

2nd	CHM-3201	Principles of Organic Chemistry	3 (2-1)
	CHM-3202	Principles of Inorganic Chemistry	3 (2-1)
	CHM-3203	Principles of Physical Chemistry	3 (2-1)
	GEN-3204	Quantitative reasoning-II	3(3-0)
	GEN-3205	Expository writing	3(3-0)
	GEN-3206	Pakistan Studies	2(2-0)
	UOQ-3207	Understanding of Quran-1	1(0-1)

SEMESTER II

CHM-3201 Principles of organic Chemistry 3(2-1)

Basic concepts in chemical bonding

- Localized and delocalized bonding. Concept of hybridization leading to bond angles, bond energies and geometry of simple organic molecules; dipole moment; inductive effect; resonance, resonance energy, rules of resonance, resonance effect, steric inhibition of resonance; hyperconjugation; tautomerism; hydrogen bonding.
- Nomenclature of organic compounds
- Common and trivial name of organic compounds; and introduction to the systematic nomenclature of mono and bi-functional organic compounds by IUPAC rules.

Aromatic Hydrocarbons

- Aromatic Compounds Structure of benzene, aromaticity, electrophilic substitution including orientation and reactivity, addition and oxidation reactions, preparation and reactivity of naphthalene.

Isomerism

- Geometrical isomerism Determination of configuration of geometrical isomers, Z, E convention and cis- and trans- isomerism in compound containing two double bonds;
- Optical isomerism Optical activity, chirality and optical activity, racemisation and resolution of racemic mixture, R, S notation, diastereoisomers. Conformational isomerism
- A brief introduction to conformation of ethane, n-butane and cyclohexane.

Chemistry of the Hydroxyl Group and Ethers

- Brief review of the physical properties, preparation and reactions of alcohols. Phenols acidity, preparation and reactions, Ethers preparation, properties and reactions.

Chemistry of Carboxylic Acids and Their Derivatives

- Physical properties of carboxylic acids, effect of substitution and structure on the strengths of acidity of carboxylic acids. Preparation, properties and reactions of carboxylic acids and their derivatives i.e. ester, amides, acid halides and acid anhydrides

Practicals

- Sixteen experiments shall be conducted based on the following

a. Techniques

- Melting and boiling point determination
- Distillation, solvent extraction, crystallization.

b. Qualitative Organic Analysis

- Systematic identification of organic compound (1Compound)

c. Preparation of Organic Compounds

- Preparation of simple organic compound like iodoform, aspirin, acetanilide etc (1preparations)

Books Recommended:

1. R. K. Bansal, "A Text book of Organic Chemistry" 2nd Ed, Wiley Eastern Ltd; (1990).
2. I. L. Finar, "Fundamental Principles of Organic Chemistry" 3rd Ed, Vol.1, Longman, (1959).
3. J. March, "Advanced Organic Chemistry Reactions, Mechanisms and Structure" 6th Ed, John Wiley & Sons (2007).
4. J. McMurry, "Organic Chemistry" 5th Ed, Thomson Asia Ltd; Singapore (2000).
5. R. T. Morrison, R. N. Boyd, "Organic Chemistry" 6th Ed, Prentice-Hall, Inc; (1992).
6. S. H. Pine, J. B. Hendrickson, G. S. Hammond, "Organic Chemistry" 4th Ed, McGraw-Hill, Inc; (1992).

CHM-3202

Principles of Inorganic Chemistry

3(2-1)

The periodic Law and Periodicity Development of periodic table;

Classification of elements based on s, p, d, and f orbitals, group trends and periodic properties in s, p, d and f block elements i.e., atomic radii, ionic radii, ionization potentials. Electron affinities, electronegativities and redox potential.

Chemical Bonding in Main Block Elements Nature and types of chemical bonding, lewis concepts, ionic, covalent, coordinate covalent bond; Valence bond theory (VBT), Molecular orbital theory (MOT). Interpretation of shapes of inorganic molecules on the basis of valence shell electron pair repulsion (VSEPR) theory and hybridization.

Acid and Bases Concepts of acids and bases including soft and hard acid base concepts. Relative strengths of acids and bases, significance of pH, pK_a, pK_b and buffers solutions. Theories of indicators; (acid base, redox, adsorption). Solubility, solubility product, common ion effect and their industrial applications.

Chemistry of the p-block Elements General characteristics of the following group of p-block elements with reference to the aspects given against each Carbon and Silicon: Group anomalies. Allotropic forms of carbon, fullerenes and their applications. Production of pure silicon for solar energy and silicon chips, silicates and silicones and industrial applications.

Nitrogen and Phosphorus Group anomalies. Preparation, structures, properties and the environmental role of oxides of nitrogen. Industrial superphosphate fertilizers. Causes of fog and smog.

Oxygen and Sulfur Group anomalies.

Preparation, structure, properties and environmental role of oxides and oxyacids of sulphur, manufacturing of sulphuric acid and its reactions. Thionic acids and use of hypo in industry. The Halogens Anomalous behavior of fluorine. Industrial preparation of chlorine. Preparation, structures, properties and uses of oxides, oxyacids of chlorine, interhalogens and pseudohalogens.

The Noble Gases Preparation, properties, structures and uses of xenon fluorides; commercial uses of noble gases.

Practicals

1. Laboratory Ethics and Safety Measures: Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations.

2. Qualitative Analysis Analysis of four ions (two cations and two anions) from mixture of salts.

3. Preparation and standardization of normal and molar solutions of HCl, NaOH and KMnO_4 .

4. Quantitative analysis

- Determination of total hardness of water using EDTA.
- Estimation of magnesium using EDTA.
- Estimation of copper (iodometrically).
- Determination of ferricyanide using KI solution
- Determination of chloride by Volhard and Mohr methods.
- Estimation of chloride/bromide ions using adsorption (fluorescein) indicator.
- Percentage determination of ferric ions in ferric alum using KMnO_4 solution.
- Determination of purity of commercial potassium oxalate using KMnO_4 solution • Estimation of ferrous ferric ions using $\text{K}_2\text{Cr}_2\text{O}_7$ solution.
- Percentage determination of barium in barium nitrate by gravimetric method.
- Gravimetric determination of nickel.

Books Recommended:

1. F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, "Basic Inorganic Chemistry" 2nd Ed, John Wiley & Sons, USA (1987).
2. B. Douglas, D. McDaniel, J. Alexander, "Concepts and Models of Inorganic Chemistry" 3rd Ed, John Wiley & Sons, Inc. (1994).
3. J. W. Hill, R. H. Petrucci, "General Chemistry" 8th Ed, Prentice-Hall, Inc. (1996).
4. J. E. Huheey, "Inorganic Chemistry Principles of Structure and Reactivity" 2nd Ed, Harper and Row Publishers (1978).
5. J. D. Lee, "Concise Inorganic Chemistry" 5th Ed, Chapman and Hall (1996).
6. G. L. Miessler, A. T. Donald, "Inorganic Chemistry" 2nd Ed., Prentice-Hall International, Inc. (1991).
7. B. Moody, "Comparative Inorganic Chemistry" 3rd Ed, Routledge, Chapman and Hall, Inc.(1991). 8. D. F. Shriver, P.W. Atkins, C. H. Langford, "Inorganic Chemistry" Oxford University Press USA (1994).

CHM-3203

Principles of Physical Chemistry

3(2-1)

Chemical Kinetics:

Introduction, rate, molecularity and order of reaction, zero, first and second with same and different initial concentrations, half-lives of reactions, experimental techniques and methods for determination of rate and order of reaction (integration, half-life, initial rate, and graphical methods), activation energy and Arrhenius equation. Collision theory, transition state theory.

Chemical Equilibrium:

General equilibrium expressions, reaction quotients, examples of equilibrium reactions in solid, liquid and gas phases, extent of reactions and equilibrium constants, effect of temperature and pressure on the equilibrium constants/compositions, von't Hoff equation, Le-Chatelier's principle.

Basic Quantum Chemistry

Limitations of classical mechanics, Wave and particle nature of matter, de Broglie equation, Heisenberg uncertainty principle. Schrodinger wave equation and its solution for particle in one dimensional box. Concept of quantization of energy

Practicals

- Determination of viscosity and parachor values of liquids.
- Determination of percent composition of liquid solutions by viscometer
- Determination of refractive index and molar refractivity.
- Determination of percent composition of liquid solutions by refractive index measurements.
- Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).
- Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).
- Determination of heat of solution by solubility method.
- Determination of heat of neutralization of an acid with a base.

Books recommended:

1. R. Albert, "Physical Chemistry" 17 Ed., John Wiley and Sons, USA (1987).
2. P. W. Atkins, "Physical Chemistry" 6 Ed, W. H. Freeman and co. New York, USA (1998).
3. K. J. Laidler, "The World of Physical Chemistry" 1st Ed., Oxford University Press USA (1993).
4. K. J. Laidler, H. M. John, C. S. Bryan, "Physical Chemistry" 4th Ed., Houghton Mifflin Publishing Company Inc. (2003).
5. P. A. Peter, "Chemical Thermodynamics", 4th Ed, Oxford University Press, USA (1983).
6. S. E. Brain, "Basic Chemical Thermodynamics" 4 Ed., E. L. B. S. Publishers, (1990).
7. M. G. Barrow, "Physical Chemistry" 5 Ed, Mc Graw Hill (1992).

GEN-3204

Quantitative Reasoning-II

3(3-0)

Course Contents:

Logic, Logical and Critical Reasoning: Introduction and importance of logic; Inductive, deductive and abductive approaches of reasoning; Propositions, arguments (valid; invalid), logical connectives, truth tables and propositional equivalences; Logical fallacies; Venn Diagrams; Predicates and quantifiers; Quantitative reasoning exercises using logical reasoning concepts and techniques.

