

## **SEMESTER-I**

### **COURSE: Foundations of Education**

**Credit Hours: 3**

**Introduction:** This course will focus on the ideological, philosophical, psychological, socio-economic and historical foundations of education. The major focus will be on developing an understanding of the participants how different philosophical theories affect education. The course will also include historical development of education of the Pakistan. Emphasize will be given on analyzing various sociological, political, economic and ideological forces that influence the process of education in our culture context. This course will also be used to develop the ability in prospective teachers to interpret knowledge within its historical, philosophical, ideological, and social contexts, which will lead to produce critical perspectives on education both within, and outside of, schools

#### **Objectives**

The students will be able to:

Explain the important features of foundation of education

Specify the role of educational thinkers in education

Discuss the modes of education

Discuss historical development of Pakistan

Evaluate the issues and problems of education.

#### **Course Content**

##### **Unit 1 Ideological Foundation of Education**

Islamic Foundations

Islamic concept of Peace

Other religions and Islam

Ideology and teacher

##### **Unit 2 Philosophical Foundations of Education**

Philosophy and Education

Main Philosophical Thoughts

Idealism

Realism

Pragmatism

Re-constructionis

### **Unit 3. Psychological Foundations of Education**

Learning and Maturation

Individual Differences

Self Concept

Academic Aptitude

Instructional Strategies and Psychology

### **Unit 4. Socio-Economic Foundations of Education**

Concept of Society and Culture

Social Conditions and Education

Economic Conditions and Education

Politics and Education

### **Unit 5. Historical Foundations of Education in Pakistan**

Pre-Pakistan Period (712 A.D. to onward)

Period from 1947-1958

Period From 1959-1971

Period from 1972-1979

Period from 1980 -1991

Period from 1992 – to date

### **Unit 6 Aims of Education**

Aims, Goals and Objectives

Taxonomies of Objectives

Aims and Objectives of Education in Pakista

### **Unit 7 Problems and Issues in Education in Pakistan**

Universalization of Primary Education

Literacy

Medium of Instruction

Diversification of Education

Environmental Education

Gender and Education

Islamization of Education

Special Education

Health Education / Drug Education

HIV / Aids, STIs, Hepatitis

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## Recommended Book

Canestrari, A. (2009). *Foundations of Education*. New York: Sage Publications

Eugene, F.P. (2005). *Critical issues in education: Anthology of reading*. New York: Sage Publications.

Goldblatt, P.F., & Smith, D. (2005). *Cases for teacher development*. New York: Sage Publications.

Holt, L.C. (2005). *Instructional patterns: Strategies for maximizing students learning*.

Murphy, D. (2005). *Foundations/Introduction to Teaching*. USA: Allyn & Bacon, Inc. New York: Sage Publications.

Semel, S. F. (2010). *Foundations of education: The essential texts*. USA: Routledge.

Pachauri, A. (2006). *Foundations of education*. New Delhi: Pragun Publications.

Kneller, G. (1971). *Foundations of education*. New York: Wiley.

Gruber, F. (1957). *Foundations of education*. Philadelphia: University of Pennsylvania Press.

## **Course: General Methods of Teaching**

**Credit Hours: 3**

**Introduction:** The purpose of course is to prepare prospective teachers in learning and using different method and techniques of teaching in order to make teaching learning process effective. Various aspects of instructions are highlighted to help teacher practice different teaching strategies successfully.

### **Objectives**

After completion of this course students will be able to:

Explain the basic concepts of teaching.

Demonstrate the essential attributes of the effective teacher.

Describe the importance and types of teacher planning

Practice different teaching methods in classroom.

Organize classroom discussion and demonstrate its appropriate use.

Apply various techniques to motivate students

Select appropriate audio visual aids in classroom teaching

Prepare lesson plans.

### **Course Content:**

#### **Unit 1**

##### **Introduction**

- 1.1. Definitions of Teaching
- 1.2. The concept of Effective Teaching
- 1.3. Role of teacher for conducive learning environment
- 1.4. Personal Characteristics of an Effective Teacher
- 1.5. Professional Characteristics of an Effective Teacher
- 1.6. The concepts of Teaching Methods, Strategies and Techniques

#### **Unit 2**

##### **Lesson Planning in Teaching**

- 2.1. The Need for lesson Planning
- 2.2. Approaches to lesson Planning
- 2.3. Weekly Planning
- 2.4. Daily Planning
- 2.5. Unit Planning
- 2.6. Course Planning

<b>Unit 3</b>	<b>Steps in Lesson Planning</b>
	3.1. Introduction
	3.2. Presentation
	3.3. Generalization
	3.4. Application
	3.5. Recapitulation
	3.6. The Lesson Plan Format
<b>Unit 4</b>	<b>Pedagogy by Level</b>
	4.1. Pedagogy of early childhood education
	4.2. Pedagogy of elementary education
<b>Unit 5</b>	<b>Inquiry Method</b>
	5.1. The Inductive Method
	5.2. Deductive Method of inquiry
	5.3. Scientific Method
	5.4. The Problem Solving Approach
	5.5. Advantages and Limitations of Inquiry Method
<b>Unit 6</b>	<b>Activity Methods &amp; Cooperative learning</b>
	6.1. Individual Project
	6.2. Group Project
	6.3. Research Projects
	6.4. Cooperative learning
	6.5. Techniques of cooperative learning
	6.6. Advantages and Limitations of activity & cooperative Method
<b>Unit 7</b>	<b>Demonstration Method</b>
	7.1. What is Classroom Discussion
	7.2. Planning the Discussion
	7.3. Organizing the Discussion
	7.4. Practicing in asking questions
	7.5. Practicing in answering the questions
	7.6. Assessing the discussion
	7.7. Advantages and Limitations of Discussion Method
<b>Unit 8</b>	<b>Student Motivation</b>
	8.1. Concept of Motivation
	8.2. Intrinsic Motivation

- 8.3.Extrinsic Motivation
- 8.4.Theories of Motivations
- 8.5.Strategies to Motivate Students**

### **Unit 9 Teaching Skills**

- 9.1. Set induction
- 9.2. Presentation
- 9.3. Identify learning difficulties of students
- 9.4. Prepare lesson according to individual needs
- 9.5. Students Evaluation

### **Unit 10 Teaching Tools**

- 10.1. Selecting the Audio Visual Material
- 10.2. Planning To Use the Materials
- 10.3. Preparing For the Audio Visual Activity
- 10.4. Kinds of AV Materials
  - ☐ White Board / Marker
  - ☐ Charts, Posters, Maps, Graphs & Models
  - ☐ Text Books
  - ☐ Hand Outs
  - ☐ Projectors
  - ☐ Multimedia

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

Allen, Mendler, (2009).”*Motivating Students Who Don't Care*”: Successful Techniques for Educators. Amazon.com

Arends, R.I. (2007) “*Learning to Teach*” (7<sup>th</sup> Edition, McGraw Hill International Edition). Boston: McGraw Hill.

