FACULTY OF SCIENCES

SYLLABUS

for

PRE-Ph.D COURSE IN CHEMISTRY
(Credit Based Evaluation & Grading System)
(SEMESTER: I - IV)

Examinations: 2019-20

GURU NANAK DEV UNIVERSITY
AMRITSAR

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Pre Ph.D. Course in Chemistry (CBE & GS)

**Scheme**

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<tr>
<th>Code</th>
<th>Paper</th>
<th>Credits</th>
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<tr>
<td>CYL 901</td>
<td>Biocatalysis, Organocatalysis and Inorganic Catalysis</td>
<td>3-0-0</td>
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<tr>
<td>CYL902</td>
<td>Biophysical Chemistry</td>
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<tr>
<td>CYL903</td>
<td>Supramolecular Chemistry</td>
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<td>CSL 901</td>
<td>Research Methodology</td>
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<td></td>
<td>Elective course from other departments (Candidate has to choose any one out the below mentioned)</td>
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<tr>
<td>ESL964</td>
<td>Good Laboratory Practices</td>
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<td>PHL902</td>
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Pre Ph.D. Course in Chemistry (CBE & GS)

BIOCATALYSIS, ORGANOCATALYSIS AND INORGANIC CATALYSIS
CYL 901

Credits: 3-0-0 (45hrs.)
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section A

Section B

Section C

Inorganic Catalysis: Fundamental reaction steps of transition metal catalysed reaction. Coordinative unsaturation, oxidative-addition, reductive elimination reactions, migratory insertion and elimination reactions. cleavage of C-H bonds, nucleophilic and electrophilic addition and abstraction. (7h)

(11h)

Books:

7. Advanced Inorganic Chemistry F.A Cotton 6th addition chapter 21 and 22, p. 1167-1294
BIOPHYSICAL CHEMISTRY
CYL902

Credits: 3-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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Section A

1. Forces & Interactions in Aqueous Solutions:
The denaturation of proteins; e.g denaturation of trypsin, the probabilities of the native & denatured states of a protein, thermal melting of proteins. Hydrogen bonds; Equilibrium constants for intra- and intermolecular peptide hydrogen bonds. Non-polar & Electrostatic interactions; hydrophobic interactions in micelles & proteins, estimation of the strength of non-polar interactions. The basis of non-polar interactions; hydrophobic interactions, cold denaturation, dispersion interactions, Electrostatic interaction.

Section B

2. Protein-protein and protein-ligand interactions; physical and chemical method for study, kinetics of protein folding-unfolding, equilibrium effect of temperature and solvent conditions on the thermodynamics of protein folding-unfolding equilibrium.

Section C

3. Techniques for the Study of Biological Structure and Function:
Spectroscopic techniques; magnetic resonance methods (epr, nmr), other optical techniques; Rotatory behaviour of macromolecules, circular dichroism (CD) and optical rotatory dispersion (ORD).
Thermal Techniques; Differential Scanning Calorimetry, Isothermal Titration Calorimetry.

Section D

4. Mechanism of Enzyme Catalysis:
Factors responsible for catalytic efficiency of enzymes and nature of enzyme active site; Kinetics of enzyme catalyzed reactions, Theories of enzyme catalysis: rate enhancements, transition state stabilization, transition state analogues, catalytic antibodies, substrate specificity and induced fit, testing theories of catalysis, Example of enzyme mechanisms: lysozyme, allosteric enzymes; and kinetics of enzyme inhibitors; Enzyme catalysis in solution-kinetics of thermodynamic analysis, effects of organic solvents on enzyme catalysis and structural consequences.
Books Recommended:


SUPRAMOLECULAR CHEMISTRY
CYL903

Credits: 3-0-0

Mid Semester Examination: 20% weightage
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Section-A
1. Introduction (11 Hrs)

What is supramolecular chemistry? Selectivity, The 'Lock and Key' Principle and Induced Fit Model, Complementarity, Cooperativity and the Chelate Effect Preorganisation, Binding Constants, Kinetic and Thermodynamic Selectivity, Solvation Effects, Supramolecular interactions, Ionic and dipolar interactions, Hydrogen bonding, -interactions, Van der Waal's interactions, Close packing in the solid state, Hydrophobic effects, Supramolecular design.