Mathematical Modeling and Analyses: Introduction to deterministic models; Use of linear functions for modeling in real-world situations; Modeling with the system of linear equations and

their solutions; Elementary introduction to derivatives in mathematical modeling; Linear and exponential growth and decay models; Quantitative reasoning exercises using mathematical modeling.

Statistical Modeling and Analyses: Introduction to probabilistic models; Bivariate analysis, scatter plots; Simple linear regression model and correlation analysis; Basics of estimation and confidence interval; Testing of hypothesis (z-test; t-test); Statistical inference in decision making; Quantitative reasoning exercises using statistical modeling.

Recommended Books:

1. Using and Understanding Mathematics: A Quantitative Reasoning Approach by Bennett, J. O., Briggs, W. L., & Badalamenti, A.
 2. Discrete Mathematics and its Applications by Kenneth H. Rosen.
 3. Discrete Mathematics with Applications by Susanna S. Epp.
 4. Applied Mathematics for Business, Economics and Social Sciences by Frank S. Budnick.
 5. Elementary Statistics: A Step-by-Step Approach by Allan Bluman.
 6. Introductory Statistics by Prem S. Mann.
 7. Applied Statistical Modeling by Salvatore Babones.
- Barrons SAT by Sharvon Weiner Green, M.A and Ira K. Wolf

GEN-3205

Expository Writing

Credit Hours: 3(3-0)

Course Objectives: The course is developed with the aim to enable the students to meet their real life communication needs by

- Helping them learn and understand basic concepts of communication process
- Practically implementing theoretical aspects in the real life situations

Course Contents:

What is Communication?

- Process of communication, effective steps of communication, basic communication skills

Paragraph Writing;

- Practice in writing a good, unified and coherent paragraphs
- Paragraph writing leading towards the writing of five to seven paragraphs long essay
- Stages of writing (brain storming, researching, drafting and editing)
- Methods of writing (cause and effect, problem solutions, comparison and contrast)

Essay Writing;

- Basic structure of essay, topic sentence, supporting sentence, concluding sentence, thesis statement
- Unity and Coherence, Introduction and Conclusion

CV and Job Application;

- Preparing a Curriculum Vitae
- Writing a formal job application

Translation Skills;

- Urdu to English

(Practice at advanced level)

Study Skills;

- Skimming and scanning, intensive, extensive and speed reading
- Summary and precis writing
- Comprehension (at advanced level)
- (sQ3R and Sq4r methods)

Academic Writing;

- Letter/ Memo writing, Minutes of Meeting, use of Dictionary, Library and Internet

Presentation Skills;

- Personality development (emphasis on content, style and pronunciation)
- Preparation stage, audience analysis, handling and asking questions, managing time, handling non-verbal means, feedback

Academic Writing;

- How to write a research proposal for research paper/term paper?
- How to write a research paper/ term paper?
- (Emphasis on style, content, language, form, clarity , consistency)

Report Writing;

- Technical Report writing
- Progress report writing
- Preparation and planning

E-mail writing;

- Creating e-mail account
- Writing and sending e-mails

Preparing for Interview and Research proposal/ research paper defense

Note: Documentaries to be shown for discussion and review

Recommended Books:

Communication Skills

a) Grammar

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b) Writing

- Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
- Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

c) Reading

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
2. Reading and Study Skills by John Langan
 - Study Skills by Richard York.
- d) Speaking

1. Ellen, K. 2002. Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top
2. Hargie, O. (ed.) Hand book of Communications Skills
3. Mandel, S. 2000. Effective Presentation Skills: A Practical Guide Better Speaking
4. Mark, P. 1996. Presenting in English. Language Teaching Publications

GEN-3206

Pakistan Studies

2(2-0)

Course Contents:

1. Introduction to Pakistan: Geographical location and significance. Historical background: Ancient civilizations in the region. • Factors leading to the creation of Pakistan.
2. Political History of Pakistan: • Formative phase. Military interventions and democratic transitions.
3. Geography of Pakistan: • Physiography: Mountains, plains, plateaus, deserts, valleys and coastal areas. • River systems: Indus River and its tributaries. Climatic regions of Pakistan.
4. Society and Culture of Pakistan: • Socio-cultural diversity. • Languages and literature of Pakistan.
5. Economic Development of Pakistan: • Agriculture and industrial sectors of Pakistan. • Economic challenges of Pakistan.
6. Contemporary Issues: • Foreign relations of Pakistan. Security challenges: terrorism, extremism, and regional conflicts. Environmental problems and sustainable development (SDGs). Media and social change.

Recommended Books:

1. "Jinnah of Pakistan" by Stanley Wolpert
2. "The Sole Spokesman: Jinnah, the Muslim League, and the Demand for Pakistan" by Ayesha Jalal
3. "The struggle for Pakistan" by Ishtiaq Husain Qureshi
4. "Pakistan, the Formative Phase, 1857-1948" by Khalid B. Sayeed
5. "Pakistan Studies: A Book of Readings" by Sikandar Hayat
6. "Constitutional and Political History of Pakistan" by Hamid Khan
7. "Trek to Pakistan" by Ahmad Saeed and Kh. Mansur Sarwar
8. "Pakistan: A Modern History" by Ian Talbot
9. "Politics in Pakistan: The Nature and Direction of Change" by Khalid B. Sayeed
10. "Physical Geography of Pakistan" by Umar Jahangir
11. "A Geography of Pakistan: Environment, People, and Economy" by Fazle Karim Khan
12. "Pakistan's Foreign Policy: An Historical Analysis" by S. M. Burke
13. "Separatism in East Pakistan" by Rizwan Ullah Kokab
14. "Being Pakistani: Society, Culture and the Arts" by Raza Rumi
15. "Pakistan's Cultural Heritage: Socio-Economic and Technological Aspects" edited by Abdul Jabbar Khan
16. "Language and Politics in Pakistan" by Tariq Rahman
17. "Sociology" by Horton and Hunt

18. "Pakistan in the Twentieth Century: A Political History" by Lawrence Ziring
 19. "Economic Development of Pakistan" by Ishrat Husain
 20. "Issues in Pakistan's Economy" by S. Zaidi

GEN-3207

Understanding of Quran-I

1(0-1)

Course Learning Objectives (CLOs)

By the end of this course, students will be able to:

- Demonstrate understanding of the background, revelation, and preservation of the Holy Quran.
- Interpret selected verses of the Quran with the help of authentic translations.
- Apply basic Arabic linguistic and grammatical features to comprehend Quranic text.
- Recognize major Quranic themes (faith, justice, ethics, mercy, patience, gratitude).
- Reflect on the Quran's guidance for personal conduct, social relations, and contemporary issues.

Course Contents:

Week	Units	Lesson	Assignments/home Task	Linguistic Rules
1	1	1-6	پڑھے گئے اسباق کے قرآنی الفاظ کا معنی لکھیں	معرفہ، مذکر مؤنث
	1	9-14	پڑھے گئے اسباق کے قرآنی الفاظ کا معنی لکھیں	جمع کی دو اقسام ، نکرہ اور و کا معنی
2	1	15-17	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ہذا، ہذہ ذالک ، تلک
	1	18-19 and revision of unit 1	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	لام تاکید ، اسم تفضیل
3	2	1-3	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ان ، لام کنی اور فی کی بحث
	2	4-6	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	حروف جار علی ، من ، الی
4	2	7-9	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	حروف جار "ب" ، لام نافیہ ، لام نفی جنس ، ما نافیہ اور الا
	2	10-13 and Revision of Unit 2	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ان ، کان ، حروف النداء
5	Unit 3	1-2	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	صفت ، موصوف

	3	3-5	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	مضاف ، مضاف الیہ
6	3	6-7	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	مضاف ، مضاف الیہ
	3	8-10 And revision of Unit 3	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	اسم فاعل ، اسم مفعول اور مثنیٰ
7	Midterm			
8	Unit 4	1-2	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر ہو منفصل ، ء ضمیر متصل
	4	3-4	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	حروف جار ، ضمیر متصل
8	4	5-8	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر منفصل انت ، ضمیر متصل "ک" مرکب اضافی اور ضمیر متصل
	4			
9	4	9-12	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر منفصل ہی ، ضمیر متصل ہا
	4	13-16	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر منفصل انا ، ضمیر متصل ی
10	4	17 and revision of unit 4	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	حال
	Unit 5	1-2	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	جمع منکر سالم ، جمع منکر سالم المسبوق بحرف الجر
11	5	3-4	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	جمع منکر سالم المسبوق بالإضافة
	5	5-6	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر ہم منفصل و متصل
12	5	7-8	پڑھے گئے اسباق کے قرآنی الفاظ ، قطعے اور جملوں کا ترجمہ لکھیں	اضافت اور حروف جار

	5	9-11	پڑھے گئے اسباق کے قرآنی الفاظ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر منفصل انتم اور متصل کم
13	5	12-14	پڑھے گئے اسباق کے قرآنی الفاظ، قطعے اور جملوں کا ترجمہ لکھیں	ضمیر منفصل نحن، متصل نا
	5	15-16	پڑھے گئے اسباق کے جملوں اور آیات کا ترجمہ لکھیں	حروف جار کو اضافت کے ساتھ ملانا
14	5	17-18	پڑھے گئے اسباق کے جملوں اور آیات کا ترجمہ لکھیں	اسما اشارہ ہؤلاء، اولئک
	5	19-23	پڑھے گئے اسباق کے جملوں اور آیات کا ترجمہ لکھیں	ما/الا، ان/الا، انما، لیس، ما، کان، (الا، الیس، الیوم، یومئذ، سبحان، مابینہما، قل، اذن، بئس، نعم ، کلا، ما ادراک، حسب، اعلم، مصیر، دینا(تمییز)
15	5	Revision unit 5		
	6	1-3	پڑھے گئے اسباق کے جملوں اور آیات کا ترجمہ لکھیں	فعل مضارع، جملہ فعلیہ، فعل مضارع، صیغہ مفرد
16	6	4-5	پڑھے گئے اسباق کے جملوں اور آیات کا ترجمہ لکھیں	فعل مضارع، صیغہ مفرد یعلم
	6	6	پڑھے گئے اسباق کے جملوں اور آیات کا ترجمہ لکھیں	فعل مضارع صیغہ جمع یعملون

Text Book

Course book: معلم القرآن از ڈاکٹر عبید الرحمن بشیر (جلد 1 تا 3)

Semester IV

GEN-4401

Introduction to Sociology

Credit Hours: 2(2-0)

Objectives: The course is designed to introduce the students with sociological concepts and the discipline. The focus of the course shall be on significant concepts like social systems and structures, socio-economic changes and social processes. The course will provide due foundation for further studies in the field of sociology.

