparation of cycloalkanes (upto cyclohexane) and their reaction with halogens and HX. Baeyer's strain theory- its limitations and modifications.
***(b) Alkenes and Alkynes*:** Nomenclature of alkenes, chemical reactivity, mechanisms of hydrogenation, bromination, Markownikoff's rule and anti- Markownikoff's rule, hydration, halohydration, hydroboration, oxidation, epoxidation, ozonolysis, hydroxylation, polymerization. Nomenclature, structure and bonding in alkynes, chemical reactivity, electrophilic addition reactions (halogenation, hydration, HX, HOX), ozonolysis, alkynides (Na, Cu and Ag) and polymerization; compare acidity of ethane, ethene and ethyne (Hybridisation concept).
***(c) Aromatic Hydrocarbons and Aromaticity*:** Molecular orbital picture of benzene, resonance energy, aromaticity, Huckel's (4n+2) rule and its application to simple molecules and ions, electrophilic, substitution reactions in aromatic hydrocarbons and general pattern of the mechanism, effect of substituent groups (activating and deactivating groups, directive influence) – mechanism of nitration, sulphonation, halogenation nuclear and side chain, formylation (Gattermann and Gattermann-Kotch), Friedel-Craft's alkylation and acylation.

Section 3 (Physical-I) **25 (7:18) Marks**

Unit V ***9 Marks***

***(a) Gaseous State-I*:** Kinetic theory of gases - postulates of kinetic theory, collisions and gas pressure, average kinetic energy, root mean square speed and absolute temperature of gas, Boltzmann constant, gas laws and kinetic theory. Real gases - deviation from ideality, compressibility factor, van der Waals equation of state, virial equation of state.

***(b) Liquid State-I*:** Qualitative description of the structure of liquids, Physical properties of liquids - vapour pressure, surface tension, viscosity, refractive index (definitions and descripttions), Liquid crystals- elementary discussion on structure and types of liquid crystals.

Unit VI ***9 marks***

***(a) Solid State-I*:** Law of constancy of interfacial angles, crystal planes, law of rational indices, Miller indices, space lattice and unit cell, packing in crystals, point defects in crystal – Vacancy defects, interstitial defect, Frenkel and Schottky defect.

***(b) Chemical Kinetics-I*:** Rate of reaction and rate constant, molecularity and order of a reaction, zero order reaction, differential and integrated forms of rate equations of first and second order reactions, pseudo-unimolecular reactions, determination of order of reactions, effect of temperature on reaction rates and energy of activation, effect of catalyst.

Chem EH 101: Part B: Practical (*Organic LC–I*) — 25 Marks(6:19)

Laboratory Course (Organic Chemistry)

Total Time Practical Exams: ***6 hours***

1. Qualitative Analysis — ***12 marks***

Systematic qualitative analysis of organic compounds containing one functional group:

(a) Detection of elements (N, Cl, Br, I)

(b) Determination of one of the following functional groups (with systematic reporting) -COOH, $-NH_2$, $-NO_2$, -OH (phenolic), -CHO and –CO-

(c) Preparation of the derivative

2. Viva Voce — ***5 marks***

3. Laboratory Record (Internal Assessment) — ***2 marks***

Chem H 101 Part B: Practical (*Organic LC- I*) — 25 Marks(6:19)

Laboratory Course (Organic Chemistry)

Total Time Practical Exams: ***6 hours***

1. Qualitative Analysis — *12 marks*

Systematic qualitative analysis of organic compounds containing two functional groups:

(a) Detection of elements (N, Cl, Br, I and S)

(b) Determination of any two of the following functional groups present in a single organic compound (with systematic reporting) -COOH, -OH (phenolic), -CHO, -CO-, $-NH_2$, $-NO_2$, $-CONH_2$, $-SO_3H$

(c) Determination of the melting point/boiling point of the compound

(d) Identification of the compound with help of a reference book

(e) Preparation of the derivative and determination of its melting point

2. Viva Voce — *5 marks*

3. Laboratory Record (Internal Assessment) — *2 marks*

Note: Courses **Chem EH 101 Part B** and **Chem H 101** have different question papers.

