TITLES & COURSE OUTLINES FOR M.PHIL. CHEMISTRY

SEMESTER-I

CHEM 7105 Nuclear Magnetic Resonance Spectroscopy Credit Hour 3
CHEM 7106 Separation Techniques Credit Hour 3
CHEM 7107 Solid State Chemistry Credit Hour 3
CHEM 7108 Radiation Chemistry Credit Hour 3

TOTAL CREDIT HOURS 12

SEMESTER-II

CHEM 7206 Organic Polymer Chemistry Credit Hour 3
CHEM 7210 Instrumental Analysis (A Practical Course) Credit Hour 3
CHEM 7102 Principles of Biochemical Processes Credit Hour 3
CHEM 7212 Advanced Chemical Kinetics Credit Hour 3

TOTAL CREDIT HOURS 12

SEMESTER III AND IV

CHEM 7499 Research and Seminars Credit Hour 12
THESIS

TOTAL CREDIT HOURS 36

OPTIONAL COURSES

1. Environmental Chemistry CHEM 7204
2. Biosynthesis of Natural Products CHEM 7207
3. Gene Technology CHEM 7211
4. Nano Chemistry CHEM 7209
Course Code: CHEM-7105  
Course Title: Nuclear Magnetic Resonance Spectroscopy  
Credit hours: 03

COURSE CONTENTS:

Basic principles of 1D and 2D NMR spectroscopy, interpretation of $^1$H- and $^{13}$C-NMR spectra, factors affecting the chemical shifts and coupling constants. Recent advances in 1D and 2D-NMR spectroscopy including $J$-resolved, shift correlated multiple quantum spectra and inverse measurements. Identification of carbon-multiplicity with Distortionless Enhancement by Polarization Transfer (DEPT) technique. Applications of Heteronuclear Multiple-Quantum Coherence (HMQC), Heteronuclear Multiple-Bond Connectivity (HMBC) and Homonuclear Shift-Correlation Spectroscopy (COSY) in structure elucidation of organic molecules. Nuclear Overhauser Enhancement (NOE) and its applications in stereochemical dispositions. Introduction, principle and therapeutic applications of Magnetic Resonance Imaging (MRI).

RECOMMENDED BOOKS:

Course Code: CHEM-7106
Course Title: Separation Techniques
Credit hours: 03

COURSE CONTENTS:


RECOMMENDED BOOKS:

i- Analytical Chemistry
R. Kellner, J-M. Mermet, M. Otto, H.M. Widmer
ii- Quantitative Chemical Analysis
Daniel.C.Harris
iii- Practical Biochemistry
Principles and Techniques
Editors: Keith Wilson and John Walker
4th edition 1997
Cambridge University Press
iv- Fundamental Laboratory Approaches for Biochemistry and Biotechnology
Alexander J Ninfa & David P Ballou
Fitzgerald Science Press Inc. 1998
Bthesda, Maryland
Course Code: CHEM-7107
Course Title: Solid State Chemistry
Credit hours: 03

COURSE CONTENTS:

Brief description to symmetry and the concept of lattice, Data collection techniques, Determination of unit cell constants by single crystal techniques. Symmetry determination, indexing, reflection intensity determination and its relationship with structure factor, data reduction and calculations of structure factors, Electron density, Patterson factor and solving structure examples and refinement of structure by least square method. Direct methods.

RECOMMENDED BOOKS:

i- Solid State Chemistry (An Introduction) 2nd Edition
   Lasley Smart & Elaine Moore

ii- Reaction And Characterization Of Solids
   Sandra E. Dann

iii- Solid State Chemistry 1982
    R. M.etselaar, H.J.M. Heijligers, J. Schoonman
Course Code: CHEM-7108

Course Title: Radiation Chemistry

Credit Hours: 03

COURSE CONTENTS:


RECOMMENDED BOOKS:

SEMESTER II

Course Code: CHEM-7206
Course Title: Organic Polymer Chemistry
Credit hours: 03

COURSE CONTENTS:


RECOMMENDED BOOKS:

i- Introduction to Polymer Chemistry
   Charles E. Carraher Jr.
ii- Text Book Of Polymer Sciences
    Fred W. Billmeyer. Jr.
iii- Introductory Polymer Chemistry
     G. S. Mishra
iv- Text Book of Polymer
    S. Chand, M. S. Bhat Nagar
v- Principles of Polymer Chemistry
   Paul J. Flory

Course Code: CHEM-7102
Course Title: Principles Of Biochemical Processes
Credit hours: 03

COURSE CONTENTS:

A. Up Stream Processing
   a) Microorganisms of Industrial importance
b) Asceptic Techniques  
c) Isolation and Purification Maintenance of Microorganisms  
d) Fermentation and Fermentors  
e) Fermentation Media–Formulation and optimization  
f) Fermentation Kinetics  
g) Biotechnological productions  
   i. Solvents e.g. Ethanol, Acetone and Butanol etc.  
   ii. Industrial Enzymes  
   iii. Pharmaceuticals e.g. Antibiotics and Hormones etc.  
   iv. Organic acids and Amino acids  
   v. Electricity  
   vi. Biofuels  

B. Down Stream Processing  
a) General Introduction to Protein Biochemistry  
   Protein structure, charge, size, specific binding, solubility, membrane-bound proteins, cytoplasmic (soluble) proteins  

b) Purification Strategies  
   Introduction to protein purification, General Guidelines for down stream processing, three-phase purification strategies  

c) Techniques in Bimolecular purification: Column Chromatographies & electrophoresis  

d) Protocol for cellular proteins  
   Membrane preparation, solubilization techniques, dialysis, fractionation, chromatographic separations, purity check, characterization techniques  

e) Advanced techniques  
   FPLC-systems, Biosensors, Protein chip, Introduction of proteomics  
   Microfiltration, ultrafiltration, diafiltration.  