- Bhatt, B. D. (1995). *Modern methods of teaching: Concept and techniques*. New Delhi: Kanishka.
- Borich, G. D. (2000). *Effective teaching methods*. Upper Saddle River, N.J: Merrill.
- Cruickshank, D. R., Jenkins, D. B., & Metcalf, K. K. (1995). *The act of teaching*. New York: McGraw-Hill.
- Ellington, H et al. (2005) “*Handbook of Educational Technology*” (3<sup>rd</sup> Edition). London: Kogan Page Limited.
- Feldman, J. A., & McPhee, D. (2008). *The science of learning & the art of teaching*. Clifton Park, NY: Thomson Delmar Learning.
- In Peterson, A. D. C. (1965). *Techniques of teaching*. Oxford: Pergamon Press
- Kochhar, S. K. (1967). *Methods & techniques of teaching*. Delhi: Sterling Publishers.
- Marzano, R. J. (2007). *The art and science of teaching: A comprehensive framework for effective instruction*. Alexandria, Va: Association for Supervision and Curriculum Development.
- Singer, A. J. (2003). *Teaching to learn, learning to teach: A handbook for secondary school teachers*. Mahwah, N.J: L. Erlbaum Associates.
- Wellington, J. J., Ireson, G., & Wellington, J. J. (2008). *Science learning, science teaching*. London: Routledge.

## ENGLISH-I (LANGUAGE IN USE)

### CREDIT HOURS: 3

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#### 1. BASICS OF GRAMMAR I

##### Recommended Book:

Oxford Practice Grammar by John Eastwood Oxford University Press. Published 2005.

- Unit No. 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90. (ARTICLES)
- Unit No. 98, 99, 100, 101, 102, 103. (PRONOUNS)
- Unit No. 104, 105, 106, 107, 110, 111, 112. (ADJECTIVES AND ADVERBS)
- Unit No. 118, 119, 120, 121, 122, 123, 124, 125, 126, 127. (PREPOSITIONS)
- Unit No. 150, 151, 152, 153. (LINKING WORDS)
- Appendix 3 Page No. 372

#### 2. READING COMPREHENSION AND SUMMARIZING SKILLS

##### Recommended Book:

Focus on Comprehension Book 4 by Peter Ellison Learners Publishing Pte. Ltd. Singapore, 2009.

- Section 1. Unit No. 1.
- Section 2. Unit No. 2, 3, 4, 5. Practice Unit 1.
- Section 3. Unit No. 6, 7, 8, 9, 10, 11. Practice Unit 2.

#### 3. PARAGRAPH WRITING I

The students are required to know basics of Paragraph Writing with an emphasis on Topic sentence and Supporting sentences and a possible Concluding sentence. (Word Limit Up to 120 words)

##### Recommended Book:

Paragraph Development: A Guide for Students of English as a Second Language by Martin L. Arnaudet, Mary Ellen Barrett. Pub. Prentice Hall College Div. 1981 (Page 1-32)

#### 4. LISTENING AND SPEAKING SKILLS

This unit will lead up to the teaching and evaluation of “Oral Presentation Skills” in the following semesters also.

##### Recommended Book:

Oxford Practice Grammar by John Eastwood Oxford University Press. Published 2005.

- Unit No. 34, 35, 36, 38, 39.

#### 5. VOCABULARY BUILDING SKILLS

GAT HIGH FREQUENCY WORDS (GAT Word List) Page No. 143-152

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

##### Recommended Book:

Guide for GAT General Test. SMART BRAIN. GRE (General, Local) by Muhammad Idrees. Pub: Dogar Brothers. 2010-2011 edition.



**TITLE: BOTANY-I (PLANT DIVERSITY)****CREDIT HOURS: 3****Syllabus Outline:**

Comparative study of the different plant groups with representative examples, including Viruses, Bacteria, Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.

**Plant Diversity:**

Comparative study of life form, structure, reproduction and economic signification of.

1. Viruses (RNA and DNA types) with special reference to Tobacco Mosaic Virus (TMV).
2. Bacteria and Cyanobacteria (Nostoc, Oscillatoria)
3. Algae; (Chlamydomonas, Spirogyra, Chara, Pinnularia, Ectocarpus and Palysiphonia)
4. Fungi (*Mucor*, *Penicillium*, *Phyllactinia*, *Ustilago*, *Puccinia* and *Agaricus*), their effects on crop production and industrial applications
5. Lichens (Physcia)
6. Bryophytes
  - a. Riccia
  - b. Ant hoceros
  - c. Funaria
7. Pteridophytes
  - a. Fossils and fossilization
  - b. Psilopsida (Psiatum)
  - c. Lycopsida (Selaginella)
  - d. Sphenopsida (Equisetum)
  - e. Pteropsida (Marsilea)
  - f. Seed Habit
8. Gymnosperms (Cycas, Pinus, Ephedra)

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Lee, E. R. (2007). Phycology (4<sup>th</sup> Ed.) Cambridge University Press U.K.
2. Sambamurty, A.V.S.S. (2005). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. 1K. International Pvt. Ltd. New Delhi, Bangalore, Mumbai. 573 P,
3. Agrios, G.N. (2004). Plant Pathology (8<sup>th</sup> Ed.), Academic Press London.
4. Prescott, L.M., Harley, J.P. and Klein, A.D. (2004). Microbiology, (3<sup>rd</sup> Ed.) W.M. C. Brown Publishers.
5. Mauseth. J.D. (2003). Botany: and Introduction to Plant Biology (3<sup>rd</sup> Ed.) Jones & Bartlett Pub.UK.
6. Biswas, C, and John, G.M. (1999). The Gymnosperms. Narosa Publishing House. New Delhi and London.
7. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology (4<sup>th</sup> Ed.) John Wiley and Sons, UK.