Course Outline

Unit I: Introduction

- a. Definition, Scope, and Subject Matter
- b. Sociology as a Science
- c. Historical back ground of Sociology

Unit II: Basic Concepts

- a. Group, Community, Society
- b. Associations
 - i. Non-Voluntary
 - ii. Voluntary
- c. Organization
 - i. Informal
 - ii. Formal
- d. Social Interaction
 - i. Levels of Social Interaction
 - ii. Process of Social Interaction
 1. Cooperation
 2. Competition
 3. Conflict
 4. Accommodation
 5. Acculturation and diffusion
 6. Assimilation
 7. Amalgamation

Unit III: Social Groups

- a. Definition & Functions
- b. Types of social groups
 - i. In and out groups
 - ii. Primary and Secondary group
 - iii. Reference groups
 - iv. Informal and Formal groups
 - v. Pressure groups

Unit IV: Culture

- a. Definition, aspects and characteristics of Culture
 - i. Material and non-material culture
 - ii. Ideal and real culture
- b. Elements of culture
 - i. Beliefs
 - ii. Values
 - iii. Norms and social sanctions

c. Organizations of culture

- i. Traits
- ii. Complexes
- iii. Patterns
- iv. Ethos
- v. Theme

d. Other related concepts

- i. Cultural Relativism
- ii. Sub Cultures
- iii. Ethnocentrism and Xenocentrism
- iv. Cultural lag

Unit V: Socialization & Personality

- a) Personality, Factors in Personality Formation
- b) Socialization, Agencies of Socialization
- c) Role & Status

Unit VI: Deviance and Social Control

- a) Deviance and its types
- b) Social control and its need
- c) Forms of Social control
- d) Methods & Agencies of Social control

Unit VII: Collective Behavior

- a) Collective behavior, its types
- b) Crowd behavior
- c) Public opinion
- d) Propaganda
- e) Social movements
- f) Leadership

Recommended Books:

1. Anderson, Margaret and Howard F. Taylor. 2001. *Sociology the Essentials*. Australia: Wadsworth.
2. Brown, Ken 2004. *Sociology*. UK: Polity Press
3. Giddens, Anthony 2002. *Introduction to Sociology*. UK: Polity Press.
4. Macionis, John J. 2006. 10th Edition *Sociology* New Jersey: Prentice-Hall
5. Tischler, Henry L. 2002. *Introduction to Sociology* 7th ed. New York: The Harcourt Press.
6. Frank N Magill. 2003. *International Encyclopedia of Sociology*. U.S.A: Fitzroy Dearborn Publishers
7. Macionis, John J. 2005. *Sociology* 10th ed. South Asia: Pearson Education
8. Kerbo, Harold R. 1989. *Sociology: Social Structure and Social Conflict*. New York: Macmillan Publishing Company.
9. Koenig Samuel. 1957. *Sociology: An Introduction to the Science of Society*. New York: Barnes and Nobel..
10. Lee, Alfred Mclung and Lee, Elizabeth Briant 1961. *Marriage and The family*. New York: Barnes and Noble, Inc.
11. Leslie, Gerald et al. 1973. *Order and Change: Introductory Sociology* Toronto: Oxford University Press.

12. Lenski, Gevbard and Lenski, Jeam. 1982. *Human Societies*. 4th edition New York: McGraw-Hill Book Company.
13. James M. Henslin. 2004. *Sociology: A Down to Earth Approach*. Toronto: Allen and Bacon.

GEN-4402

Civics and Community Engagement

Credit Hours: 2(2-0)

Course Contents:

1. Civics and Citizenship:
 - Concepts of civics, citizenship, and civic engagement.
 - Foundations of modern society and citizenship.
 - Types of citizenship: active, participatory, digital, etc.
2. State, Government and Civil Society:
 - Structure and functions of government in Pakistan.
 - The relationship between democracy and civil society.
 - Right to vote and importance of political participation and representation.
3. Rights and Responsibilities:
 - Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973.
 - Civic responsibilities and duties.
 - Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.)
4. Community Engagement:
 - Concept, nature and characteristics of community.
 - Community development and social cohesion.
 - Approaches to effective community engagement.
 - Case studies of successful community driven initiatives.
5. Advocacy and Activism:
 - Public discourse and public opinion.
 - Role of advocacy in addressing social issues.
 - Social action movements.
6. Digital Citizenship and Technology:
 - The use of digital platforms for civic engagement.
 - Cyber ethics and responsible use of social media.
 - Digital divides and disparities (access, usage, socioeconomic, geographic, etc.) and their impacts on citizenship.
7. Diversity, Inclusion and Social Justice:
 - Understanding diversity in society (ethnic, cultural, economic, political etc.).
 - Youth, women and minorities' engagement in social development.
 - Addressing social inequalities and injustices in Pakistan.
 - Promoting inclusive citizenship and equal rights for societal harmony and peaceful co- existence.

Suggested Reading

1. "Civics Today: Citizenship, Economics, & You" by McGraw-Hill Education.
2. "Citizenship in Diverse Societies" by Will Kymlicka and Wayne Norman.

3. "Engaging Youth in Civic Life" by James Youniss and Peter Levine.
4. "Digital Citizenship in Action: Empowering Students to Engage in Online Communities" by Kristen Mattson.
5. "Globalization and Citizenship: In the Pursuit of a Cosmopolitan Education" by Graham Pike and David Selby.
6. "Community Engagement: Principles, Strategies, and Practices" by Becky J. Feldpausch and Susan M. Omilian.

GEN-4403

Ideology and Constitution of Pakistan

Credit Hours: 2(2-0)

Course Objectives

By the end of this course, students will be able to:

1. Demonstrate enhanced knowledge of the basis of the ideology of Pakistan with special reference to the contributions of the founding father of Pakistan.
2. Demonstrate fundamental knowledge about the Constitution of Pakistan 1973 and its evolution with special reference to state structure.
3. Explain about the guiding principles on rights and responsibilities of Pakistan citizens as enshrined in the Constitution of Pakistan 1973.

Course Contents

- 1. Introduction to the Ideology of Pakistan:**
 - Definition and significance of ideology.
 - Historical contest of the creation of Pakistan (with emphasis on socio-political religious and cultural dynamics of British India between 1857 till 1947).
 - Contributions of founding fathers of Pakistan of Pakistan in the freedom movement including but not limited to Allama Muhammad Iqbal, Muhammad Ali Jinnah., etc.
 - Contributions of women and students in the freedom movement for separate homeland for Muslims of British India.
- 2. Two-Nation Theory:**
 - Evolution of the Two-Nation Theory (Urdu-Hindi controversy, Partition of Bengal, Simla Deputation 1906, Allama Iqbal's Presidential Address 1930, Congress Ministries 1937 Lahore Resolution 1940).
- 3. Introduction to the Constitution of Pakistan:**
 - Definition and importance of a constitution.
 - Ideological factors that shaped the Constitution(s) of Pakistan (Objectives Resolution 1949).
- 4. Constitution and State Structure:**
 - Structure of Government (executive, legislature, and judiciary).
 - Distribution of powers between federal and provincial governments.
 - 18th Amendment and its impact on federalism.
- 5. Fundamental Right, Principles of Policy and Responsibilities:**
 - Overview of fundamental rights guaranteed to citizens by the Constitution of Pakistan 1973 (Articles 8-28).
 - Overview of Principles of Policy (Articles 29-40).
 - Responsibilities of the Pakistan citizens (Article 5).

6. Constitutional Amendments:

- Procedures for amending the Constitution.
- Notable Constitutional amendments and their implications

Recommended Books

1. "The Idea of Pakistan" by Stephen P. Cohen.
2. "Ideology of Pakistan" by Javed Iqbal.
3. "The Struggle for Pakistan" by I.H. Qureshi.
4. "Pakistan the Formative Phase" by Khalid Bin Sayeed.
5. "Pakistan: Political Roots and Development" by Safdar Mahmood.
6. "Ideology of Pakistan" by Sharif-ul-Mujahid.
7. "The Struggle for Pakistan: A Muslim Homeland and Global Politics" by Ayesha Jala.
8. "Jinnah, Pakistan and Islamic Identity: The Search for Saladin" by Akbar S. Ahmed.
9. "The Making of Pakistan: A Study in Nationalism" by K.K. Aziz.
10. "Pakistan: A New History" by Lan Talbot.
11. "Pakistan in the Twentieth Century: A Political History" by Lawrence Ziring.
12. "The Constitution of Pakistan 1973". Original.
13. "Constitutional and Political Development of Pakistan" by Hamid Khan.
14. "The Parliament of Pakistan" by Mahboob Hussain.
15. "Constitutional Development in Pakistan" by G.W. Choudhury.
16. "Constitution-Making in Pakistan: The Dynamics of Political Order" by G.W. Choudhury.