Third Semester **Total: 100 Marks**

Chem EH 301 :

PART- A : *Inorganic, Organic & Physical* **75 (19:56) marks**

Section 1(Inorganic) **25(7:18) marks**

Unit I: s- and p-Block Elements and Their Compounds ***9 marks***

Group discussion of the elements with respect to position in the periodic table, electronic configuration, atomic and ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, oxidation states, variation of acidic and basic properties of their oxides and oxy-acids, inert pair effect and catenation.

Preparation, important reactions, structure and use of the following compounds: sodium thiosulphate. potassium iodide, boric acid, aluminium chloride, lithium aluminium hydride, hydrazine, and lead tetraacetate.

Unit II: d- and f-Block Elements ***9 marks***

Electronic configuration of d-block elements, Transition metals-defination and characterstic features of transition elements, relative stability of oxidation states, variation of properties in first, second and third row transition metals.

Electronic configurations of lanthanides and actinides, comparison of their oxidations states, synthetic elements (synthesis of Np and Pu), variation in their atomic and ionic radii – lanthanide contraction ,difficulty in the separation of lanthanides – and ion exchange method of separation.

Preparation, important reactions, structures and uses of nickel tetracarbonyl, potassium ferrocyanide, potassium ferricyanide, potassium dichromate, potassium permanganate, and uranium hexafluoride.

Section 2 (Organic -III) **25 (6:19) Marks**

Unit IV ***9½ marks***

***(a) Carboxylic Acids and their Derivatives*:** Nomenclure, effect of substituents on the acidity of aliphatic and aromatic carboxylic acid, methods of preparation (oxidation of alcohols and aldehydes, acid hydrolysis of nitriles), reaction: reduction using $LiAlH_4$, formation of esters, acid chlorides, anhydrides and amides, comparison of chemical reactivity of these derivatives.

(b) Organometallic Compounds-I: Grignard reagents: Synthesis of alkanes, alcohols, acids, aldehydes, ketones, amines with mechanism. Organolithium compounds: preparation and reactions with H_2O, CO_2 & epoxide.

***(c) Active Methylene Compounds*:** Active methylene group, examples of active methylene compounds, tautomerism, difference between tautomerism and resonance (keto-enol tautomerism). Use of ethyl acetoacetate and diethyl malonate (synthesis of butanoic acid, succinic acid, cinnamic acid, crotonic acid, ethyl methyl ketone, barbituric acid).

Unit V

9½ marks

(a) Nitro Compounds (Aliphatic and Aromatic): Preparation, properties (aliphatic)– α –hydrogen acidity, halogenation, reaction with NaOH, HNO_2, hydrolysis, carbonyl compounds.

(b) Amines (Aliphatic and Aromatic): Nomenclature, preparation of amines (reduction of nitro compounds and Gabriel phthalimide synthesis), basicity and effect of substituents on basicity, chemical reactivity- acylation, action of nitrous acid, action of CS_2, carbyl amine reaction, condensation with carbonyl groups and ring substitution. Distinction between primary, secondary and tertiary amines (Hinsberg and Hoffmann).

***(c) Diazo Compounds*:** Preparation and stability of diazo compounds (aliphatic and aromatic). Reactions of benzene diazonium chloride (Sandmeyer, diazo coupling and arylation).

Section 3 (Physical-III)

25 (6:19) Marks

Unit VI

10 marks

***(a) Thermodynamics-II*:** Carnot cycle and its efficiency, Carnot's theorem, Entropy (S) as a state function, entropy changes of ideal gases in different processes. Gibbs function (G) and Helmholtz function (A), criteria for thermodynamic equilibrium and spontaneity, variation G and A with pressure, volume and temperature, Gibbs-Helmholtz equation, Clausius-Clapeyron equation, Trouton's rule.

(b) Chemical Equilibrium: Law of mass action, equilibrium constant (K) from thermo-dynamic considerations, temperature and pressure dependence of equilibrium constants (K_p and K_c) – van't Hoff equation, relation of K_p and K_c, equilibria in homogeneous and heterogeneous systems, Le Chatelier's principle.

