Session 2019-20

Chaudhary Bansi Lal University, Bhiwani

(A State University established under Haryana Act No. 25 of 2014)

Department of Chemistry
Examination Scheme
&
Syllabi
For
Pre-PhD Course Work
(with effect from 2019-20)

Chaudhary Bansi Lal University, Bhiwani
Department of Chemistry

Scheme of Examination for Pre-Ph.D. Course Work in Chemistry

Credits = 12 **Marks = 300**

Paper Code	Name of the Paper	Credits	Contact Hours Per Week	Examination Scheme		Total
				External Theory/ Presentation	Internal Assessment	
19 CHEP-101	Paper-I: Research Methodology	4	4	80	20	100
19 CHEP-102	Paper-II: Inorganic Chemistry/Physical Chemistry/Organic Chemistry	4	4	80	20	100
19 CHEP-103	Paper-III: Review of Literature	4	4	80	20	100
Total		**12**	**12**	**240**	60	**300**

Duration: 6 Months (1 Semester)
Total Credits: 12
Total Marks: 300

Each candidate has to study three papers (Paper I, II & III); Paper II has three options and one paper is to be chosen (Inorganic Chemistry/Organic Chemistry/Physical Chemistry)
Each paper will be of 100 marks and 4 credits with teaching load of 4 hrs/week)

19 CHEP-101
Paper-I: Research Methodology

Maximum Marks: 100
Theory: 80
Internal: 20
Max. Time: 3 hrs.
Credit: 4

Note: The question paper will contain eight questions in all. The candidates are required to attempt any five questions. All questions carry equal marks.

Unit I

Research Methodology: Meaning, Scope, Primary sources of literature survey,Journals, patents etc., secondary sources of literature survey, Books, Reference books, Text books, listing of letters.

Chemical Literature: (1) The structure of chemical information, Importantpaper based and electronic based sources, How to find chemical information on specific compounds and their synthesis; (2) Abstracts and Journals in chemistry, Electronic forms of Journals, major libraries, subscribing Journals related to chemistry in the region and country; and (3) Patents and Patents writing, Parts of patent applications characteristics of the disclosure for a chemistry invention.

Unit II

Scientific Writing : Scientific Document; Organization and writing of researchpaper, short communications, review articles, monographs, technical and survey reports, authored book and edited books and dissertation.

Writing of Thesis: Format of a thesis: Review of literature, formulation, writing methods, results, preparation of tables, figures, writing discussion, summary and conclusion, synopsis, reference citing and listing, bibliography, avoiding plagiarism.

Unit III

Data Collection: Methods of Data Collection. Case study method, Measurement and Scaling Techniques: Measurement Scales, Meaning of Scaling, Test of Second Measurements. Meaning of Scaling, Scale Classification Bases, Important Scaling and Scale Construction Techniques.

Computer applications in research: Basic operating systems – handling different operating systems. MS Office.

Drawing graphs and diagrams- Exploring Univariate and Multivariate Data using Tables and Plots- Stem and Leaf, Box Plot, Spider Plot, Q-Q Plot and Probability Plot, Graphical Methods of Clustering.Photoshop and Paints.

Unit IV

Scientific soft wares in research: Data Analysis using Tools like MS Excel, Minitab, ChemDraw and MATLAB.

Digital Methods and Web Search: Internet basics, Internet protocols, pre-requisites, search engines- google scholar, chemspider, scifinder, scopus, reaxys, research gate; using advanced search techniques, web resources, e- journals, e-books, journal access, subscribing TOC alerts, hot articles, citation index – h-index and i-index; Impact factor.

Recommendation for the Candidate:

The candidate is expected to consult standard books, monographs, research papers and accounts for the above mentioned course.

19 CHEP-102
Paper-II: Inorganic Chemistry (Optional)

Maximum Marks: 100
Theory: 80
Internal: 20
Max. Time: 3 hrs.
Credit: 4

Note: The question paper will contain eight questions in all. The candidates are required to attempt any five questions. All questions carry equal marks.

Unit-I

Electro analytical Techniques

Polagraphy:- Introduction and Basic Principles, Polarograph, Polarographic cells, Half wave Potential and its significance. DME:- Advantages and Disadvantages of DME, SCE Carbon electrodes-Carbon paste Electrode, Types of Currents:- Diffusion Current, Migration Current, Kinetic Currents, Catalytic Currents, Limiting Currents Amperometry :- Principles and Applications, Square Wave Polarography, Voltametry, Coulometry, Superimposed, AC Polarography:- Principles, theory and applications of these techniques.

Unit-II

Nanomaterials:- Definition, Methods of Preparation, Properties of Nanomaterials:- Physio chemical and optical, Electrical and Electronics properties. Applications of Nanomaterials Gold, Silver & Pt Nanomaterials: General Properties and Applications

Unit-III

Phosphorescent Materials: Luminescence, Types of Luminescence, Fluorescence, Phosphorescence, Frank Condon Principle, Jablouski diagram, Organic Electroluminescence, Organic, Light Emitting diode, Structure and working of OLED,Applications of OLED Inorganic phosphorescent materials, Long Persistant phosphors phosphors for LED, Applications of Inorganic Phosphors.