BOT-4404 Cell Biology, Genetics & Evolution

3(2-1)

Aims and Objectives

To understand

1. Structure and functions of cell.
2. Nature of genetic material and hereditary process.
3. Familiarization with evolutionary processes.

Course Contents

a) Cell biology

1. Structures and Functions of Biomolecules Carbohydrates, Lipids, Proteins, Nucleic Acids
2. Cell: Physico-chemical nature of plasma membrane and cytoplasm.
3. Ultrastructure of plant cell with a brief description and functions of the following organelles
Cell wall, Endoplasmic reticulum, Plastids, Mitochondria, Ribosomes, Dictyosomes, Vacuole, Microbodies (Glyoxysomes and Peroxisomes)
4. Nucleus: Nuclear membrane, nucleolus, ultrastructure and morphology of chromosomes, Karyotype analysis
5. Reproduction in somatic and embryogenic cell, mitosis and meiosis, cell cycle

6. Chromosomal aberrations; Changes in the number of chromosomes. Aneuploidy and euploidy.
Changes in the structure of chromosomes, deficiency, duplication, inversion and translocation.

b) Genetics

1. Introduction, scope and brief history of genetics. Mendelian inheritance; Laws of segregation and independent assortment, back cross, test cross, dominance and incomplete dominance.
2. Sex linked inheritance, sex linkage in Drosophila and man (colour blindness), XO, XY, WZ mechanisms, sex limited and sex-linked characters, sex determination.
3. Linkage and crossing over: definition, linkage groups, construction of linkage maps, detection of linkage.
4. Molecular genetics; DNA replication. Nature of gene, genetic code, transcription, translation, protein synthesis, regulation of gene expression (e.g., lac operon).
5. Transmission of genetic material in Bacteria: Conjugation and gene recombination in E. coli, transduction and transformation.
6. Principles of genetic engineering / biotechnology; Basic genetic engineering techniques.
7. Application of genetics in plant improvement: Induction of genetic variability (gene mutation, recombination), physical and chemical mutagens, selection, hybridization and plant breeding techniques. Development and release of new varieties.
8. Introduction to germplasm conservation

c) Evolution

The nature of evolutionary forces, adaptive radiation, differential reproductive potential, first plant cell, origin of organized structures, early aquatic and terrestrial ecosystem, first vascular plant.

Practical

Study of cell structure using compound microscope and elucidation of ultrastructure from electron microphotographs

1. Measurement of cell size.
2. Study of mitosis and meiosis by smear/squash method and from prepared slides.
3. Study of chromosome morphology and variation in chromosome numbers.
4. Extraction and estimation of carbohydrate, protein, RNA and DNA from plant sources

Genetics

1. Genetical problems related to the transmission and distribution of genetic material.

2. Identification of DNA in plant material. Carmine/orcein staining.
3. Study of salivary gland chromosomes of *Drosophila*.

Recommended Books:

1. Hoelzel, A. R. 2001. Conservation Genetics. Kluwer Academic Publishers.
2. Dyonsager, V.R. (1986). Cytology and Genetics. Tata and McGraw Hill Publication Co. Ltd, New Delhi.
3. Lodish. H. 2001. Molecular Cell Biology. W. H. Freeman and Co.
4. Sinha, U. and Sinha, S. (1988). Cytogenesis Plant Breeding and Evolution, Vini Educational Books, New Delhi.
5. Strickberger, M.V. (1988), Genetics, MacMillan Press Ltd., London.
6. Carroll, S.B., Grenier, J.K. and Welnerbee, S.d. 2001. From DNA to Diversity - Molecular Genetics and the Evolution of Animal Design. Blackwell Science.
7. Lewin, R, 1997. Principles of Human Evolution. Blackwell Science.
8. Strickberger, M. W. 2000 Evolution. Jones & Bartlet Publishers Canada
9. Ingrouille M. J. & B. Eddie. 2006. Plant Diversity and Evolution. Cambridge University Press.

GEN-4405

Organic Chemistry

Credit Hours: 4(3-1)

Course Contents:

1. Basic Concepts in Organic Chemistry Hybridization of orbitals of carbon atoms in alkanes, alkenes, alkynes and arenes. Hybridization of orbitals of nitrogen, oxygen and sulphur atoms in various functional groups. Localized and delocalized chemical bonding. Conjugation and hyper conjugation. Resonance, rules of resonance, resonance energy, resonance hybrid, factor effecting the resonance; inductive effect, Applications of inductive effect and resonance on various properties of organic compounds; Steric effect and its applications, Hydrogen bonding and its effect on various properties of organic compounds, Tautomerism.
2. Nomenclature of Organic Compounds: Nomenclature of alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes, spiroalkanes, monofunctional and polyfunctional derivatives of open chain and cyclic compounds, polysubstituted benzenes, polycyclic hydrocarbons such as naphthalene, anthracene, phenanthrene and their derivatives and heterocyclic compounds.
3. Aromatic Hydrocarbons: Structure of benzene, Resonance energy of benzene, Aromaticity, Criteria for aromaticity, Evidences of aromaticity, Natural sources of aromatic hydrocarbons; Preparation of aromatic hydrocarbons by different methods. Reactions of aromatic hydrocarbons:

electrophilic aromatic substitution reactions i.e. nitration, halogenation, Friedal-Crafts reaction and its limitations, sulfonation; Orientation and reactivity of substituted benzenes; Nucleophilic aromatic substitution reactions; reaction such as addition, hydrogenation, Birch reduction, and oxidation reactions of side chain. Polycyclic aromatic hydrocarbons like naphthalene, anthracene and phenanthrene, their resonance structures and relative stabilities. Synthesis of naphthalene, Electrophilic substitution reactions of naphthalene, Oxidation and reduction reactions, Brief description of orientation and reactivity of naphthalenes.

4. Isomerism Conformational Isomerism: conformational analysis of ethane, n-butane, cyclohexane, mono- and di-substituted cyclohexanes. Optical isomerism: optical activity, chirality and optical activity; enantiomers, diastereomers; racemates and their resolution; D, L and R, S conventions; Optical isomerism in cyclohexanes, biphenyls and allenes. Geometrical isomerism: cis and trans isomers; E-Z convention; determination of configuration of the isomers; inter-conversion of geometrical isomers; geometrical isomerism in cyclic compounds.

5. Alkyl halides: Preparation of alkyl halides from alcohols, carboxylic acids; Chemical reactions: Aliphatic nucleophilic substitution reactions, SN1 and SN2 mechanism, effects of the nature of substrates, attacking nucleophile, leaving group and the nature of solvent. Elimination reactions, E1 and E2 mechanisms, orientation of elimination (Hoffmann and Saytzeff rules). Grignard Reagents; synthesis, structure, and reactions with active hydrogen compounds carbonyl compounds such as aldehydes, ketones, esters, acid halides and CO₂; reaction with nitriles, ethylene oxides, sulphur and oxygen.

6. Chemistry of Phenols and Ethers Phenols: Physical properties; Synthesis of phenols, reactions of phenols such as acylation, Friedal-Crafts reaction, Nitration, Sulphonation, Carbonation, Formylation and Diazo coupling. Ethers: Physical properties, Preparation of ether from alcohols, alkyl halides and alkenes; Reactions of ether, brief introduction of crown ethers and polyethers.

7. Chemistry of Carbonyl Compounds: Preparation of aldehydes and ketones, by pyrolysis of calcium salts of acids, acylation of alkenes and arenes, reduction of acid halides and nitriles. Physical properties of aldehydes and ketones; Structure and reactivity of carbonyl group; Comparison of the reactivity of aldehydes and ketones; Nucleophilic addition of water, alcohols, ammonia and its derivatives, hydrogen cyanide, bisulfite, reduction and oxidation reactions; Aldol condensation and related reactions, Cannizzaro's reaction, Wittig reaction, oxidation reactions, chemical tests of aldehydes and ketones.

8. Chemistry of Carboxylic Acids and their Derivatives: Physical properties of carboxylic acids; Effects of different parameters on the acid strengths of aliphatic and aromatic carboxylic acids. Chemical properties like salt formation nucleophilic acyl substitution, reduction of carboxylic acids,

decaronylation, Hunsdicker reaction, Kochi reaction, substitution at α -carbon. Preparations, properties and reactions of acids chlorides, acids anhydrides, amides, cyanides and esters; Maolnic and acetoacetic esters synthesis.

9. Heterocyclic Compounds: Methods of preparation of pyrol and pyridine, their aromatic character and comparison with benzene. Important reactions of pyrrol and pyridine.

Recommended Books:

1. M. Yousan, A Textbook of Organic Chemistry, Ilmi kitab Khana, Urdu Bazar, Lahore. 2. Khairat M. Ibe Rasa, M.A. Rehman and Abdul Rehman, Organic Chemistry, Caravvan Book House, Lahore.

Reference Books:

1. Younas, M., Text Book of Chemistry, Ilmi Kutab Khana, Lahore.
2. Rehman, A., Text Book of organic Chemistry, Karwan Book House, Lahore.
3. Bhatti, H. N. and Rahman, R. 2013. Text Book of Organic Chemistry. Caravan Book House Pakistan.
4. Bahl, A., and B. S. Bhat. "A Text Book of Organic Chemistry, 17th Edn, S."Chand and Company, New Delhi ISBN: 81-219.
5. March, J., Advance Organic chemistry, John Wiley & Sons, New York.
6. I. L. Finar, "Organic chemistry", Vol. I, Pearson Education, L.P.E.
7. I. L. Finar, , "Organic chemistry", Vol. II, 5th Edition, L.P.E.
8. Jerry March, "Advanced Organic chemistry, Reaction, Mechanism and Structure", 5th Edition, Wiley Inter Science.
9. Morison and Boyd, "Organic chemistry", 6th Edition, Prentice Hall.
10. Seyhan N. Ege, "Organic chemistry Structure and Reactivity", 3rd Edition, The University of Michijan, A.I.T.D.S. Publishers & Distributors (Redg).

