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Syllabus 2023-24
Panjab University

BSc

(CHEMISTRY)

FIFTH SEMESTER

SCO 80-81, Sec.15D, Chandigarh
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CHEMISTRY**SEMESTER-5th**

Scheme of Teaching and Examination

<i>Paper</i>	<i>Course</i>		<i>Teaching Hrs.</i>	<i>Max. Marks</i>
XVII	Inorganic Chemistry-A	30	3 periods per week	22+3 internal assessment
XVIII	Organic Chemistry-A	30	3 periods per week	22+3 internal assessment
XIX	Physical Chemistry-A	30	3 periods per week	22+3 internal assessment
XX	Laboratory Practicals		6 periods per week	22+3 internal assessment
<i>Total 15 periods/week</i>				<i>100</i>

SEMESTER-6th

Scheme of Teaching and Examination

<i>Paper</i>	<i>Course</i>		<i>Teaching Hrs.</i>	<i>Max. Marks</i>
XXI	Inorganic Chemistry-B	30	3 periods per week	22+3 internal assessment
XXII	Organic Chemistry-B	30	3 periods per week	22+3 internal assessment
XXIII	Physical Chemistry-B	30	3 periods per week	22+3 internal assessment
XXIV	Laboratory Practicals		6 periods per week	22+3 internal assessment

Total 15 periods/week ***100***

Total Marks

SEMESTER-5-100

SEMESTER-6-100

200

CHEMISTRY**SEMESTER-5th**

Scheme of Teaching and Examination

<i>Paper</i>	<i>Course</i>		<i>Teaching Hrs.</i>	<i>Max. Marks</i>
XVII	Inorganic Chemistry-A	30	3 periods per week	22+3 internal assessment
XVIII	Organic Chemistry-A	30	3 periods per week	22+3 internal assessment
XIX	Physical Chemistry-A	30	3 periods per week	22+3 internal assessment
XX	Laboratory Practicals		6 periods per week	22+3 internal assessment
			Total 15 periods/week	100

Paper-XVII: INORGANIC CHEMISTRY-A

Time : 3 Hrs
Max. Marks: 22+3
30 Hrs. (2 Hrs/Week)
3 Periods/Week

Objective of the course

To teach the fundamental concepts of Chemistry and their applications. The syllabus pertaining to B.Sc. (GENERAL) (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh and affiliated colleges. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I**(8 Hrs.)****Metal – Ligand Bonding in Transition Metal Complexes :**

Limitations of valence bond theory, an elementary idea of crystal – field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal – field parameters, Spectro chemical Series.

UNIT-II**(7 Hrs.)****Thermodynamic and Kinetic Aspects of Metal Complexes :**

A brief outline of thermodynamic and Kinetic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

UNIT-III**(8 Hrs.)****Organometallic Chemistry :**

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal – ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls

UNIT-IV

(7 Hrs.)

Bioinorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions. Nitrogen fixation.

Instructions for paper setters and candidates:

- i. Examiner will set total of **NINE** questions comprising **TWO** questions from each unit and **ONE** compulsory question of short answer type covering whole syllabi.
- ii. The students are required to attempt **FIVE** questions in all, **ONE** question from each unit and the Compulsory question.
- iii. Compulsory question carries six marks and remaining all questions carry four marks each.

Books suggested

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman and Hall Ltd., 1991.
3. Shriver, D.E., Atkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.
4. Dauglas, B., McDaniel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1999.
5. Porterfeild, W.W., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984.
6. Miessur, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Ltd., 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
9. Puri, B.R., Sharma, L.P., Kalia, K.C. Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publishers. 2006-07.

Paper-XVIII: ORGANIC CHEMISTRY-A**Time : 3 Hrs****Max. Marks: 22+3****30 Hrs. (2 Hrs/Week)****3 Periods/Week****Objective of the course**

To teach the fundamental concepts of Chemistry and their applications. The syllabus pertaining to B.Sc. (GENERAL) (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh and affiliated colleges. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I**Electromagnetic Spectrum: Absorption Spectra –I:****(7 Hrs.)**

Ultraviolet (UV) absorption spectroscopy – Absorption laws (Beer – Lambert Law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Woodward Fieser Rules and their applications in calculating maximum values of conjugated alkenes (cyclic as well as acyclic) and conjugated carbonyl compounds.

UNIT-II**(7 Hrs.)****Electromagnetic Spectrum: Absorption Spectra-II:**

Infrared (IR) absorption spectroscopy – Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

UNIT-III**(8 Hrs.)****Spectroscopy**

Nuclear magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance (^1H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, area of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

UNIT-IV**(8 Hrs.)****Carbohydrates**

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+) – glucose. Mechanism of mutarotation.

Structure of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Instructions for paper setters and candidates:

- i. Examiner will set total of **NINE** questions comprising **TWO** questions from each unit and **ONE** compulsory question of short answer type covering whole syllabi.*
- ii. The students are required to attempt **FIVE** questions in all, **ONE** question from each unit and the Compulsory question.*
- iii. Compulsory question carries six marks and remaining all questions carry four marks each.*

Books suggested

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: New Age International, 1985, Vol. I, II, III.
4. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
5. Solomons, T.W., Fundamentals of Organic Chemistry; 5th edition, Pubs: John Wiley & Sons, 1997.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.