**TITLE: BOTANY-LAB-I (PLANT DIVERSITY)****CREDIT HOURS: 1****Syllabus Outline:**

Culturing, preservation and staining of microorganisms. Study of morphology and reproductive structures of the plant types mentioned in theory. Identification of various plant types mentioned from prepared slides and fresh specimens.

**Syllabus:**

1. Culturing and staining of microbial types
2. Maintenance and preservation of cultures of microbes (Bacteria/ Cyan bacteria / Algae / Fungi)
3. Identification of various types mentioned in the syllabus from fresh and, preserved specimens and prepared slides.
4. Study of morphology and reproductive structures of the type mentioned in theory (Specimens/prepared slides)

**Assessment Strategies (Practical) :**

The student will be assessed according to the following criteria  
Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Lee, E. R. (2007).Phycology (4<sup>th</sup> Ed). Cambridge University Press U.K.
2. Sambamurty, A.V.S.S. (2005). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Pale botany. I.K. International Pvt. Ltd. New Delhi, Bangalore, Mumbai.
3. Agrios, G.N. (2004). Plant Pathology (8<sup>th</sup> Ed.), Academic Press London.
4. Nlauseth. J.D. (2003). Botany and Introduction to Plant Biology (3<sup>rd</sup> Ed.) Jones & Bartlett Pub UK.
5. Prescott, L.M., Harley, J.P. and Klein, A.D. (2004).Microbiology, (3<sup>rd</sup> Ed.) WM. C. Brown Publishers.
6. Giswas, C, and John, G.M. (1999).The Gymnosperm&Narosa Publishing House. New Delhi and London
7. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996).Introductory Mycology. (4<sup>th</sup> Ed.) John Wiley and Sons, UK.

## **CHEMISTRY-I (PHYSICAL CHEMISTRY)**

### **CREDIT HOURS: 3**

### **COURSE OBJECTIVES**

The objective of the course is for students

1. Understand and apply the laws of thermodynamics and kinetics.
2. Understand the role that thermodynamics and kinetics play in chemical equilibrium.
3. Understand how mathematics, models and approximations are used to explain chemical phenomena and fundamental properties of matter.
4. Use concepts of thermodynamics/kinetics/equilibrium to make predictions and give explanations about chemical systems and fundamental properties of matter.
5. Develop skills in making decisions in the lab, in data acquisition, and critical evaluation of data.
6. Appreciate the role physical chemistry plays in chemical (physical, biological, etc. systems.

### **COURSE CONTENT:**

#### **1. STATES OF MATTER**

##### **A. Gases:**

Law of equipartition of energy, Collision diameter, collision number, collision frequency and mean free path; Viscosities of gases, measurements, effect of temperature and pressure on viscosities of gasses; Critical phenomenon of gases and experimental determination of  $P_c$ ,  $V_c$  and  $T_c$ ; Concept of molecular velocities of gasses according to Maxwell's distribution law and comparison of various velocities.

##### **B. Liquids:**

The properties of liquids like surface tension, viscosity, refractive index and dipole moment; Parachor, reheatochor and molar refraction as additive and constitutive properties; Measurement of refractive index and dipole moment; Magnetic susceptibility and its measurement by Gouys balance.

##### **C. Solids:**

Symmetry operations and Bravais lattices; Concept of X-Ray diffraction, Bragg's equation and crystal structure analysis; Powder method of crystal structure analysis; X-ray crystallography of sodium chloride crystal; Heat capacities of solids.

#### **2. CHEMICAL THERMODYNAMICS:**

Heat capacity as  $C_p$  and  $V_c$ ; Difference in  $C_p$  and  $C_v$  and ratio of  $C_p$  and  $C_v$  towards atomicity; Temperature dependence of heat capacities; Quantitative effect of temperature over enthalpy change and internal energy change; Types of thermodynamical processes; Isothermal reversible expansion of ideal gases; Adiabatic process of ideal gasses; Second law of thermodynamics, Carnot cycle, efficiency of

heat engine and concept of entropy; Thermodynamics scale of temperature entropy for phase transition, spontaneity and reversibility; Entropy change in reversible and irreversible processes; Temperature dependence of entropy, Variation of entropy with pressure and volume; Concept of free energy; Derivation of Gibbs and Helmholtz equation; standard free energy of formation; Partial molar quantities, Chemical potential, variation of chemical potential with pressure and temperature fugacity; Thermodynamic of equilibrium, Reaction isohore; Calusius-Clapeyron equation; Molecular basis of entropy and probability.

### 3. CHEMICAL KINETICS:

Derivation of kinetic expression of zero order, first order, second order (with same and different concentration) and third order reactions (with same concentrations) with suitable examples; Equation for half life periods and determination of rate constants; Methods of measurements of order of reactions giving examples with different techniques; Derivation of Arrhenius equation and measurements of Arrhenius parameters, Measurement of slopes of Arrhenius plots for some important reactions Bimolecular collision theory of reaction rates and its failures; Collision theory of uni-molecular, gas phase reactions (Lindeman mechanism); Introduction transition state theory of reaction rates.

### 4. SOLUTION:

Thermodynamics derivation of colligates properties as lowering of vapor pressure, elevation of boiling point, depression of freezing point; Relationship between lowering of vapor pressure with  $\Delta T_b$  and  $\Delta T_f$ ; Osmotic pressure an their determination; Concept of semi permeable membrane, Isotonic solution, theory of osmotic pressure, relationship between vapor pressure and osmotic pressure, Abnormal colligative properties describing association and disassociation of solutes; Fractional distillation and idea of azotropes in detail; Concept of colloids; Classification of Colloids; their properties with reference to dialysis, electro dialysis, sedimentation, precipitation, ultra filtrations, Suspensions and gels; Tyndal cone effect; Macromolecules and micelles.

### 5. SURFACE CHEMISTRY:

Introduction to adsorption; Difference between physical and chemical adsorption; Adsorption of gases by solids; Different types of adsorption isotherms with special reference to Langmuir adsorption isotherm and its applications; Freundlich adsorption isotherm giving some important applications; Brief introduction to catalysis; Theories of Catalysis; Activation energy for catalyzed reactions; Kinetics of enzyme catalysis; Theories of catalysis; Activation energy for catalyzed reactions; Kinetics of enzyme catalysis.