Organic Chemistry Practical

1. Compound Analysis: Identification of organic compounds containing only one functional group with special emphasis on compounds containing following functional groups. -COOH, -OH, C=O, -NH₂ and -CONH₂
2. Preparation of organic compounds: Preparation and techniques of purification of tribromophenol, nitrobenzene, aspirin, ethyl benzoate and benzoic acid from toluene, butyl chloride, acetanilide.
3. Basic Experimental techniques used in organic chemistry: Simple distillation, Solvent extraction, Sublimation, Re-Crystallization.

4. Estimation (Volumetric): Determination of molecular weight of carboxylic acid. Estimation of amide group and glucose.

Recommended Book:

Muhammad Abid Khawaja, Practical Chemistry Note Book, Organic Chemistry, Ilmi Kitab Khana, Urdu Bazar, Lahore.

GEN-4406 Animal Form and Function-I Credit Hours: 4(3+1)

Course Objectives:

The Objectives of the courses are:

1. To teach about animals' diversity adapted in different strategies' for performance of their similar functions through modifications in body parts in past and present times.
2. To impart understanding of diverse strategic structural adaptations in each of the functional systems of nutrition, excretion, osmoregulation and reproduction and development for effective survival in their specific conditions.
3. To understand the organ systems, their specialization and coordination with each other and constantly changing internal and external environment, inside and outside the animal's body.
4. To embrace the phenomena in basic structure of each system that determines its particular function.

Course Learning Outcomes:

1. Acquire the concept that for the performance of a function for example exchange of respiratory gases the different forms are adapted in t environments e.g. gills in aquatic and lungs in terrestrial environment.
2. Understand that diverse forms adapted to perform the same functions are because of the different past and present conditions.
3. Solve of emergence of diversity of forms for the performance of similar function.
4. Analyze the requirements of diverse forms for the performance of similar function in their past and present needs.
5. Evaluate the adaptations in forms for its efficiency in managing the function in differing situations in the past and present times.
6. Demonstrate that a form is successfully adapted to perform a function adequately and successfully.

Course Outline:

1. Nutrition and Digestion:
 - a. Evolution of nutrition; the metabolic fates of nutrients in heterotrophs; digestion
 - b. Animal strategies for getting and using food, diversity in digestive structures of invertebrates.

- c. The mammalian digestive system: gastrointestinal motility and its control
 - d. Oral cavity, pharynx and esophagus, stomach, small intestine: main site of digestion; large intestine; role of the pancreas in digestion; and role of the liver and gallbladder in digestion.
2. Temperature and Body Fluid Regulation:
- a. Homeostasis and Temperature Regulation; The Impact of Temperature on Animal Life; Heat Gains and Losses; Some Solutions to Temperature Fluctuations; Temperature Regulation in Invertebrates, Fishes, Amphibians, Reptiles, Birds and Mammals; Heat Production in Birds and Mammals
 - b. Control of Water and Solutes (Osmoregulation and Excretion); Invertebrate and Vertebrate
 - c. Excretory Systems; How Vertebrates Achieve Osmoregulation; Vertebrate Kidney Variations; Mechanism in Metanephric Kidney Functions. Reproduction and Development
3. Reproduction:
- a. Asexual reproduction in invertebrates; advantages and disadvantages of asexual reproduction;
 - b. Sexual reproduction in invertebrates; advantages and disadvantages of sexual reproduction; sexual reproduction in vertebrates; reproductive strategies; examples of reproduction among various vertebrate classes;
 - c. The human male reproductive system: spermatogenesis, transport and hormonal control, reproductive function;
 - d. The human female reproductive system: folliculogenesis, transport and hormonal control, reproductive function; hormonal regulation in gestation; prenatal development and birth: the placenta; milk production and lactation.
4. Descriptive Embryology:
- a. Fertilization; embryonic development: cleavage, and egg types; the primary germ layers and their derivatives;
 - b. Echinoderm embryology;
 - c. Vertebrate embryology: the chordate body plan,

 - d. Amphibian embryology, development in terrestrial environments,
 - e. Avian embryology, and the fate of mesoderm.

Practicals:

- 1. Study of excretory system in an invertebrate and a vertebrate representative (Model).
- 2. Study of digestive system in invertebrate and a vertebrate representative (Dissection).
- 3. Dissection and study of male and female reproductive system in vertebrates and invertebrates.

4. Study of stages in the development of an Echinoderm.
5. Study of early stages in the development of a frog, chick and a mammal.

Note: Prepared slides and preserved specimen and/or projection slides and/or CD ROM computer projections may be used.

Books Recommended

1. Pechenik, J.A. 2013. Biology of Invertebrates, 4th Ed. (International), Singapore: McGraw-Hill.
2. Arthur, M. M. 2010. Vertebrate Embryology.
3. Hickman, C.P., Roberts, L.S., Larson, A. 2004. Integrated Principles of Zoology, 11th Ed. (International), Singapore: McGraw-Hill.
4. Miller, S.A., Harley, J.B. 2002. Zoology, 5th, 6th, 7th, 8th, 9th, 10th & 11th Ed. (International), Singapore: McGraw-Hill.
5. Campbell, N.A. 2002. Biology, 6th Ed. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
6. Kent, G.C., Miller, S. 2001. Comparative Anatomy of Vertebrates. New York: McGraw-Hill.
7. Hickman, C.P., Kats, H.L. 2000. Laboratory Studies in Integrated Principles of Zoology. Singapore: McGraw-Hill.

VI Semester

CHM-5601

Physical Chemistry-II

4(3-1)

1. **Quantum mechanics**

Black Body radiations, photoelectric effect, Compton effect, postulates of quantum mechanics, concept of wave functions, operators, eigen and non-eigen functions, derivation of Schrodinger wave equation for one dimension and three dimensions, concept of degeneracy, orthogonal and normalized set of functions, tunneling effect, Pauli exclusion principle.

2. **Electrochemistry**

Conductance, resistance, types of electrolytic dissociation, weak and strong electrolytes, activity, activity coefficients and their determination by emf method, Debye-Huckel limiting law, Huckel and Onsager equation on conductance, concept of electrode potential, standard electrode potential, development of cells, calculation of cell constant, change in free energy and entropy of electrochemical cells, electrochemical basis for corrosion.

3- **Nuclear Chemistry**

Atomic nucleus, nuclides, nuclear stability, modes of decay, nuclear energetics, , fusion and fission, non-spontaneous nuclear processes, nuclear reactors, beta decay systematic, nuclear spins.

Books Recommended

1. Albery, R.A and Silbey, R.J., "Physical Chemistry" John Wiley, New York, 1995.
2. Atkins, P.W, "Physical Chemistry" 5th Ed., W.H. Freeman & Company, New York, 1994.
3. Barrow, G. M., "Physical chemistry" McGraw Hill, Singapore, 1988.
4. Levine, I.N., "Quantum Chemistry" 4th Ed., Prentice Hall, New Jersey, and Prentice Hall India 1991.
5. Hanna, M.W., "Quantum Mechanics in Chemistry" 3rd Ed., The Benjamin/Cummings Co., California, 1981.
6. Lowe, J.P., "Quantum Chemistry" 2nd Ed. Academic Press. Boston.2 New York, 1993.
7. Bockris, J.M. and Reddy, A. K. N., "Modern Electrochemistry" Plenum Press, New York, 1970.

8. Bard. A. and Faulkner, L.R., "Electrochemical Methods Fundamentals and Applications"
John Wiley, New York, 1980.

Potentiometry

1. Determine the pH of a given solution by buffer solution method.
2. To find out the strength of HCl solution by titrating it against NaOH solution using pH meter.
3. Determine the dissociation constant of weak acid using potentiometer.

Conductometry

1. Conductance measurements.
2. Find out the strength of HCl solution by titrating it against NaOH solution conductometrically.

Books Recommended

1. Daniel, F. and et al, "Experimental physical chemistry" New York McGraw Hill, New York.
2. Findlay, A.and. Kitchner, J.A., "Practical physical Chemistry" Longman, Green and Co.,1976.
3. Shoemaker, D.P. and Garland, C., "Experiments in physical chemistry" McGraw Hill, New York.

CHM-5602

Organic Chemistry-II

4(3-1)

Functional Groups Chemistry: Synthesis and reactions with mechanisms and stereochemical aspects. Hydrocarbons (Saturated, unsaturated, aromatic) alkyl halides, alcohols, phenols, ethers, amines, carbonyl compounds, carboxylic acids and their derivatives. Brief introduction to UV, IR, Mass spectrometry and NMR.

Recommended Books

1. F.A. Carey, Organic Chemistry, 6th ed., McGraw-Hill, Higher Education, Boston (2006).

2. J.G. Smith, Organic Chemistry, McGraw-Hill, Boston (2006).

Supplementary Books

1. T.W.G. Solomon and C.B. Fryhle, Organic Chemistry, 8th ed., John-Wiley, New York (2004).

2. L.G. Wade, Organic Chemistry, 5th ed., Pearson Education, New Delhi (2003).

3. M.A. Fox and J.K. Whitesell, Organic Chemistry, 3rd ed., Jones and Bartlett, Boston (2003).

Supplementary Books

1. T.W.G. Solomon and C.B. Fryhle, Organic Chemistry, 8th ed., John-Wiley, New York (2004).

2. L.G. Wade, Organic Chemistry, 5th ed., Pearson Education, New Delhi (2003).

3. M.A. Fox and J.K. Whitesell, Organic Chemistry, 3rd ed., Jones and Bartlett, Boston (2003).

Organic Chemistry Laboratory-II

i) Separation of three component mixtures by chromatographic (CC, TLC) methods. (10 mixtures)

ii) Simple preparations: at least four by the choice of teacher concerned.

