FACULTY OF SCIENCES

SYLLABUS

FOR

B.Sc. (Hons) Physics

(Semester III-IV)
Session: 2018-19

KHALSA COLLEGE AMRITSAR

(An Autonomous College)

Please visit the College website time to time.

B.Sc. (Hons) Physics Semester-III

B.Sc. (Hons) Physics Semester-III

Physical Chemistry

45 Hrs. **Time: 3 Hrs.**

Max. Marks: 40+10(Internal Assessment)

Instructions for paper setters and candidates

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight short questions carrying 1 Mark each.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 8 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

UNIT I

1. Solutions and Colligative Properties 12Hrs.

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, Dilute solution, colligative properties, Raoult's law, relative lowering ofvapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and itsmeasurement, determination of molecular weight from osmotic pressure, elevation of boilingpoint and depression of freezing point.

UNIT-II

2. Surface Chemistry 11 Hrs.

Bulk phases and interfacial region,types of interfaces; Surface tension and interfacial tension.Thermodynamics of surfaces, plane interface, curved interface, Laplace and Kelvin equations, the contactangle, capillary rise and surface tension. Surface tension of solutions,Gibbs adsorption equation and itsderivation from thermodynamic considerations. Surfactants, Surface films on liquids. Criteria for
spreading in liquid-liquid systems. (Wetting as contact angle and capitulary action Phenomenon solidliquidsystems).

UNIT-III

3. Chemical Kinetics 7 Hrs.

Rate of reaction, rate constant and rate laws, the order of reaction, first, second & third and zero orderreactions, half-lives; determination of reaction order. Temperature dependence of reaction rates, reactionmechanism, rate-determining step approximation, steady-state approximation. Catalysis, homogeneous catalysis, autocatalysis, oscillation reactions.Enzyme catalysis, heterogeneous catalysis.

UNIT-IV

4. Liquid State 10 Hrs.

Intermolecular forces, structure of liquids (a qualitative description). Structural differencesbetween solids, liquids and gases. Liquid crystals: Difference between liquids crystal,

solid andliquid.Classification, structure of nematic and cholestric phases.Thermography and sevensegment cell.

5. Colloidal State **5 Hrs.**

Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical andelectrical, properties, stability of colloids,protective action, Hardy Schulze law, gold number.Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers.generalapplications of colloids.

Suggested Books

ESSENTIAL:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)

FURTHER READING:

1. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.
2. Physical Chemistry by R. J. Silbey, R. A. Albert &Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

B.Sc. (Hons) Physics Semester-III
Physical Chemistry
PRACTICAL

Max. Marks: 40+10(Internal Assesment) **Labs Hrs.: 60**

Crystalisation:
Concept of indication of crystalisation. Phthalic acid from hot water (using fluted filter paper & stem less funnel)
Acetanilide from boiling water.
Naphthalene from Ethanol
Benzoic acid from water

Physical Chemistry
1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalyzed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)
3. To study the viscosity and surface tension of glycerine solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine H of the dissolution process.
5. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

B.Sc. (Hons) Physics Semester-IV

B.Sc. (Hons) Physics Semester-IV

Molecular Spectroscopy

45 Hrs. **Time: 3 Hrs.**

Max. Marks: 40+10(Internal Assessment)

Instructions for paper setters and candidates

VI. Examiner will make five sections of paper namely Section-I, II, III, IV and V

VII. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.

VIII. Section-I will consist of eight short questions carrying 1 Mark each.

IX. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 8 Marks.

X. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

UNIT – I

1. Energy and Electromagnetic Spectrum **5 Hrs**

Introduction, electromagnetic spectrum and Units, Regions of the spectrum, Basic features of different spectrometers, Statement of Born-Oppenheimer approximation, Degree of freedom, Frank Condon Principle, Fluorescence and Phosphorescence.

II. Ultraviolet and Visible Spectroscopy **6 Hrs**

The energy of electronic excitation, Measurement techniques, Beer-Lambert Law, Molar extinction coefficient. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, Auxochromes, Absorption and intensity shifts, Transition probability. Factors affecting λ_{max} , Effect of steric hindrance to coplanarity, Solvent effects.

UNIT – II

III. Infrared Spectroscopy **5 Hrs**

Vibrational energy levels, Selection rules, Force constant, Fundamental vibration frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups. Sampling techniques.

IV. Applications of UV and IR Spectroscopy **7 Hrs**

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α,ß -unsaturated carbonyl compounds. Applications of IR spectroscopy, Absorption of

Common functional Groups, Interpretation of simple IR spectra, Finger print regions. Simple numerical problems based on UV and IR spectroscopy.

UNIT-III

V. Proton Magnetic Resonance spectroscopy (^{1}H NMR) 6 Hrs

The Nuclear spin, Larmor frequency, the NMR isotopes, Population of nuclear spin level, Spin and Spin lattice relaxation. Measurement techniques (CW & FT method), Solvent used.

Chemical shift, Reference compounds, Shielding constant, Range of typical chemical Shifts, Simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

VI. Applications of NMR spectroscopy 5 Hrs

NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p- nitrophenols, acetophenone. Simple numerical of structure elucidation of NMR spectroscopic data.

UNIT- IV

VII. Mass Spectrometery 5 Hrs

Basic Principles. Elementary theory. Molecular ions, isotope ions, Fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, Simple cleavage, Cleavages at a hetero atom, Multicentre fragmentations, Rearrangements, Diels – Alder fragmentation, Mc Lafferty rearrangement.

VIII. Applications of Mass Spectroscopy 6 Hrs

Cleavage associated with common functional groups , Aldehydes, Ketones, Cyclic and Acyclic Esters, Alcohols, Olefins, Aromatic compounds, Amines, Interpretation of the spectrum of unknown simple molecules.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York
2. D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster; Publisher: John Willey and Sons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing Company Inc.

5. Introduction to Spectroscopy – D. L. Pavia, G. M .Lampman, and G. S. Kriz
Publisher: Brooks / Cole, a part of cengage learning

B.Sc. (Physics Hons.) (SEMESTER–IV)

Physical Chemistry

Time: 3 Hrs.
Max. Marks: 40+10(Internal Assesment) **Periods: 6**

Note. The question paper will be set by the examiner based on the syllabus.

1. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).

2. Polarimetry: Determine the %age composition of an optically active solution.

3. Calorimetry:
   a) Determination of Heat of neutralization
      (i) Strong acid-strong base
      (ii) Weak acid-strong base.
   b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3

4. Conductometry:
   a) Determination of cell constant.
   b) Determination of specific and equivalent conductance of electrolyte (NaCl andHCl).
   c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.
   d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid on charcoal.