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Books:**

1. Adamson A. W. "Understanding Physical Chemistry" 3<sup>rd</sup> Ed., Benjamin Cummings Publishing Company Inc.
2. Akhtar M.N.& Ghulam Nabi, "Textbook of Physical Chemistry", ilmi Kutab Khana, Lahore.
3. Bhatti H.N. and K.Hussain, "Principles of Physical Chemistry"; Carwan Book House, Lahore.
4. Maron S.H. & B. Jerome, "Fundamentals of Physical Chemistry", Macruthan Publishing Co., Inc. New York. (Also published by National Book Foundation).
5. Atikins P.W.& M.J.Clugston, "Principles of Physical Chemistry" Pitman Publishing Company (1988).
6. Moore W.J. "Physical Chemistry", 5<sup>th</sup> Ed. Longmans Publishers.
7. Jones M. "Elements of Physical Chemistry" Addison-Sesky Publishing Company.
8. G.M.Barrow, International six Edition "Physical Chemistry".
9. IRA. N. Levine fourth edition "Physical Chemistry"
10. Alberty and Danials, "Physical Chemistry"
11. Castallon, "Physical Chemistry"
12. Laidler & Meiser "Physical Chemistry"
13. Friemental "Chemistry in Action"

**CHEMISTRY LAB-I (PHYSICAL CHEMISTRY)****CREDIT HOURS: 1**

1. Determination of percentage composition by surface tension, viscosity and refractive index method.
2. Determination of heat of solution for solids and liquids.
3. Quantitative measurement of colored salt of  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$  in colorimeter.
4. Study of first order reaction:
  - a) Study of hydrolysis of methylacetate
  - b) Measurement of rate constant
5. Measurement of molecular weight by; Depression of freezing point.
6. Determination of transition temperature of  $\text{Na}_2\text{SO}_4 \cdot 10 \text{H}_2\text{O}$  ;  $\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$ ;  $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Books:**

1. Crocleford H.D., H.W.Biard, F.W. Getzen & J.W. Nowell, "Laboratory Manual of Physical Chemistry", 2<sup>nd</sup> Ed., John Wiley & Sons London.
2. Das R.C. and B. Behera, "Experimental Physical Chemistry", Tata McGraw Hill Publishing Company Limited.
3. Levitt B.P., "Findlay's Practical Physical Chemistry", 9<sup>th</sup> Ed., Longman Group Limited.

## ZOOLOGY I ANIMAL DIVERSITY-I (*CLASSIFICATION, PHYLOGENY AND ORGANIZATION*)

CREDIT HOURS: 3

### **Aims and Objectives:**

The course is designed to provide students with:

- a. concepts of evolutionary relationship of animal kingdom.
- b. knowledge about animal kingdom, emphasizing their phylogenetic relationships and simple to complex mode of animal life.
- c. The common processes of life through its chemistry, biochemical and molecular processes.

### **Introduction**

Classification of organisms; definition, concept, evolutionary relationships and tree diagrams; patterns of organization.

### **Animal-Like Protists: The Protozoa:**

Evolutionary perspective; life within a single plasma membrane; symbiotic life-styles. Protozoan taxonomy: (up to phyla, subphyla and super classes, wherever applicable). Pseudopodia and amoeboid locomotion; cilia and other pellicular structures; Nutrition; Genetic Control and reproduction; symbiotic ciliates; further phylogenetic considerations.

### **Multicellular and Tissue Levels of Organization:**

Evolutionary perspective: origins of multicellularity; animal origins. Phylum porifera: cell types, and skeletons; body forms; maintenance functions, reproduction. Phylum cnidaria (coelenterata) the body wall and nematocysts; alternation of generations; maintenance functions; reproduction and classification up to class. Phylum ctenophore; further phylogenetic considerations.

### **The Triploblastic, Acoelomate Body Plan:**

Evolutionary perspective; phylum platyhelminthes: classification up to class; the free-living flatworms and the tapeworms; phylum nemertea; phylum gastrotricha; further phylogenetic considerations.

### **The Pseudocoelomate Body Plan: Aschelminths:**

Evolutionary perspective; general characteristics; classification up to phyla; Feeding and the Digestive System, other organ systems; Reproduction and Development of phylum phylum rotifera and phylum nematoda; phylum kinorhyncha. Some important nematode parasites of humans; further phylogenetic considerations

### **Molluscan Success**

Evolutionary perspective: relationships to other animals; origin of the coelom; molluscan characteristics; classification up to class. The characteristics of shell and associated structures, feeding, digestion, gas exchange, locomotion, reproduction and



development, other maintenance functions and diversity in gastropods, bivalves and cephalopods; further phylogenetic considerations.

#### **Annelida: The Metameric Body Form**

Evolutionary perspective: relationship to other animals, metamerism and tagmatization; classification up to class. External structure and locomotion, feeding and the digestive system, gas exchange and circulation, nervous and sensory functions, excretion, regeneration, reproduction and development, in polychaeta, oligochaeta and hirudinea; further phylogenetic considerations.

#### **Arthropods: Blueprint for Success**

Evolutionary perspective: classification and relationships to other animals; metamerism and tagmatization; the exoskeleton; metamorphosis; classification up to class; further phylogenetic considerations.

#### **Hexapods and Myriapods: Terrestrial Triumphs**

Evolutionary perspective; classification up to class. External structure and locomotion, nutrition and the digestive system, gas exchange, circulation and temperature regulation, nervous and sensory functions, excretion, chemical regulation, reproduction and development in hexapoda; insect behavior; insects and humans; further phylogenetic considerations.

#### **The Chemical Basis of Animal Life**

Atoms and elements: building blocks of all matter; compounds and molecules: aggregates of atoms; acids, bases, and buffers; the molecules of animals: fractional account of carbohydrates, lipids, proteins, nucleotides and nucleic acids based on their structural aspects.

#### **Energy and Enzymes: Life's Driving and Controlling Forces**

Energy and the laws of energy transformation; activation energy; enzymes: structure, function and factors affecting their activity; cofactors and coenzymes; ATP: how cells convert energy? An overview.

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Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### **Books Recommended**

Campbell, N. A. (2002). *Biology* (6<sup>th</sup> ed). Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

Hickman, C. P. & Kats, H. L. (2000). *Laboratory studies in integrated principles of zoology*. Singapore: McGraw Hill.

Hickman, C.P., Roberts, L.S., & Larson, A. (2004). *Integrated principles of zoology* (12<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Kent, G. C. & Miller, S. (2001). *Comparative anatomy of vertebrates*. New York: McGraw Hill.