Suggested Readings

1. Furniss, B.S., Hannaford, A.J., Smith, P.N.G., & Taldull, A.R., Vogels Textbook of Practical Organic Chemistry, 5th Ed., Longman Scientific & Technical, London, 1989.

2. Adams, R., Johnson, J.R., & Wilcox Jr., Laboratory Experiments in Organic Chemistry, 6th Ed., Collier-Macmillan, London, 1970.

CHM-5603 Inorganic Chemistry –II

4(3-1)

1. Introduction to Coordination Chemistry

Electronic configuration and oxidation states of transition metals, Werner's theory for coordination complexes and its comparison with Blomstrand-Jorgensen Chain Theory, ligands, nomenclature of coordination complexes. Bonding Theories (VBT, MOT and CFT) for explanation of coordination bonding. Common geometries of coordination complexes. Chelates and chelate

effect. Distortion in Structures. The spectrochemical series, colour of metal complexes. Magnetic properties (diamagnetism, paramagnetism), Isomerism, Stereochemistry.

2. **Pi-Acceptor Ligands**

Introduction Mono-, bi- and polynuclear transition metal carbonyls, bonding nature, general characteristics and reactions. The 18-electron rule as applied to metal carbonyls, Rationalization of molecular structures, Equation of Structures based on spectroscopic evidence

Suggested Readings

- Cotton, F.A. and Wilkinson G., “Advanced Inorganic Chemistry”, 5th Ed, John Wiley & Sons, New York, 1988.
- James Huheey, E., “Inorganic Chemistry, Principles of Structure and Reactivity”, 3rd. Ed., Cambridge, Harper International, London, 1983.
- Basolo, F. and Johnson, R., “Coordination Chemistry”, W.A. Benjamin, Inc., 1964.
- Zafar Iqbal M., “Pi-Acceptor Ligands”, UGC Islamabad, 1982.
- Kent Murmann R., “Inorganic complex compounds”, Reinhold publishing corporation, New York, 1964.
- Kamlesh Bansal, “Coordination Chemistry”, Campus Books International, New Dehli, 2003.

Inorganic Chemistry Lab –II

1. Complexometric Titrations

- Estimation of Mg^{+2} and Zn^{+2} with EDTA (direct Titration).
- Estimation of Ni^{+2} with EDTA (Back Titration).
- Estimation of Ca^{+2} and Zn^{+2} in a Mixture (Masking).
- Estimation of Cd^{+2} and Zn^{+2} in a Mixture (Demasking).
- Estimation of SO_4^{2-} and PO_4^{3-} with EDTA (Indirect Titration)

2. Redox Titrations

- Use of Ferric Sulphate solution for the estimation of Iron in an Iron ore.
- Use of potassium Iodate for the determination of the following;
 - (i) Copper (ii) H₂O₂

Suggested Readings

Bassett J., "Vogel's text books of quantitative analysis", 4th Ed., Longman Group Limited, 1978

CHM-5604 Biochemistry-II 4(3-1)

Biocatalysis and acid-base regulation:

Body fluids as electrolytes solutions, pH, Henderson-Hasselbalch equation and buffers,. Acid and bases, amino acids as acids and bases, buffering capacity of amino acids, regulation of acid base balance, acidosis, alkalosis, homeostasis, detoxification, circulatory system and its role to maintain body homeostasis.

Enzymes:

Chemical nature, nomenclature and classification of enzymes. Cofactors, substrate specificity, enzyme-substrate interaction. Kinetics of single substrate reactions, effect of different factors on enzymes activity, enzyme inhibition, regulatory enzymes, allosteric enzymes, multi enzymes system, zymogens and isozymes, immobilized enzymes and their uses.

Recommended Books.

1. Lehniger, A.L, "Principles of Biochemistry", Worth Publisher, New York, (2001).
2. Voet, D. and Voigt J. G., "Biochemistry", John Wiley & Sons, New York, (2000).
3. West, Text Book of Biochemistry", 4th Ed., (2000).
4. Zubay, G., biochemistry, 4th Ed. Macmillan Publishing Co. (1999).
5. Wilhelm R. Frisell, "Human Biochemistry", Macmillan Publishing Co., Inc. New York (1982).
6. Guyton AC and Hall JE. "Text Book of Medical Physiology", 9th Ed, W. B. Saunders Company, Tokyo, (1996).

Biochemistry Laboratory-II

1. Determination of cholesterol in fluids.
2. Determination of hemoglobin in the fluids.
3. Estimation of ascorbic acid in the given sample.
4. Determination of chloride in fluids.
5. Determination calcium in fluids.
6. Determination of total acidity in the given sample

Recommended Books

1. D. T. Plummer, "An Introduction to Practical Biochemistry", Tata Mc Graw-Hill Publishing company Ltd., New Delhi, 1988.
2. K. K. Pillai, J. S. Qadry, "Biochemistry and Clinical Pathology" CBS Publishers & Distributors, 1996.
3. S. P. Dandekar, S. A. Rane, "Practical and viva in Medical Biochemistry", Reed Elsevier India PrivateLtd., 2004.

VIII Semester

Courses for Semester-VIII (Physical Chemistry Section)

CHM-6801 Quantum Mechanics

3(3-0)

Operators and their properties, algebra of operators, quantum mechanical operators, complex numbers, well behaved function, probability function and average values, Schrödinger formulation of quantum mechanics, dynamic variables, state functions, the law of quantum mechanics, stationary states, corollaries of quantum mechanics, stationary states, atomic units, derivation of quantum numbers from Schrodinger wave equation, polar co-ordinate system, applications of Schrodinger wave equation for hydrogen and helium atom.

Books Recommended

1. Levine, I.N., "Quantum Chemistry" 4th Ed., Prentice Hall, New Jersey, and Prentice Hall India 1991.
2. Hanna, M.W., "Quantum Mechanics in Chemistry" 3rd Ed., The Benjamin/Cummings Co., California, 1981.
3. Lowe, J.P., "Quantum Chemistry" 2nd Ed. Academic Press. Boston., New York, 1993.

CHM-6802 Colloids and Surfactants 3(3-0)

Colloids, difference between colloidal and true solution, types of colloids, phases of colloidal solution, difference between lyophilic and lyophobic colloids, preparation of colloidal dispersion, purification of colloidal solution, properties of colloidal suspension, determination of size of colloidal particles by sedimentation of suspension and ultra-centrifuge method, electro kinetic phenomena, electrophoresis, electro osmosis and streaming potential, coagulation of colloids, protection of the colloidal state, gold number, origin of charge on sol particles. Stability of solution, associated colloids, micelles, mechanism of micelle formation. Emulsions, preparation of emulsions, role of emulsifier, properties of emulsion, gel, types of gels, properties of gels, applications of colloids.

Suggested Readings

1. Hiementz, PC. and Rajaqopalam, R., "Principles of colloid, & surface Chemistry" Marcel Dekker, 1997.

2. Fennel-Fvans, D., "The colloidal Domain" VCH, 1994.

CHM- 6803 Electrochemistry 3(3-0)

Theories of electrolytes, interfacial phenomenon, electrode kinetics, Butler Volmer equation, Nernst equation, activity and activity coefficient, applications of activity coefficients, ionic strength, Kohlrausch's law of independent migration, standard electrodes, emf of the cell with transference and without transferences, electrolysis, ionic theory of electrolysis, electrochemical series, displacement reactions, batteries and commercial cells, dry cell, lead storage cell, fuel cells,

Books Recommended

1. Bockris, J.M. and Reddy, "Modern Electrochemistry" A.K.N. 2 Vols. Plenum Press, New York, 1970.
2. Bard. A. and Faulkner, L.R., "Electrochemical Methods Fundamentals and Application" John Wiley, New York, 1980.

CHM-6804 Nuclear and Radiation Chemistry 3(3-0)

Introduction, composition of the nucleus, natural and artificial radioactivity, radioactive decay, half-life, fission and fusion reactions, nuclear reactors, stellar energy, natural and artificial transformation, transuranic elements, acceleration of charged particles (projectiles), linear accelerator, cyclotrons, radiation hazards, nuclear waste and their treatment, uses of traces in chemistry.

Books Recommended

1. Friedlander, G. And Kennedy, J.W., "Nuclear and Radiochemistry" Others 3rd Ed., John Wiley & Sons, New York, 1980.
2. Arnikar, H.J., "Essentials of Nuclear Chemistry" 4th Ed. New Age International Publishers Ltd. Wiley Eastern Ltd. New Delhi, 1995.
3. Spinks, J.W.T. and Woods, R.J., "An Introduction to Radian Chemistry" 2nd Ed., John Wiley, New York, 1976.

CHM-6805 Chemical Thermodynamics 3(3-0)

Thermodynamics of systems of variable composition, dependence of state functions on variables, thermodynamic behaviour of ideal gases, fugacity and determination of fugacity, criteria for equilibrium partial molal quantities, determination of molal quantities, ideal solutions, laws of dilute solutions, activity, activity coefficient and its determination and equilibrium constant, colligative properties, phase rule.

Books Recommended

1. Alberty, R.A and Silbey, R.J., "Physical Chemistry" John Wiley, New York, 1995.
2. Atkins, P.W., "Physical Chemistry" 5th Ed., W.H. Freeman & Company, New York, 1994.
3. Barrow, G. M., "Physical chemistry" McGraw Hill, Singapore, 1988.
4. Klotz, I.M., "Chemical Thermodynamics" 3rd Ed., W.A. Benjamin Inc., California, 1972
5. Pitzer, K.S., "Thermodynamics" 3rd Ed., McGraw-Hill, New York, 1995.