Section-B
2. Solution Host–guest Chemistry-I (12 Hrs)


Section-C
3. Solution Host–guest Chemistry-II (4 Hrs)

Supramolecular catalysis and enzyme mimics, Calix[4]arenes and Cyclodextrins as catalysts. Use of spectral techniques like NMR, UV and fluorescence in analytical sensing

4. Supramolecular Polymers, Gels and Fibres (7 Hrs)


Section-D
5. Molecular Devices (11 Hrs)

Books:

CSL901: Research Methodology in Computer Science

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4   0   0

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Section A
Research Aptitude: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is done.

Section B
Research Process: Reviewing the literature, Formulation of research problem, Nature and type of variables, Hypothesis - meaning, types, development of hypothesis and its testing, Meaning & Functions of Research Design

Data Analysis: Sources, acquisition and interpretation of data, Quantitative and qualitative data, Graphical representation and mapping of data, Sensitivity Analysis with Data Tables, Optimization with EXCEL Solver, Summarizing Data with Histograms and Descriptive Statistics, Pivot Tables, Summarizing Data with database statistical functions, using correlation, Multiple Regression, Using Sampling to Analyze Data

Section C
Significance of Report Writing: Different Steps in writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report, Art of scientific writing-Steps to better writing, flow method, organization of material and style, Drawing figures, graphs, tables, footnotes, references etc. in a research paper

Section D
Use of internet in research work : Use of internet networks in research activities in searching material, paper downloading, submission of papers, relevant websites for journals and related research work. Introduction to Patent laws etc., process of patenting a research finding, Copy right, Cyber laws.

References:
1. Research Methodology Methods and Techniques, Kothari, C. R., Wiley Eastern Ltd.
4. Practical Research Methods, Dawson, C., UBSPD Pvt. Ltd.
References:


GOOD LABORATORY PRACTICES
ESL964

Credits 3-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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Section-A

1. **Introduction to chemical analysis**: Nature of analytical chemistry, general directions of chemical analysis: Cleanliness in the laboratory, Recording and planning data. Data quality: Bias, Precision, Uncertainty, Method detection limit, Checking correctness of analysis, Expression of results, Significant figures, Collection and preservation of sample.

Section-B


Section-C


4. **Chemical reagents and standards**: Grade and purity of chemicals, Proper storage of chemicals and standards, Laboratory pure water, Preparation of reagent grade water, Reagent water quality.

Section-D


6. **Filtration**: Gravity, Vacuum, Centrifugation, Distillation: Simple, Fractional, Vacuum, Refluxing, Ion exchange, Drying and washing sample, Liquid-liquid extraction by separating funnel, Soxhlet extraction.

7. Software’s for stock room management, Role of computers in Laboratory occupational health and safety, Waste minimization and disposal.
Pre Ph.D. Course in Chemistry (CBE & GS)

References:

1. Csuros, M., Environmental Sampling and Analysis, Lewis Publications.


Note: For courses LSL901 and ESL964 students will attend classes in Department of Botanical and Environment Sciences.
EXPERIMENTAL TECHNIQUES
PHL902

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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Section-A
Physical basis, theory, instrumentation and applications of X-Ray Fluorescence Spectroscopy; LASER fluorimetry; Gamma-Gamma method; Neutron activation analysis and Neutron-Neutron method.

Section B
Gamma ray spectrometric technique for uranium, thorium and potassium analysis. Alpha particle track etch detector.

Section C

Section D

References:

Disaster Management
ESL961

Credits 3-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
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SECTION-A
1. Introduction to disasters, common terminologies. Management acts, policies & institutions in India.
2. Earthquakes
   Damage Prevention and Rehabilitation by
   Retrofitting Dos and Don'ts While Constructing
   Buildings Case study-Bhuj Earthquake 2001

SECTION-B
3. Floods
   Standard Operating Procedure for Administration
   Standard Operating Procedure for Individuals
   Case study-Assam Floods 2004
4. Cyclones
   Case study-Orissa Super Cyclone 1999
5. Droughts

SECTION-C
6. Landslides
7. Fire disasters- Forest Fires
   Case study-Peerchu Lake – A Disaster in Being Kumbakonam School Fire Tragedy
8. Avalanches
9. Tsunami
   Case study-Tsunami 2004

SECTION-D
9. Nuclear Disasters
   Dos and Don'ts While Commercial Nuclear
Disaster 10. Chemical and industrial Disasters
   Chemical and Industrial Disaster Mitigation
   Case study-Bhopal Gas Tragedy 1984

Note: Related Case Studies can be included as per the topic.