Miller, S. A. (2002). *General zoology laboratory manual* (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Miller, S. A., & Harley, J. B. (2000). *Zoology* (6<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Pechenik, J. A. (2000). *Biology of invertebrates*, (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

## ZOOLOGY LAB-I

### CREDIT HOURS: 1

#### Course Content

1. Study of Euglena, Amoeba, Entamoeba, Plasmodium, Trypanosoma, Paramecium as representative of animal like protists. (Prepared slides).
2. Study of sponges and their various body forms.
3. Study of principal representative classes of phylum Coelenterata.
4. Study of principal representative classes of phylum Platyhelminthes.
5. Study of representative of phylum Rotifera, phylum Nematoda.
6. Study of principal representative classes of phylum Mollusca.
7. Study of principal representative classes of phylum Annelida.
8. Study of principal representative classes of groups of phylum Arthropoda.
9. Brief notes on medical/economic importance of the following: Plasmodium, Entamoeba histolitica, Leishmania, Liverfluke, Tapeworm, Earthworm, Silkworm, Citrus butterfly.
10. Preparation of permanent stained slides of the following: Obelia, Daphnia, Cestode, Parapodia of Nereis.
11. Tests for different carbohydrates, proteins and lipids.  
Note: Emphasis on the concept that tests materials have been ultimately obtained from living organisms and constituted their body.
12. Protein digestion by pepsin.

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#### Books Recommended

- Campbell, N. A. (2002). *Biology* (6<sup>th</sup> ed). Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
- Hickman, C. P. & Kats, H. L. (2000). *Laboratory studies in integrated principles of zoology*. Singapore: McGraw Hill.
- Hickman, C.P., Roberts, L.S., & Larson, A. (2004). *Integrated principles of zoology* (12<sup>th</sup> ed) (International). Singapore: McGraw Hill.
- Kent, G. C. & Miller, S. (2001). *Comparative anatomy of vertebrates*. New York: McGraw Hill.

Miller, S. A. (2002). *General zoology laboratory manual* (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Miller, S. A., & Harley, J. B. (2000). *Zoology* (6<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Pechenik, J. A. (2000). *Biology of invertebrates*, (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

# PHYSICS 1(ELEMENTARY MECHANICS)

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**PRE-REQUISITE: FSc Level Physics**

**INTRODUCTION: CREDITE HOURS: 3**

This course is one part of four that constitute the Introductory Physics program for Physics Majors. It is a stepping stone to all the upper-level Physics courses providing fundamental knowledge, mathematical techniques and laboratory practices. Many of the concepts in mechanics introduced in this course will be encountered again & expanded upon in later courses.

## **COURSE OBJECTIVE:**

The main objective of this course is to understand the different motions of objects on a macroscopic scale and to develop simple mathematical formalisms to analyze such motions. This is a calculus-based introductory course with maximum emphasis on applying the acquired knowledge to solving problems.

## **COURSE OUTLINE:**

**Basic Concepts:** Units and Dimensions, SI Units, Changing Units, Scalars and Vectors, Adding **Vectors:** Graphical as well as Component Method, Multiplying Vectors: Dot and Cross Products.

**Dynamics:** Motion in One, Two and Three Dimensions: Position & Displacement, Velocity and Acceleration, Motion under Constant Acceleration, Projectile Motion, Uniform Circular Motion, Relative Velocity and Acceleration in One and Two Dimensions, Inertial and Non-Inertial Reference Frames.

**Newton's Laws:** Newton's Laws of Motion and their Applications involving some particular forces including Weight, Normal Force, Tension, Friction, and Centripetal Force, Newton's Law of Gravitation, Gravitational Potential Energy, Escape Velocity, Kepler's Laws, Satellite Orbits & Energy.

**Work and Kinetic Energy:** Work done by Constant and Variable Forces: Gravitational and Spring Forces, Power, Conservative and Non-conservative Forces, Work and Potential Energy, Isolated Systems and Conservation of Mechanical Energy, Work Done by External Forces including Friction and Conservation of Energy.

**System of Particles:** Motion of a System of Particles and Extended Rigid Bodies, Center of Mass and Newton's Laws for a System of Particles, Linear Momentum,

Impulse, Momentum & Kinetic Energy in One and Two Dimensional Elastic and Inelastic Collisions.

**Rotational Motion:** Rotation about a Fixed Axis, Angular Position, Angular Displacement, Angular Velocity and Angular Acceleration, Rotation under Constant Angular Acceleration, relationship between Linear and Angular Variables, Rotational Inertia, Parallel-axis Theorem, Torque and Newton's Law for Rotation, Work and Rotational Kinetic Energy, Power, Rolling Motion,

**Angular Momentum:** Angular Momentum for a single Particle and a System of Particles, Conservation of Angular Momentum, Precession of a Gyroscope, Static Equilibrium involving Forces and Torques, Determination of moment of inertia of various shapes i.e. for disc, bar and solid sphere. Angular Momentum: Angular Velocity, Conservation of angular momentum, effects of Torque and its relation with angular momentum.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### REFERENCE BOOKS:

1. Physics Vol. I & II (extended) by Resnick, Halliday and Krane, 4th Edition, John Wiley and Sons Inc, New York, 1992.
2. Physics Vol. I & II by Resnick, Halliday and Krane, 5th Edition, John Wiley and Sons Inc, New York, 2002.
3. Fundamental of Physics by Halliday Resnick and Krane, 5th Edition, John Wiley and Sons Inc, New York, 1999.
4. University Physics 8th Edition by Sears, Zemansky and Young, Addison-Wesley, Reading (MA), USA, 2000.
5. Physics by Alonso and Finn: Addison-Wesley, Reading (MA), USA, 1999.

## PHYSICS LAB-I (GENERAL PHYSICS-I)

1. To determine height of an inaccessible object by sextant
2. Time Measurement - The Simple Pendulum
3. To Find the Value of G by Free Fall Method
4. Verification of law of moment by using Bell Crank lever
5. To determine the frequency of A.C supply by Meld's apparatus
6. Study the Compound Pendulum and Determine the Value of g
7. To determine the modulus of rigidity of a wire by a spiral spring
8. To Determine the Young's Modulus of wire
9. To Determine the Modulus of Rigidity of Wire by Dynamic Method
10. To determine the modulus of rigidity of wire by Maxwell needle

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### REFERENCE BOOKS:

1. Physics Vol. I & II (extended) by Resnick, Halliday and Krane, 4th Edition, John Wiley and Sons Inc, New York, 1992.
2. Physics Vol. I & II by Resnick, Halliday and Krane, 5th Edition, John Wiley and Sons Inc, New York, 2002.
3. Fundamental of Physics by Halliday Resnick and Krane, 5th Edition, John Wiley and Sons Inc, New York, 1999.
4. University Physics 8th Edition by Sears, Zemansky and Young, Addison-Wesley, Reading (MA), USA, 2000.
5. Physics by Alonso and Finn: Addison-Wesley, Reading (MA), USA, 1999.