CHM-6806 Catalysis 3(3-0)

Catalysis, criteria of catalysis or characteristics of catalytic reactions, types of catalysis, promoters, catalytic poisoning and poisoning effect of catalyst, autocatalysis, negative catalysis, and inhibitors, activation energy and catalysis, theories of catalysis, the intermediate compound formation's theory, the adsorption theory, active centers on catalyst surface, acid base catalysis and its mechanism, heterogeneous catalysis, mechanism of heterogeneous catalysis, kinetics of heterogeneous (surface) catalytic reactions, enzyme catalysis, characteristic of enzyme catalysis, mechanism of enzyme reactions.

Books Recommended

1. Bond, G.C., "Heterogeneous catalysis: Principles and Applications", 2nd Ed., Oxford, Clarendon Press, 1987.
2. Agrawal, G. L., "Basic chemical kinetics" Tata McGraw-Hill Publishing company limited, 1990.

CHM-6807 Computational Chemistry 3(3-0)

Computer Aided Numerical Methods: Least square curve fitting method for linear functions and its modified forms for other functions, statistical analysis. Numerical differentiation. Geometrical Application of Integration: Area under the curves of various natures, calculation of volume, and length of curve line. Numerical integration: Rectangular, trapezoidal and parabolic methods of approximation. Molecular Modeling: Model building using different force field parameters, geometry optimization.

CHM-6808 Solid State Chemistry 3(3-0)

Unit cells and crystal systems: Lattices and their description: Bravais lattice; Miller indices; unit cell contents. Point groups and their relevant classification based on symmetry. Space groups and crystal structures: Close-packed structures (cubic, hexagonal, tetragonal and other packing arrangements). Important structure types (Rutile, Rock Salt, Zinc Blend, Wurtzite, etc.) Perfect and imperfect crystals: Types of defects with description. Diffusion of ions in solids; dislocation; mechanical properties and reactivity of solids. Theories of electrical conductance: Different types of solids, metals and non-metals.

CHM-6861 Advanced Practical's in Chemistry 4(0-4)

Inorganic Chemistry Section

CHM-6816 Inorganic Chemistry in Biological systems 3(3-0)

Essential and trace elements in biological systems, Metallobiomolecules, The classification of biomolecules containing metal ions, Biochemistry of iron. Electron carriers and metallo-enzymes, The distribution of dioxygen carriers, Structures of oxygen binding site at Fe(II), Models of dioxygen binding, Photosynthesis and respiration, Metal based drugs.

Suggested Readings

- Cotton, F.A. and Wilkinson, "Advanced Inorganic Chemistry", 5th Ed, G. John Wiley & Sons, New York, 1988.
- James Huheey E., "Inorganic Chemistry, Principles of Structure and Reactivity" 3rd. Ed, Cambridge, Harper International, London, 1983.
- Stake M., "Bioinorganic Chemistry", Discovery publishing house.

CHM-6817 Chemical Crystallography 3(3-0)

Structures and energetic of metallic and ionic solids, Packing of solid, polymorphism, alloys and inter-metallic compounds, lattice energy. Born-Haber cycle, application of lattice energy, defect in solid state, Symmetry, unit cells, crystal systems, lattice lattice point and space group X-rays, production and diffraction, Bragg's equation, diffractational data collection, data reduction. Application of XRD and method towards structure elucidation (including geometry and other parameters) of crystalline solids.

Suggested Readings

- Ladd M. F.C. and Paman R.A., "Structure Determination by X-ray Crystallography", 1st Ed., Plenum Press, New York, 1977.
- Cullity B.D., "Elements of X-ray Diffraction", 2nd Ed., Addison-Wesley Publishing Company, Ind., 1978.
- Woolfson M. M., "An Introduction to X-ray Crystallography", Cambridge University Press. UK, 1970.
- West A.R., "Solid state chemistry and its application", John. Wiley.
- Rodgers G.E., "Introduction to coordination, solid state and descriptive Inorganic chemistry", Mcgraw Hills, 1994.

CHM-6818 Inorganic Polymers 3(3-0)

Introduction of polymer materials, Preparation of polyorganosiloxanes and various systems containing P-N, S-N and transition-metal polymers, Preparation and structures of sulphanes and Borates, Characterization of polymeric materials by using various analytical techniques, Applications.

Suggested Readings

- Bill Meyer F., "Text Book of Polymer Science", 3rd Ed; John Wiley & sons.
- Joel R. Fried, "Polymer Science and Technology", Prentice Hall, Inc., 1995.

- Seymour R.B. and Carraher C.E., "Polymer Chemistry, an Introduction", Jr. 4th Ed, Marke Dekker, Inc. New York, 1981.
- J.M.G. Cowie, Polymers Chemistry and Physics of Modern Materials, Billing & Sons Ltd. UK.

CHM-6819 Basics of Nuclear Chemistry 3(3-0)

The development of Nuclear Chemistry, Fundamental particles and nuclear structure, Radioactivity, types of radioactive decay, half-life, nuclear fusion, nuclear fission, nuclear forces, the atomic nucleus, production of isotopes and radio-nuclides, the binding energy, exchange forces, nuclear quantum numbers, the shell model, pairing energy, properties of nuclear radiations, Nuclear Reactions, measurement of radioactivity, types of GM counters, Nuclear Reactors, Applications of Nuclear Isotopes

Suggested Readings

- Choppin G.R. and Rydberg J., "Nuclear Chemistry, Theory and Applications",
- Friedlander G., Kewedy J.W., "Nuclear and Radiochemistry", Macias E.S. and Miller J. M., 1989.
- Chase G.D., "Principles of Radioisotope Methodology",
- Fashataziz and Rodges M.A.J., "Radiation Chemistry, Principles and Applications"
- Kaplan Oxford "Nuclear Physics", New Dehli. 1954.
- Gilreath E.S., "Fundamental concepts of Inorganic Chemistry". McGraw Hill, 1958.

CHM-6820 Industrial Chemistry 3(3-0)

Basic data for the development of the industrial unit e.g. basic chemical data, chemical control, raw materials etc, Chemical processes i.e. unit operations, unit process, Chemistry and technology of industries like water conditioning, cement, glass, ceramic, chloralkali, leather, fertilizers, sugar and starch, steel , petroleum, oil, fats and waxes, soap and detergent , pulp and paper etc

Suggested Readings

- Austin G.T., "Chemical Process industries", 5th Ed. Publishing by McGraw Hill, International.

- Patry C., "Industrial Chemistry", Oxford publishing, New Dehli, 1988.
- Streven and Brink, "Chemical process Industries", McGraw Hill.
- Buchel, Moretto and Wodith, "Industrial Inorganic Chemistry", John Wiley & Sons.
- Weissermel and Ape, "Industrial Inorganic Chemistry", Verlag Chemie.
- Pandey, "Text Book of Chemical Technology, Vol. I & II", Vikas Publishing Co, New Dehli.
- Crogsins, "Unit Operation in Organic Synthesis", McGraw Hill.
- Sing A., "Industrial Chemistry, Vol. I & II", Ahmed. Publishers. New Dehli.

CHM-6821 Organometallic Chemistry 3(3-0)

Nature of metal-carbon bond, chemistry of metal sigma, metal Pi-complexes and their nature of bonding. Synthesis and properties of organometallic compounds (Pi-bonded olefins, cyclopentadienyl, polyenes and acetylenes), Applications of organometallic compounds in synthetic chemistry & industry

Suggested Readings

- Cotton G.F.A. and Wilkinson, "Advanced Inorganic Chemistry", 5th Ed., New York, John Wiley & Sons.
- Huheey, J. E., "Inorganic Chemistry, Principles of Structure and Reactivity", 3rd. Ed, Cambridge, Harper International, London, 1983.
- Yamamoto A., "Organotransition Metal Chemistry" A. Wiley Interscience Publication, London, 1986.
- Crabtree R.H., "The organometallic chemistry of the Transition Metals", John Wiley & sons.

CHM-6822 Advanced Inorganic Chemistry-III 3(3-0)

• Non-Aqueous Solvents

Introduction, Classification of solvents, Types of reactions in solvents, Effect of Physical and Chemical properties of solvents, Study of reactions in liq. NH₃, liq SO₂ liq HF, liq H₂SO₄ and liq BF₃, Reactions in molten salt systems.

- **Organic Reagents Used in Inorganic Analysis**

Typical reagents used, their classification and specific nature, methods of application with specific examples, complexometric titration involving the use of EDTA and other chelating agents

Suggested Readings

- Holzbecher Z., “Hand Book of organic reagents in Inorganic Analysis”, Ellis Harwood Limited, London, 1976.
- Sisler, London H. H., “Chemistry in Non-Aqueous Solvents’, Chapman and Hall, 1961.
- Gilreath E. S., “Fundamental concepts of Inorganic Chemistry”, McGraw Hill, 1958.

CHM-6861 Advanced Practical’s in Chemistry 4(0-4)

Biochemistry Section

CHM-6846 Cell biology and cell biosignaling 3(3-0)

Cell Biology:

Introduction to cell theory and structure , chemical composition of cell organelles, their structure and functions. Transportation through plasma membrane, glucose transport channels, nucleus, structure and function, chromosomes gene, the cell cycle, mitosis, meiosis and cytokinesis.

Biosignaling

Cell signal transduction, insulin signaling pathway. Distruption of insulin signaling during insulin resistance and diabetes. Leptin signaling to regulate food intake / appetite. Disrutptio of leptin signaling in obesity and leptin resistance.