Unit VII

9 marks

***(a) Dilute Solutions*:** Colligative properties, Raoult's law and Henry's law, relative lowering of vapour pressure, elevation in boiling point, depression in freezing point, osmosis, osmotic pressure and its determination, relation between colligative properties and molecular mass, determination of molecular mass, van't Hoff factor, abnormal molar mass, Reverse osmosis and its applications.

(b) Colloids: Classification of colloids, preparation of colloids – peptisation, Bredig's method and condensation methods, purification of colloids, properties of colloids – Tyndall effect, Brownian movement, electrophoresis and electro-osmosis, protective colloids and gold number.

Chem EH 302:

Part B Practical *(Inorganic LC-I)* **25 (6:19) marks**

Laboratory Course (Inorganic)

Total Practical Examination Time: **6** hours

Part I: Qualitative Analysis *12 marks* Inorganic Mixtures containing five radicals/ions to be analyzed – one of the radicals /ions must be interfering (borate, chromate or phosphate). Following ions/radicals to be included:

Ag^{+}, Pb^{2+}, Hg_2^{2+}, Hg^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, As^{3+}, Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Ba^{2+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+}, K^{+}, NH_4^{+}.Cl^{-}, Br^{-}, I^{-}, SO_4^{2-}, NO_3^{-}, BO_3^{3-}, PO_4^{3-}, CrO_4^{2-}.

Part II:

(a) Sessional Work : *2 marks*

(b) Viva Voce : *5 marks*

Fifth Semester *Total: 200 Marks*

Chem H 501:

Inorganic Chemistry – V **50 (12:38) marks**

Unit I *7 marks*

(a) Molecular Symmetry: Symmetry elements and symmetry operations: symmetry planes and reflections, inversion center, proper axis and proper rotations, improper axis and improper rotations; molecular point groups; systematic classification of molecules into point groups with examples (i) linear molecules, ($C_{\infty v}$, $D_{\infty h}$), (ii) molecules with no C_n or S_n,(C_s and C_1 only) , (iii) molecules with cubic point group, (T_d and O_h) , (iv) H_2O, NH_3, $XeOF_4$, XeF_4, PF_5, B_2H_6, Cyclohexane (chair and boat forms).

Unit II *8 marks*

(a) **Complexometric titration** (using EDTA), metal ion indicators, masking and demasking reagents; principles of argentometric titrations, estimation of chloride using adsorption indicators; principles of gravimetric estimation of chloride, theory of precipitation, coprecipitation, post-precipitation and digestion of the precipitate.

(b) Error Analysis: Significant figures; errors (determinate and indeterminate), accuracy and precision: normal distribution of indeterminate errors; propagation of errors – mean and standard deviations; rejection of data – the F-test, t-test and Q-test.

(b) Organic Reagents in Inorganic Analysis: Basic qualities of the reagents and conditions; advantages of organic precipitants and their limitations; study of Oxine, α-nitroso β-naphthol, cupferron, cupron, and dimethylglyoxime .

Unit III *8 marks*

Nucleus and Radioactivity-II: Types of radioactive decay; radioactive equilibrium; spontaneous fission, nuclear reactions, Q value, principles of separation of isotopes – gaseous diffusion, electrolysis and electromagnetic separation methods; application of radioisotopes as tracers; detection and measurement of radioactivity (GM counter).

Stability of nucleus and nuclear forces, magic number concept, nuclear binding energy:. Basic principles and types of nuclear reactors.

Unit IV *7 marks*

Crystal Field Theory (CFT): (i) d-orbital splitting by electrostatic field {octahedral, tetrahedral and factors affecting crystal field splitting energy (10Dq value)} and spectrochemical series; Structural and thermodynamic effects of d-orbital splitting, variation of ionic radii, Jahn-Teller effect, hydration and lattice energies of first row transition metal ions; octahedral vs. tetrahedral coordination; adjusted CFT and molecular orbital theory for octahedral complexes.