**Course Title: Mathematics A-I [Calculus (I)]****Course Rating: 4 Cr. Hours****Preliminaries**

- Real numbers and the real line
- Functions and their graphs
- Shifting and scaling graphs
- Solution of equations involving absolute values
- Inequalities
- Complex numbers system. Polar form of complex numbers, De Moivre's theorem
- Circular function, hyperbolic functions, logarithmic

**Limit and Continuity**

- Limit of a function, left hand and right hand limits, Theorems of limits
- Continuity, Continuous functions

**Derivatives and its Applications**

- Differentiable functions
- Differentiation of polynomial, rational and transcendental functions
- Mean value theorems and applications
- Higher derivatives, Leibniz's theorem
- L'Hospital's Rule
- Intermediate value theorem, Rolle's theorem
- Taylor's and Maclaurin's theorem with their remainders

**Integration and Definite Integrals**

- Techniques of evaluating indefinite integrals
- Integration by substitutions, Integration by parts
- Change of variable in indefinite integrals
- Definite integrals, Fundamental theorem of calculus
- Reduction formulas for algebraic and trigonometric integrands
- Improper integrals, Gamma functions

**Recommended Books**

1. Thomas, B. G, Weir, D. M., Hass, J., & Giordano R. F. (2005). *Thomas Calculus* (11<sup>th</sup> Ed.) Addison Wesley Publishing Company,
2. H. Anton, I. Bevens, S. Davis, *Calculus*, 8<sup>th</sup> Edition, John Wiley & Sons, Inc. 2005
3. Hughes-Hallett, Gleason, McCallum, et al, *Calculus Single and Multivariable*, 3<sup>rd</sup> Edition. John Wiley & Sons, Inc. 2002.
4. Frank A. Jr, Elliott Mendelson, *Calculus*, Schaum's outlines series, 4<sup>th</sup> Edition, 1999
5. C.H. Edward and E.D Penney, *Calculus and Analytics Geometry*, Prentice Hall, Inc. 1988
6. E. W. Swokowski, *Calculus and Analytic Geometry*, PWS Publishers, Boston, Massachosetts, 1983.



**Course Title: Mathematics B-I [Vectors & Mechanics (I)]**  
**Course Rating: 4 Cr. Hours**

**Vector Algebra**

- Introduction to vector algebra
- Scalar and vector product
- Scalar triple product and vector triple product
- Applications to geometry

**Vector Calculus**

- Limit, continuity and differentiability of vector point functions
- Partial derivatives of vector point functions
- Scalar and vector fields
- The gradient, divergence and curl
- Expansion formulas.

**Forces**

- Fundamental concepts and principles
- Inertial-non-inertial frames, Newton's laws
- Resultant of several concurrent forces
- The parallelogram law of forces
- Resolution of a forces, triangle of forces
- Lamy's theorem, polygon of forces
- Conditions of equilibrium for a particle
- External and internal forces, principle of transmissibility
- Resultant of like and unlike parallel forces
- Moment of forces about a point, Varignon's theorem
- Moment of a couple, equivalent couples, composition of couples
- Reduction of coplanar forces to a force or a couple

**Friction**

- Dry friction and fluid friction
- Laws of dry friction, coefficients of friction, angle of friction
- Equilibrium of a particle on a rough inclined plane
- Particle on a rough inclined plane acted on by an external force
- Conditions for sliding or titling

**Virtual Work**

- Principle of virtual work
- Problems involving tensions and thrust

**Recommended Books**

1. Thomas, *Calculus*, 11<sup>th</sup> Edition. Addison Wesley publishing company, 2005
2. Jafferson, B. Beadsdworth, T. *Further Mechanics*, Oxford University Press, 2001
3. Joseph F, Shelley. *Vector Mechanics*, Mc-Graw Hill Company, 1990

4. Murray R. Spiegel, *Theoretical Mechanics*, Schaum's Outline Series, McGraw Hill Book Company
5. Hwei P. HSU, *Applied Vector Analysis*, San Diego, New York, 1984.
7. Murray R. Spiegel, *Vector Analysis*, Schaum's Outline Series, McGraw Hill Book Company, 1959
6. D.K. Anand and P.F. Cunnif, *Statics and Dynamics*, Allyn and Becon, Inc. 1984

## Semester II-Course Outlines

### ENGLISH-II (ACADEMIC READING AND WRITING)

CREDIT HOURS: 3

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#### 1. BASICS OF GRAMMAR II

**Recommended Book:**

Oxford Practice Grammar by John Eastwood Oxford University Press. Published 2005.

- Unit No. 4, 5, 8, 9, 11, 12, 13, 16, 18, 20, 22, 23, 24, 26, 28, 29, 30 (Tenses)
- Unit No. 128, 129, 130, 131 (Phrasal Verbs)

#### 2. READING AND CRITICAL THINKING

**Recommended Book:**

Focus on Comprehension Book 4 by Peter Ellison Learners Publishing Pte. Ltd. Singapore, 2009.

- Section 4. Unit No. 12, 13, 14, 15. Practice Unit 3.
- Section 5. Unit No. 16, 17, 18.
- Section 6. Unit No. 19. Practice Unit 4.

#### 3. PARAGRAPH WRITING II

The students are required to FURTHER know of Paragraph Writing with an emphasis on Topic sentence and Supporting sentences and a possible Concluding sentence. (Word Limit Up to 120 words)

**Recommended Book:**

Paragraph Development: A Guide for Students of English as a Second Language by Martin L. Arnaudet, Mary Ellen Barrett. Pub. Prentice Hall College Div. 1981 (Page 179-185)

#### 4. STUDY SKILLS

- The students are expected to be proficient in Reading Skills like Skimming, Scanning, Speed Reading and avoiding Faulty Reading Habits.