RECOMMENDED BOOKS:  
1. Principles of Fermentation Technology
Course Code: CHEM-7209
Course Title: Nano Chemistry
Credit hours: 03

COURSE CONTENTS:

Nanotechnology, nanomaterials, mesoporous, microporous and macroporous materials.

Nanoscale, Nanometer, Nanoparticles, Nanotubes, Thin films, Nanocomposites, Nanostructured bulk materials.

Synthesis of nanoparticles, mesoporous materials and composites (Bottom Up and Top Down Production). Synthesis by anodization, hydrothermal, convention heating, deposition-precipitation methods.

Characterization of nanomaterials by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Brunauer, Emmett and Teller (BET) adsorption method, Thermogravimetric Analysis (TGA), Atomic Absorption Spectroscopy (AAS), Ultraviolet-Visible Spectroscopy (UV-Vis) and Fourier Transform Infrared (FTIR) spectroscopy etc.
Importance of nanotechnology with special reference to environmental pollution, gas sensors, solar cells, catalysis.

RECOMMENDED BOOKS:


Course Code: CHEM-7204
Course Title: Environmental Chemistry
Credit hours: 03

COURSE CONTENTS:

(A). COMMONALITEIS IN ENVIRONMENT
The nature and composition of human environment, Relationship between environment, development and population. Elements of Environmental Management and Regulatory System in Pakistan (NEQS. Institutional Pollution Charge). Introduction to Agenda-21, ISO 14000 Sustainable Development. Cleaner Production, 5Rs Concept, Environmental Impact Assessment, Climate change, Ozone depletion, Acid rain and Acid precipitation.

(B). WATER POLLUTION
Sources of water pollution (industrial, sewage and agriculture), point and non-point source pollution, , Important parameters of water pollution monitoring, Wastewater treatment practices in Pakistan.

(C). ATMOSPHERIC CHEMISTRY:
The nature and composition of the atmosphere. The oxides of carbon, sulphur and nitrogen in the atmosphere. Particulate matter and minor inorganic pollutants in the atmosphere, atmospheric monitoring and chemical toxicology.

RECOMMENDED BOOKS:
1-Environmental Chemistry by Anil Kumar Volume-VI
2-Textbook of environmental chemistry by M., Mehra, O.D Tyagi
3-Principles of environmental chemistry by Geetha, Swanminathan, H Kothandaraman
4-Environmental chemistry by Ian Williams
5-An introduction to environmental chemistry by J.E. Andrews, P Brimblecombe, T.D. Jickells
6-Environmental chemistry by Stanley E. Manahan
7-Introduction to Atmospheric Chemistry by Daniel J Jacob
8- Atmospheric Chemistry and Physics, From Air Pollution to Climate Change Second Edition
Course Code: CHEM-7210  
Course Title: Instrumental Analysis (A practical Course)  
Credit hours: 03

COURSE CONTENTS:

1. Crystal structure determination of Organic and Inorganic compounds by Single Crystal Diffraction Technique
2. Quantitative determination of C,H,N and S in a given sample by using Elemental Analyzer
3. Estimation of metals by using Atomic absorption spectrophotometry
4. Extraction of oil from the pericarp of some citrus fruits/Fennel and their GC-MS analysis
5. Assay of drugs by using High Performance Liquid Chromatography
6. Purifications of serum proteins by Fast Protein Liquid Chromatography
7. Purity determination of active pharmaceuticals drugs by spectrophotometry

RECOMMENDED BOOKS:

1) Crystal Structure determination By Werner Massa
2) An introduction to X-Ray Crystallography By Michael M Woolfson
3) Analytical Chemistry By Gary D. Christian
4) Fundamentals of Analytical Chemistry By Douglas A Skoog

Course Title: Gene Technology
Course Code: Chem 7211
Crédit Horus: 03

COURSE CONTENTS:


RECOMMENDED BOOKS:

Principles Of Fermentation Technology
by Stanbury
Fermentation Microbiology and Biotechnology
by El-Mansi
Biochemistry (Mosby International Edition)
by James M Orten and Otto W. Neuhah
Fundamentals of Biochemistry
By Donald Voet and Judith G. Voet
Modern Protein Chemistry: Practical Aspect
By Gary C Howard and William E.
Biochemistry
by Albert L. Lehninger
Advances In Protein Chemistry
By Christian Anfinsen, John Edsall, Frederic Richards and David Eisenberg,
Course Title: **Biosynthesis of Natural Products**  
Credit hours: **03**

**COURSE CONTENTS:**

General Classification of Natural Products. Polyketide, Mevalonate and Shikimate metabolic pathways. Biosynthesis of fatty acids, prostaglandins, polyacetylenes, polyketide aromatic compounds, biosynthesis of terpenes and steroids, compounds derived from shikimic acid, biosynthesis of alkaloids from amino acids; biosynthesis of other amino-acid derived compounds (e.g. penicillin), biosynthesis of commercially important natural products (antibiotics, perfumery products, alkaloids, etc).

**RECOMMENDED BOOKS:**


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Course Code: **CHEM-7212**  
Course Title: **Advanced Chemical Kinetics**  
Credit hours: **03**  
Course Outlines:

**Reference Books for Chemical Kinetics**