Paper-XIX: PHYSICAL CHEMISTRY-A

Time : 3 Hrs
Max. Marks : 22+3
30 Hrs. (2 Hrs/Week)
3 Periods/Week

Objective of the course

To teach the fundamental concepts of Chemistry and their applications. The syllabus pertaining to B.Sc. (GENERAL) (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh and affiliated colleges. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I**(8 Hrs.)****Elementary Quantum Mechanics-I**

:

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect.

De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

UNIT-II**(7 Hrs.)****Elementary Quantum Mechanics-II :**

Molecular orbital theory, basic ideas – criteria for forming M.O. from A.O., construction of M.O.'s by LCAO – H_2^+ ion. Calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ , σ^* , π , π^* orbitals and their characteristics. Hybrid orbitals – sp , sp^2 , sp^3 ; calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2 , comparison of M.O. and V.B. models.

UNIT-III**(8 Hrs.)****Photochemistry-I**

:

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of Photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state.

UNIT-IV

(7 Hrs.)

Photochemistry-II :

Qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples). Photochemistry of carbonyl compounds and alkenes.

Instructions for paper setters and candidates:

- i. Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.*
- ii. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.*
- iii. Compulsory question carries six marks and remaining all questions carry four marks each.*

Books suggested

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford university press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Company Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; I edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems, Pubs: Wiley Eastern limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd, 2002.
9. Moore, W.J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd., 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book Company, 1989.
11. Banwell, C.N., McCash, E.M., Fundamentals of Molecular Spectroscopy; 4th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 1999.
12. Atkins, P. Friedman, R. Molecular Quantum Mechanics; 4th edition Pubs: Oxford University Press, 2007.
13. Levine, I.N., Quantum Chemistry; 5th edition, Pubs: Prentice Hall International Inc., 2000.

Paper – XX: LABORATORY PRACTICALS**Max. Marks: 22+3****INORGANIC CHEMISTRY**

Synthesis and Analysis:

6 Periods/ week

- (a) Preparation of sodium trioxalatoferrate (III), $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ and determination of its composition bypermaganometry.
- (b) Preparation of copper tetraammine complex $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$.
- (c) Preparation of cis-and trans-bisoxalatodiaqua chromate (III) ion.

Instrumentation

Solvent Extraction

Separation and estimation of Mg(II) and Fe(II).

PHYSICAL CHEMISTRY**Electrochemistry**

- (a) To determine the strength of the given acid conductometrically using standard alkali solution.
- (b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
- (c) To study the saponification of ethyl acetate conductometrically.
- (d) To determine the ionization constant of a weak acid conductometrically.
- (e) To study the distribution of iodine between water and CCl_4 .
- (f) To study the distribution of benzoic acid between benzene and water.

Molecular Weight Determination

- (a) Determination of molecular weight of a non – volatile solute by Rast method.
- (b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution of the substance.

General Instruction to the Examiners :**Note:** Practical examination will be of four hours duration & shall consist of the following questions:

Q.No. 1*. Preparation of an inorganic complex : 7 marks

Q.No. 2. Physical Chemistry : 7 marks

Students shall be allowed the choice to opt for one experiment out of the three offered. The candidate will write theory, short procedure and calculations of that experiments in the next 10 minutes. Note – Book / Books is/are not allowed during writing.

Q.No. 3. Viva-Voce : 5 marks

Minimum of four questions (2 marks each) be asked on the background of practical course.

Q.No. 4. Note Book : 3 marks

*If a question on preparation is asked, then the students shall be required to give Equation, requirements & short procedure in the first 10 minutes. Note Books are not allowed during writing.

Books Suggested (Laboratory Courses)

1. Denny, R.C. Vogel's Quantitative Inorganic Analysis; 4th edition, Pubs: English Language Book Society, 1985.
2. Harwoor, L.M., Moody, J., Experimental Organic Chemistry; 1st edition, Pubs: Blackwell Scientific Publicaitons, 1989.
3. Palmer, W.G., Jamer, C., Swinehart, S., Experimental Inorganic Chemistry; 1st edition, Pubs: Perlkin-Elmer Corporation, 1969.
4. Forniss, B.S., Rogers, V., Vogel's Text Book of Practical Organic Chemistry; Pubs: Dorling Kindhsky Pvt. Ltd., 1989.
5. Garland, C.W., Experiments in Physical Chemistry; 1st edition, Pubs: McGraw Hill Book Company, 1989.
6. Bansal, R.K., Laboratory Manual of Organic Chemistry; 3rd edition, Pubs: Wiley Eastern Limited, 1994.
7. Furniss, B.S., Hannaford, A.J., Rogers, V., Smith, P.W.G., Tatchell, A.R., Vogel's Text Book of Practical Organic Chemistry; 4th edition, Pubs: Longman group, 1978.
8. Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th edition, Pubs: R.Chand& Co., New Delhi, 2002.
9. Das, R.C., Behra, B. Experimental Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd., .
10. Levitt, B.P., Findlays Practical Physical Chemistry; 8th edition, Pubs: Longman group Ltd. London & New York, 1978.

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