**Recommended Book:**

English Language Communication Skills for B.Ed by Nadeem Aziz. Pub: Majeed Book Depot. (Page 139-159)

#### 5. VOCABULARY BUILDING SKILLS

WORD ROOT METHOD Unit 1-6. Page No. 88-103.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Book:**

Guide for GAT General Test. SMART BRAIN. GRE (General, Local) by Muhammad Idrees. Pub: Dogar Brothers. 2010-2011 edition.

## **Course: Computer (Introduction and Application)**

**Credit Hours: 2**

### **Introduction**

This course is designed in view of the application of computer in wide range of areas. Operating systems is very interesting subject the student will know about operating system its types how it works ,all important functions which it performs about computer systems and also how it manages computer memory.

### **Course Content**

#### **Introduction to Operating systems**

Introduction to Operating Systems, what is an operating system.

Types of Operating System. Operating Systems modes

Hardware, Software, Firmware

Introduction, Hardware, Software, Firmware.

#### **Process Management**

Introduction, Definitions of Process, process states, Process states transitions, the process control block, Operations on process, suspend and resume, interrupt processing.

#### **Dead lock and Indefinite Postponement**

Introduction, Examples of Deadlock. A related problem: Indefinite Postponement, Resource concepts, Four necessary conditions for Deadlock, Deadlock Prevention , Deadlock Avoidance and the Banker's Algorithm. Dead lock Detection, Dead lock Recovery

#### **Memory Management (Real Storage)**

Introduction, storage organizations, storage management, storage hierarchy, storage management strategies, Contiguous vs Noncontiguous storage allocation

#### **Virtual Memory**

**Introduction** Evolution of Storage organizations, virtual storage basic concepts, multilevel storage organizations, Block mapping, Segmentations

## **File System Management**

Directories and names, types of file systems objects, file systems functions, information types, file system architecture,

## **Computer Lab / Practical**

1. Installation of Windows 2000 professional : Installation from CD, installation from network.
2. Configuring the Windows 2000 Environment: Control Panel, Management console, Installing New Hardware
3. Managing the Desktop: Desktop setting, Accessibility Features, Local Setting
4. Managing Users: Creating Users, Disabling User Account, Deleting User Account, Renaming User, Changing Password, Managing User Properties
5. Managing Groups: Creating Groups, Group membership, renaming Group , Deleting group, Local Group Properties.
6. User Profiles and hardware profiles: Local user profiles, Roaming Profiles, Mandatory Profiles, Managing hardware profiles.
7. Managing Disks: File systems File System conversion, Disk storage, Disk Management Utilities
8. Files and Printing Management: File and Folder Basic Management, Creating Shares, Share Permissions, Managing Printer Properties, Sharing Printer, Printer Permission
9. Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## **Recommended Books**

Operating Systems by H.M. Deitel

1. Operating Systems Concepts by Silberschatz Galvin & Gagne

## **Course: Human Development and Learning**

**Credit Hours: 3**

### **Introduction**

This course focuses on developing effective secondary school teachers and head teachers. The aim of the course is to make prospective teachers well acquainted with the process of running schools in effective and efficient manner besides being well versed with the duties and responsibilities of the teachers. The course covers knowledge about school management; organization; function of head teachers, record keeping and school-community relations related issues and matters.

### **Objectives**

After studying this course, students will be able to understand:

- Basic concepts in human development, growth and learning;
- Process of human development and its classroom application;
- Various aspects and stages of human development;
- Different approaches to human learning;
- Individual differences and their effect on teaching learning.

## **Course Content**

### **Unit 1: Introduction**

- a. Definitions of Human Development and Growth
- b. Difference between Growth and Development
- c. General Principles of Human Development
- d. Factors influencing Human Development
- e. A Frame work for studying Human Development

### **Unit 2. Physical Development**

- a. Concept and definition of individuals
- b. Physical Development from Infancy to Adolescence
- c. Physical Characteristics of Learners of:
- d. Preschool and Kindergarten
- e. Primary Level
- f. Elementary Level
- g. Secondary Level
- h. Higher Secondary Level
- i. Role of Teacher in Physical Development

### **Unit 3. Intellectual Development**

- a. Intellectual Development from Infancy to Adolescence
- b. Intellectual Characteristics of Learners of:
- c. Preschool and Kindergarten
- d. Primary Level

- e. Elementary Level
- f. Secondary Level
- g. Higher Secondary Level
- h. Role of Teacher in Intellectual Development

#### **Unit 4. Social Development**

- a. Social Development from Infancy to Adolescence
- b. Social Characteristics of Learners of:
  - c. Preschool and Kindergarten
  - d. Primary Level
  - e. Elementary Level
  - f. Secondary Level
  - g. Higher Secondary Level
- h. Role of Teacher in Social Development

#### **Unit5. Emotional Development**

- a. Emotional Development from Infancy to Adolescence
- b. Emotional Characteristics of Learners of:
  - c. Preschool and Kindergarten
  - d. Primary Level
  - e. Elementary Level
  - f. Secondary Level
  - g. Higher Secondary Level
- h. Role of Teacher in Emotional Development

#### **Unit 6. Moral Development**

- a. Morality as Rooted in Human Nature
- b. Morality as the Adoption of Social Norms
- c. Moral Reasoning
- d. Development of Morally Relevant Self-Control
- e. Correlates of Moral Conduct

#### **Unit 7. Language Development**

- a. What is Language?
- b. Components of Language
- c. The Sequence of Language Development
- d. Biological and Environmental Influences on Language Development

## **Unit 8. Human Learning**

- a. Definition and Concept of Learning
- b. Process of Learning
- c. Factors Affecting Learning
- d. Thorndike's Laws of Learning
- e. Transfer of Learning

## **Unit 9. Approaches to Learning**

- a. Behavioral Approach
- b. Cognitive Approach
- c. Social Learning Approach
- d. Humanistic Approach

## **Unit10. Individual Differences**

- a. Sources and Types of Individual Differences
- b. Dealing with Academic Ability Grouping
- c. Differences in Learning and Thinking Styles
- d. Effects of Individual Differences on Learning

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books:**

Arif, H. A. (2003) *Human Development and Learning*. Lahore: Majeed Book Depot.

Berk, L. E. (2006) *Child Development*. (7th Edition). Pearson Prentice Hall: Pearson Education, Inc.

Dembo, M.H. (1994) *Applying Educational Psychology* (5th Edition). New York: Longman.

Mehnaz Aziz (2007), *Assessing children's Development through observation*, Children's Global Network Pakistan.

Mehnaz Aziz (2007), *Individualized teaching in ECE*, Children's Global Network Pakistan.