Unit V *8 marks*

Magnetochemistry: Explanations of diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism, origin of paramagnetic moment: electron spin moment and orbital angular moment, magnetic susceptibility, Curie law, Curie-Weiss law, Bohr magneton, magnetic susceptibility measurement by Gouy and Faraday methods; explanation of magnetic behaviour of $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, $[Co(NH_3)_6]Cl_6$, $K_2[Ni(CN)_4]$, $K_3[CoF_6]$, $K_3[MnF_6]$, $Ni(CO)_4$.

Chem H 502:
Organic Chemistry

50 (13:37) Marks

Unit I *9 marks*

***(a) Polynuclear Aromatic Hydrocarbons*:** Introduction; molecular orbital structure of naphthalene; resonance; Preparations, reactions, mechanism and orientation of electrophilic substitution. Preparations and reactions of α - and β-naphthols (azo-coupling, reactions with HNO_2 and $FeCl_3$. Preparation and reactions of anthracene.

***(b) Peptides, Proteins and Vitamins*:** *(i) Peptides* – definition and preparation of di- and tripeptides from α-amino acids. *(ii) Proteins* - introduction, classification, primary, secondary, tertiary and quart-ernary structures of proteins, α- and β-proteins, helical and sheet structures. *(iii) Vitamins* – definition, classification and biological importance of vitamins. Carotenoids – occurrence, isolation and synthesis, β-carotene as a source of vitamin A_1, synthesis of vitamin A_1 and ascorbic acid.

Unit II *9 marks*

***(a) Organic Stereochemistry-II*:** Nomenclature of enantiomers (R and S); relative and absolute configuration; inversion, retention, conformation of cyclic compounds – cyclohexane, mono-substituted and disubstituted cyclohexane (1,2-, 1,3-, 1,4-) with reference to their stability both Newman and chair form. Stereochemical aspects of addition of bromine to alkenes.

***(b) Introduction to Dienes*:** Conjugated, isolated and cumulated dienes (allenes); preparations and reactions of conjugated dienes (1,3-butadiene and isoprene). Addition reaction of 1,3–dienes (1,2 and 1,4 addition).

***(c) Polymers*:** Types of polymers and polymerization processes. Addition (chain-growth) polymerization; free radical vinyl polymerization; ionic vinyl polymerization [Ziegler–Natta polymerisation]. Condensation (step-growth) polymerization, polyesters (Dacron), polyamides (Nylon-6, Nylon-6,6), ureaformaldehyde resins (Bakelite), polyurethanes. Natural and synthetic rubbers (Neoprene, Buna-S, Butyl rubber).

Unit III *10 marks*

***(a) Introduction to Organic Synthesis*:** Formation of carbon-carbon bond, electrophilic and nucleophilic carbon species, acid-assisted reaction (Friedel Crafts alkylation and acylation, Gatterman-Koch formylation), base assisted condensations (Knoevenagel, Michael, Wittig reaction, Claisen reaction, Claisen-Schmidt reaction, Mannich reaction).

***(b) Rearrangements*:** Carbocation rearrangements – pinacole-pinacolone, Wagner-Meerwein, dienone-phenol. Beckmann, Wolff, Hofmann, Curtius, Lossen, Schmidt, benzil-benzilic acid, benzidine-semidene, Favorskii, Fries and Claisen rearrangements.

Unit IV *9 marks*

***(a) Heterocyclic Compounds-II*:** Introduction to condensed five- and six-membered heterocycles, preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer-Indole synthesis, Skraup and Bischler-Napieralski syntheses.

***(b) Green Chemistry*:** Definition, goals, principles and techniques (brief discussions); Solvent free reactions, Microwave assisted reactions (their advantages over conventional method with example).

***(c) Inorganic Reagents in Organic Synthesis*:** $NaBH_4$, $LiAlH_4$, B_2H_6, Na/liq.NH_3, aluminium isopropoxide, $KMnO_4$, $K_2Cr_2O_7$, HIO_4, Lead tetraacetate, peracids.

Chem H 503:

Physical Chemistry -V

50 (13:37) Marks

Unit I: Gaseous State-II

9 marks

Maxwell's distribution law of molecular speeds, molecular speeds and energy distribution as a function of temperature, calculation of the most probable, average and root mean square speeds of molecules, Maxwell-Boltzmann distribution, degrees of freedom of motion, principle of equipartition of energy, collision diameter, collision cross-section, collision frequency and mean free path, viscosity of gases, Boyle temperature, critical phenomena-critical constants, p-v isotherm of carbon dioxide, continuity of state, law of corresponding states and reduced equation of state, vapour density and limiting density.