Unit-IV

Organometallic Compounds of Main Group Elements: General characteristics of different types of main group organometallics, stability, routes of M-C bond formation: Oxidative addition, transmetallation, Carbanion halide exchange, metal-hydrogen exchange, metal hydride addition to alkenes, methylenations and by Aryl diazonium salts. Structure elucidation by spectral techniques like IR, NMR, Mossbauer for compound of Si, Ge, Sn, Pb, As, Sb, Bi and Te.

Books recommended:

1. Lindsay, S. M., *Introduction to Nanosciences,* Oxford University Press (2010)
2. Muralidharan, V. S. & Subramania, A., *Nano Science and Technolony*, Ane Books Pvt. Ltd. (2009)
3. Cotton, F.A., Garg, V.C. & Wilkinson, *Advanced Inorganic Chemistry*, John Wiley 4th ed. (1930).
4. Gupta, B.D. & Elias, A.J., *Basic Organometallic Chemistry; Concepts, Synthesis and Applications* University Press 1st ed. (2010)
5. Rohtagi-Mukherjee, K. K., *Fundamentals of photochemistry*, New Age International (2018)
6. Turro, N. J., Ramamurthy, V., Scaiano, J. C., *Principles of molecular photochemistry An Introduction,* University Science Books 1st ed. (2009)

19 CHEP-102
Paper-II: Physical Chemistry (Optional)

Maximum Marks: 100
Theory: 80
Internal: 20
Max. Time: 3 hrs.
Credit: 4

Note: The question paper will contain eight questions in all. The candidates are required to attempt any five questions. All questions carry equal marks.

Unit-I

Electrodics: Electron transfer under an interfacial electrical field; Butler-Volmer equation, electrode kinetic involving semiconductor solution interface; Rate determining step in photo-electrochemical reaction; Ionic conductivity in solids; Solid electrolytes; Fast-ion conductors, oxygen ion conductors, sodium ion conductors; Solid state ionic devices, Batteries: Lithium batteries; Sodium batteries; fuel cells; sensors.

Unit-II

Quantum mechanics: The Born-Oppenheimer approximation, The Hellmann-Feynman theorem, Huckel molecular orbital (HMO) theory for linear and cyclic conjugated systems, . Applications of HMO theory (i) to set up and solve Huckle determinant equation (ii) to calculate resonance energy; (iii) to draw wave functions for molecular orbitals for the following molecules: (1) Ethylene molecule (2) Allyl system (Allyl radical and related ions) (c) Butadiene (d) Cyclobutadiene (e) Cyclopropenyl system (cyclopropenyl radical and the related ions) (f) Benzene ring.

Unit-III

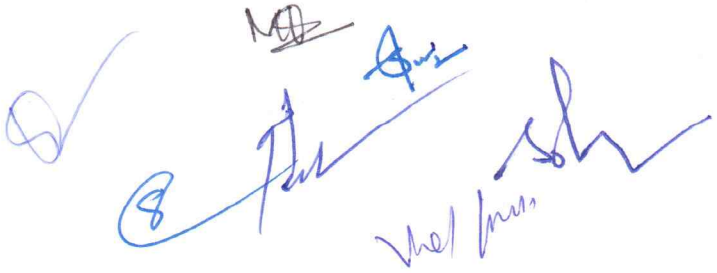
Surface Chemistry: Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), surface films on liquids (electro kinetic phenomenon),Surface active agents: General features, structure & classification, micellisation, mass action model and phase separation model, hydrophobic interactions, critical micellar concentration (CMC), factors affecting CMC of surfactants, thermodynamics of micelle formation, counter ion binding to micelles, reverse micelles.

Unit-IV

Nano materials Technology: Nano materials, Properties of nano structured materials (optical, magnetic, chemical and photo catalytic properties), Techniques for their synthesis (Hydrothermal, Solvothermal, solgel, Precipitation, Reverse Micelle Synthesis, Physical Vapour deposition (PVD), Chemical Vapour Deposition (CVD), Electro deposition and Characterization of nanomaterials by X-ray diffraction(XRD), Scanning Electron Microscope (SEM), Energy dispersive X-ray Analysis, Transmission Electron Microscope (TEM), Atomic Force microscopy (AFM) techniques. Applications of nanoscience and nanotechnology in various fields.