Recommended Books

1. Alberts, “ Essential Cell Biology”, 3rd Ed., 2010.
2. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, “Molecular Biology of the Cell”, 5th Ed., Garland Sciences, Taylor and Francis, 2008.
3. H. Lodish, A. Berk, L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell, “.Molecular Cell Biology”, 4th Ed., W.H. Freeman, 2000.

4. G. Karp John, "Cell and Molecular Biology: Concepts and Experiments", Wiley & Sons, 2008.

CHM-6847 Microbiology and immunology 3(3-0)

Microbiology

Fundamentals of microbiology: Prokaryotic cell structure and function, Prokaryotic growth and nutrition. Prokaryotic genetics.

Virus and eukaryotic microorganisms: Virus, bacteria, fungi and parasites. Bacterial diseases: Airborne, food borne and waterborne bacterial diseases.

Industrial microbiology and biotechnology: Microorganisms in industry. Alcoholic beverages. Other important microbial products.

Immunology:

Chemistry of immunoglobulins, myeloma and hybridoma immunoglobulins, immune systems and its abnormalities. Allergy and inflammation. Complement system, peripheral leucocytes and macrophages. Immune disorders: Type I IgE-Mediated hypersensitivity, other types of hypersensitivity, autoimmune disorders, immunodeficiency disorders.

Recommended Books

1. E. Benjamini, R. Coico, G. Sunshine, "Immunology: A short course", 4th Ed., Wiley- Liss Inc., Canada, 2000.
2. J. G Cappuccino, N. Sherman, "Microbiology: A laboratory manual", 4th Ed., Benjamin/Cummings Publishing Co., N. Y., 1996.
3. J. Kurby, "Immunology", 2nd Ed., W. H. Freeman and Co., N. Y., 1994.
4. I. Riott, J. Brostoff, D. Male, "Immunology", 3rd Ed., Mosby-Year Book, Europe Ltd., London, 1993.
5. Slonczewski, "Microbiology: An Evolving Science", 2008.
6. 2. Versalovic , "Therapeutic Microbiology: Probiotics and Related Strategies", 2008.

CHM-6848 Nutrition 3(3-0)

Major dietary constituents

Nutritional importance of carbohydrates, proteins and amino acids, lipids and dietary fibers. Energy needs: Assessment and requirement of energy in different age groups.

Nutrition in growth and aging: Nutritional requirement in infancy and childhood. Diet, nutrition and adolescence. Nutrition in the Elderly.

Minerals Biochemical role of Calcium, Chromium, Copper, Iron, Iodine, Magnesium, phosphorous, Selenium, and Zinc. Their dietary sources, Vitamins

Role of vitamins as coenzymes.

Structure, physiological functions, deficiency diseases and recommended dietary allowances of the following vitamins.

Fat Soluble vitamins: A, D, E, and K

Water Soluble vitamins: Thiamine, Riboflavin, Niacin Pantothenic acid, Folic acid, Biotin and Ascorbic acid.

Recommended Books

1. R. K. Murray, D. K. Granner, P. A. Mayes, "Harper's Biochemistry", Rodwell, 2000.
2. Wardlaw, Insel, "perspectives in nutrition", Mosby, New York, 1999.

CHM-6860 Biochemistry practical's lab IV 3(0-3)

1. DNA extraction and purifications.
2. Preparation of Agarose gel and DNA separation.
3. Separation of proteins using SDS-PAGE.
4. Extraction of Acetyl choline esterase from chicken brain.
5. Enzyme inhibition studies.

CHM-6861 Advanced Practical's in Chemistry 4(0-4)

Organic Section

CHM-6831 Reaction Mechanism-II 3(3-0)

Oxidation & Reduction reactions

- Oxidation: Introduction; oxidation of hydrocarbons; olefinic bonds; oxygenated systems including alcohols, aldehydes and ketones.
- Reduction: Introduction; reduction of hydrocarbons; cycloalkanes; conjugated olefins; alkynes; aromatic rings; hydrogenolysis of aldehydes and ketones.

Aromatic Electrophilic Substitution

ArSE1, ArSE2 and ArSE3 Mechanisms. Brief account of arenium ion mechanism; orientation and reactivity in mono substituted and di substituted benzene; study of halogenation, nitration, sulfonation, formulation Friedel Craft's alkylation and acylation reactions.

Aromatic Nucleophilic substitution Study of following mechanisms

- i. Intermediate complex mechanism
- ii. Benzyne mechanism
- iii. SN1
- iv. ANRORC mechanism
- v. Radical nucleophilic mechanism

Suggested Readings

1. Issac, Neil S., Physical Organic Chemistry, Longman Scientific and Technical Publishers, USA.
2. Handrickson, J. B., Cram, D.J. and Hammond, G.S., Organic Chemistry, 3rd Ed, MacGraw-Hill, Tokyo, 1970.
3. Morrison, R.T., and Boyd, R.N., Organic Chemistry, 6th Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
4. March, J., Advanced Organic Chemistry, 4th Ed., John Wiley & Sons, New York, 1992.
5. Lowry T.H. & Richardson, K.W., Mechanism and Theory in Organic Chemistry, 3rd Ed., Harper & Row Publishers, New York, 1987.
6. Finar, I.L., Organic Chemistry, 6th Ed., Vol. 1 & 2, Longman, London, 1973.
7. McMurry, J., Fundamentals of Organic Chemistry, 4th Ed., Brooks/Cole Publishing Co., California, 1994.

CHM-6832 Spectroscopy-II 3(3-0)

Structure elucidation of organic compounds on the basis of UV, IR, NMR and Mass spectral information.

Suggested Readings

1. McMurry, J., Fundamentals of Organic Chemistry, 4th Ed., Brooks/Cole Publishing Co., California, 1994.
2. Brown, D.W., Floyed, A. J. and Sainsbury, M., Organic Spectroscopy, J. Wiley and sons, Chichester, 1998.
3. Williams, D.H. & Fleming, I., Spectroscopic Methods in Organic Chemistry, 4th Ed., McGraw-Hill Book Co., London, 1987.
4. Hesse, M., Meir, H. and Zech, B., Georg, Thieme Spectroscopic Methods in Organic Chemistry, Verlag, Stuttgart, New York, 1997.
5. Younas, M., Organic Spectroscopy, A. H. Publisher, Lahore.
6. Atta-ur-Rehman, NMR Spectroscopy, Vol. 1, National Academy of Higher Education, University Grants Commission Islamabad.

CHM-6833 Natural Products 3(3-0)

Alkaloids: Introduction, classification, isolation and general methods of structure determination. Chemistry of Ephedrine, Conine, Nicotine. Biosynthesis of alkaloids.

Terpenoids: Introduction, classification, isolation and general methods of structure determination. Chemistry of Citral, α -Pinene and Camphor. Biosynthesis of terpenoids.

Steroids: Introduction, classification, isolation and general methods of structure determination. Chemistry of Cholesterol, Vitamin D. Biosynthesis of steroids.

Suggested Readings

1. March, J., Advanced Organic Chemistry, 4th Ed., John Wiley & Sons, New York, 1992.
2. Finar, I.L., Organic Chemistry, 6th Ed., Vol. 1 & 2, Longman, London, 1973.

CHM-6834 Introduction to Organic Polymers 3(3-0)

Definition; Classification; Types of polymerization reactions; Step-growth and chain-growth polymerization; Polymer characterization and molecular weight determination.

Suggested Readings

1. Young, R., & Lovell, P.A., Introduction to Polymers, Chapman & Hall Publishers, UK.
2. Cowie, J.M.G., Polymers Chemistry and Physics of Modern Materials, Billing & Sons Ltd. UK.

CHM-6835 Pericyclic Reactions and Photochemistry 3(3-0)

Pericyclic Reactions

Introduction; Classification; Examples of thermal and photochemical electrocyclic, cycloaddition and sigmatropic reactions. Symmetry of orbitals and correlation diagrams. Theories of concerted pericyclic reactions Woodward-Hofmann theory, Fukui's theory of Frontier Orbital method, Mobius-Huckel theory.

Photochemistry

Introduction; 1st and 2nd law of photochemistry; Quantum yield; Norrish Type I and Type II reactions; Jablonskii diagram; Phosphorescence; Fluorescence.

Suggested Readings

1. Woodward & Hoffman, The Conservation of Orbital Symmetry, Verlag Chemie, G. Mb. H.
2. Hendrickson, J.B., Cram, D.J. , and Hammond, G.S., Organic Chemsitry, 3rd Ed, MacGraw- Hill, Tokyo, 1970.
3. Morrison, R.T. and Boyde, R.N., Organic Chemistry, 6th Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
4. Lowry, T.H., & Richardson, K.W., Mechanism and Theory in Organic Chemistry, 3rd Ed., Harper & Row Publishers, New York, 1987.

CHM-6836 Organic Synthesis-II 3(3-0)

Introduction to reterosynthesis; Functional Group Interconversion; C-C, C-N and C-O bond formation; Analysis and synthesis of 1,1-, 1,2- and 1,3-difunctionalized compounds.

Suggested Readings

1. March, J., *Advanced Organic Chemistry*, 4th Ed., John Wiley & Sons, New York, 1992.
2. Norman, R.O.C. and Coxon, J.M., *Principles of Organic Synthesis*, 3rd Ed., Blackie Academic and Professional, London, 1993.
3. Warren, S., *Organic Synthesis, The Disconnection Approach*, John Wiley & Sons, Chichester, 1992.
4. Finar, I.L., *Organic Chemistry*, 6th Ed., Vol. 1 & 2, Longman, London, 1973.

CHM-6837 Special Topics in Organic Chemistry 3(3-0)

Any area of choice of teacher offering the course.

CHM-6861 Advanced Practicals in Chemistry 4(0-4)

Advanced Practical will include at least four practicals from each section, i.e. Organic, Inorganic/Analytical, Biochemistry and Physical chemistry.