Unit II: Physical Properties and Molecular Structure

7 marks

Determination of surface tension, viscosity and refractive index of liquids. Physical properties and chemical constitution- additive and constitutive properties, molar volume, parachor, specific and molar refraction. Polar and non-polar liquids, dielectric constant, dipole moment, structure of molecules, polarization, Clausius-Mossotti equation. Dipole induced dipole and vander Waals interactions in molecules.

Unit III: Solid State-II

6 marks

Symmetry elements in crystals-plane of symmetry, axis of symmetry, centre of symmetry, seven crystal systems, Law of symmetry, Bravais lattices, X-ray diffraction of crystals, Bragg's law, crystal structure determination-Laue's method and powder method.

Unit IV: Chemical Kinetics-II

7 marks

Catalyzed reactions – homogeneous catalysis, acid-base catalysis, enzyme catalysis - Michaelis-Menten equation: Theory of Reaction rates – collision theory, transition state theory of unimolecular reactions.

Complex reactions – opposite, parallel, consecutive and chain reactions, rate determining step, steady state approximation and derivation of rate laws of complex reactions.

Unit V: Molecular Spectroscopy

8 marks

Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. Rotational and Vibrational spectra of diatomic molecules: frequency expressions, selection rules and applications to estimate molecular parameters; isotope effect in vibrational spectrum. Beer-Lambert's law, Einstein's law.

Chem H 504

PART –A (Practical – Organic LC-II)

25 (6:19) Marks

Laboratory Course (Organic)

Total Time for Practical Exams: ***6 hours***

1. Separation of Mixtures — *6 marks*

(a) Separation of binary organic mixtures based on acid-base concept

(b) Determination of melting points

2. Organic Preparation — *6 marks*

(a) Preparation of the following compounds

(i) Phthalimide (from phthalic anhydride)

(ii) m-Dinitrobenzene (from benzene)

(iii) Picric acid (from phenol)

(iv) p-Bromoacetanilide (from acetanilide)

(v) Benzilic acid (from benzil)

(vi) Methyl Orange (from sulphanilic acid)

3. Viva Voce — *5 marks*

4. Laboratory Record (Internal Assessment) — *2 marks*

Chem H 504

PART –B (Practical – Physical LC-II) 25 (6:19) Marks

Laboratory Course (Physical)

Total Practical Examination Time: **6 hours**

The following experiments are to be carried out in the class. In the examination, each student should be asked to do any **one** experiment

List of Experiments

1. Conductometric titrations of an acid by a base.
2. Acid-base titration using potentiometer.
3. Verification of Beer-Lambert's law using copper sulfate or $K_2Cr_2O_7$ solution colorimetrically and determination of the concentration of the supplied solution
4. Determination of velocity constant for the decomposition of hydrogen peroxide using ferric chloride as catalyst; and to determine the activation energy.
5. Determination of the heat of solution of solid calcium chloride and to determine lattice with the help of Born-Haber cycle.
6. Determination of the critical solution temperature of the phenol-water system.
7. Study on the kinetics of the reaction between potassium persulfate and potassium iodide at two temperatures with determination of activation energy
8. Study of the adsorption of oxalic acid on charcoal and verification of Freundlich's adsorption isotherm.
9. Determination of surface tension of a liquid/solution by drop-weight method.
10. To obtain the viscosity–composition (v/v) curve of ethanol-water/ glycerolwater/ methanol-water system and to determine the composition (v/v) of a given unknown mixture.
11. Determination of partition coefficient of a solute between two immiscible solvents (e.g. iodine in water/organic solvent; benzoic acid in water/benzene).
12. Determination of pKa value of different sets of buffer by pH-metric titration using glass electrode

(*cont'd* ……..

Distribution of marks:

Viva Voce	: *05 Marks*
Laboratory Record	: *02 Marks*
Experiment	: *12 Marks*

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