Books recommended:

1. Kapoor, K.L., *A Textbook of Physical Chemistry Volume 4*, Tata Mc Graw Hill (2015).
2. Mcquarrie, D. A., *Quantum Chemistry,* University Science Books 2nd ed. (2008)
3. Chandra, A.K., *Introductory Quantum Chemistry*, Tata Mc Graw Hill, 4th ed. (1998)
4. Levine, I. N., *Quantum Chemistry,* Pearson 7th ed. (2016).
Bockris, J. O' M. & Reddy, A. K. N., *Modern Electrochemistry 1: Ionics* Springer 2nd ed. (1998)
5. Bockris, J. O' M., & Reddy, A. K. N., *Modern Electrochemistry 2B: Electrodics in Chemistry, Engineering, Biology and Environmental Science* Springer 2nd ed. (2001)
Chattopadhyay, K. K., Banerjee, A. N., *Introduction to Nanoscience and Technology,* PHI Learning
Pvt. Ltd. (2009).
6. Lindsay, S. M., *Introduction to Nanosciences,* Oxford University Press (2010)
7. Muralidharan, V. S. & Subramania, A., *Nano Science and Technolony*, Ane Books Pvt. Ltd. (2009)



19 CHEP-102
Paper-II: Organic Chemistry (Optional)

Maximum Marks: 100
Theory: 80
Internal: 20
Max. Time: 3 hrs.
Credit: 4

Note: The question paper will contain eight questions in all. The candidates are required to attempt any five questions. All questions carry equal marks.

Unit-I

Stereo selective Synthesis: Principle of stereo selectivity, 1,2- and 1,3-asymmetric induction, acyclic, stereoselection, distereoselection in cyclic systems. Enantioselective synthesis: Enantioselective hydroboration, hydrogeantion, epoxidation, enantioselective synthesis via hydrazones. Role of enzymes in chiral synthesis.

Unit-II

Disconnection approach of synthesis: Introduction, main synthetic strategies, Syntheticstrategies of 1,2- and1,4-difuntionalised compounds, Group disconnection, Umpolung Strategies,functionalisation of carbonyl compounds. Synthetic approach to cyclic systems. Retro synthetic and reconnection strategies.
Reagents: Preparation and application of following reagents: Hypervalent iodine, organoboron reagents (IBBN, CATB, IpC_2BH, PINB), Organosilicon compounds, Trifluoromethyl sulphonates (triflates).

Unit-III

Heterocyclic compounds: General synthesis of (a) compounds with three or more heteroatoms in the ring (1,2,3)- and (1,2,4)-triazoles (1,2,4)- and (1,3,4)-oxadiazoles, (1,2,5)- and (1,3,4) thiadiazoles (1.2.3)-, (1,2,4)- and (1,3,5)-triazines. Tetrazoles and tetrazines.
(b) Bridgehead nitrogen containing compounds: 9 Indolines, Imidazo [1,2-a] and [1,5 a]pyridines Triazolo [1,5-a] pyridines, S-triazolo [3,4-b] [1,3,4] thiadiazoles Imidazo [2,1-b] [1,3,4] thiadiazoles, S-triazolo [3,4-b] [1,3,4] thiadiazines Thiazolo [3,2-b] [1,2,4] triazoles.

Unit-IV

Green Chemistry

Basic principles of green chemistry, Application of non-conventional techniques in organic synthesis (ultrasonic, microwave and grinding). Solid state synthesis and synthesis under solvent free conditions, Use of ionic liquids.

Drug discovery and development

A rational approach to drug design and drug development of following drugs: cimetidine oxamniquine.

Books recommended:

1. Asymmetric Synthesis Ed. J, D. Morrison, vol. 1-5. Academic Press.
2. Stereochemistry of Organic Compounds by D. Nasipuri.
3. Designing organic synthesis by S. Waren.
4. Heterocyclic Cchemistry by T. L. Gilchrist.
5. Comprehensive Heterocyclic Chemistry by A. R. Katritzky and C. W. Rees.
6. Green Chemistry by M. Kidwai and V. K. Ahluwalia.
7. Wilson and Gisvold's Text Book of organic medicinal and pharmaceutical chemistry Ed. R. F. Dorge.

19 CHEP-103
Paper-III: Review of Literature

Maximum Marks: 100
Theory: 80
Internal: 20
Credit: 4

1. The candidate will be required to study any of the following thrust areas of the research work being carried out in the department and submit a copy of review of literature with at least 50 relevant up to date references. (40)

i). Heterocyclic Chemistry
ii). Medicinal Chemistry
iii). Hypervalent Iodine Chemistry
iv). Application of Reagents in Chemistry
v). Green Chemistry
vi). Synthetic Organic Chemistry
vii). Theoretical Chemistry
viii). Computational Chemistry
ix). Physical Chemistry
x). Inorganic Chemistry
xi). Pharmaceutical Chemistry
xii). Nanochemistry
xiii). Natural Products Chemistry
xiv). Radiation Chemistry
xv). Nuclear Medicine
xvi). Material Chemistry
xvii). Supramolecular Chemistry
xviii). Nanomaterials
xix). Energy Storage Devices
xx). Any other thrust(s) are duly approved by the DRC

2. Presentation/Seminar on relevant review of literature submitted before the evaluation committee. (40)

Recommendation for the Candidate:

The candidate is expected to consult standard books, monographs, research papers and accounts for the above mentioned course