Ormrod, J.E. (1998) *Educational Psychology Developing learners*. New Jersey: Prentice Hall.



Santrock, J.W. (2001) *Educational Psychology*. Boston: McGraw Hill.

Vander Zanden, J. W. (1997) *Human Development*. (6th Edition). New York: The McGraw-Hill Companies, Inc.

Woolfolk, A (2004) *Educational Psychology* (9th Ed.). Singapore: Pearson Education. Inc.

**COURSE TITLE: BOTANY-II (PLANT SYSTEMATIC ANATOMY & DEVELOPMENT THEORY)**

**CREDIT HOURS: 3**

**Syllabus Outline:**

Introduction to Plant Systematics, aims and objectives. History of classification, Introduction to nomenclature, International code Morphological study of families, Anatomical study of cell wall and the internal structure (tissues) of the plant body Simple and complex tissues structure, function and relationship. Developmental embryology.

**Plant Systematics:**

Introduction to Plant Systematics: aims, objectives and importance.

**Classification:**

Brief history of various systems of classification (Artificial, Natural and Phylogenetic) with emphasis on Takhtajan's System of Classification.

**Nomenclature:**

Introduction: Importance of Latin names and binomial nomenclature with an introduction to International code of Botanical Nomenclature ICBN), St. Luis Code.

**Morphology:**

Brief account of various morphological characters of root, stem and leaf. inflorescence, flower, placentaion and fruit types

**Diagnostic Characters:**

Economic importance and distribution patterns of the following families:

1. Ranunculaceae
2. Brassicaceae (Cruciferae)
3. Fabaceae (Leguminosae)
4. Rosaceae
5. Euphorbiaceae
6. Solanaceae
7. Lamiaceae (Labiatae)
8. Apiaceae (Umbelliferae)
9. Asteraceae (Composite)
10. Liliaceae (Sen.Lato)
11. Poaceae (Graminae)

**Anatomy:**

Cell wall structure and chemical composition

**Simple Tissues:**

Parenchyma, Collenchyma, Sclerenchyma

**Epidermis:**

Epidermis and epidermal appendages including stomata.

**Complex tissues:**

Xylem, Phloem

**Meristem:**

Types of meristem, stem and root apices, secondary meristem, vascular cambium and periderm. Structure and development of primary root and stem, structure of leaf. Developmental embryology: *Capsella bursa/ pastoris*, structure of anther, microsporogenesis, Microgametophyte, structure of ovule, megasporogenesis, Megagametophyte, Endosperm formation

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended**

1. Raven. P.H., Evert, R.E. and Eichhorn, S.E. (2010). Biology of Plants. W.H. Freeman and Company Worth Publisher.
2. Stuessy, T.F. (2009). Plant Taxonomy. Columbia University Press. USA.
3. Lawrence, G.H.M. (2007). Taxonomy of Vascular Plants. (2<sup>nd</sup> Ed.). MacMillan and Co. New York.
4. Raymond, F. and Eichhorn, S.E. (2005). Esau's Plant Anatomy. Meristems cells and tissue of the plant body, (3rd Ed.) John Wiley and Sons & Sons Inc.
5. Pandey, B.P. (2004). A Text Book of Botany (Angiosperms). S. Chand and Co. New Delhi.
6. Moore, R.C., W.D. Clark and Vodopich, D.S. (2003). Botany. McGraw Hill Company, U.S.A.
7. Mauseth, J. D. (1998). An introduction to Plant Biology. Multimedia Enhanced. Jones and Bartlett Publisher UK.
8. Fahn, A. (1990). Plant Anatomy. Pergamon Press Oxford.
9. Maheshwari, P. (1971). Embryology of Angiosperms. McGraw Hill. New York.
10. Esau, K. (1960). Anatomy of Seed Plants John Wiley and Sons, New York.

**COURSE TITLE: BOTANY LAB-II (PLANT SYSTEMATIC ANATOMY & DEVELOPMENT THEORY)**

**CREDIT HOURS: 1**

**Syllabus Outline:**

Identification of families, Technical description of the flowers, Field trips, Specimen collection, Epidermis. Epidermal appendages, study of stomata, Study of xylem, transverse section of leaf and stem.

**Identification of families:**

With the help of keys description of flower (in technical- terms) of the families Ranunculaceae, Brassicaceae, Fabaceae Rosaceae, Euphorbiaceae, Cucurbitaceae, Solanaceae, Lamiaceae, Apiaceae, Asteraceae, Liliaceae and Poaceae.

**Field Trips:**

Field trips shall be undertaken to study and collect local plants Students are required to submit forty fully identified herbarium specimens.

**Anatomy:**

Study of epidermis, stomata and trichomes

**Tissues:**

(Study of simple tissues from fresh material and prepared slides as well. Study of complex tissues: xylem, maceration and study of xylem from macerated material).

**Stem and Leaf:**

Make a transverse section of stem and leaf of angiosperm.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Raven, PH. Even, R.E. and Eichhom, S.E. (2010). *Biology of Plants*. W.H. Freeman and Company Worth Publisher.
2. Lawrence, G.H.M. (2007). *Taxonomy of Vascular Plants*. (2<sup>nd</sup> Ed.). MacMillan and Co. New York.
3. Raymond, F. and Eichhorn, S.E. (2005). *Esau's Plant Anatomy. Meristems cells and tissue of the plant body*, (3<sup>rd</sup> Ed.) John Wiley and Sons Inc. New York.
4. Panday, B.P. (2004). *A Text Book of Botany (Angiosperms)*. S. Chand and Co. New Delhi.

5. Moore, R.C., W.D. Clark and Vodopich, D.S. (2003). *Botany*. McGraw Hill Company, U.S.A.
6. Foster. F. (2002). *Practical Plant Anatomy*. John Wiley and Sons, New York.
7. Mauseth, J. D. (1998). *An introduction to Plant Biology*. Multimedia Enhanced. Jones and Bartlett Publisher. UK.
8. Zahur, M.S. (1992). *The Taxonomy of Angiosperms*. Al-Hejaz Printers. Lahore.
9. Fahn, A. (1990). *Plant Anatomy*. Pergamum Press Oxford.
10. Maheshawari, P. (1971). *Embryology of Angiosperms*. McGraw I-fill New York.
11. Esau, K. (1960). *Anatomy of Seed Plants*. John Wiley and Sons, New York.

## **CHEMISTRY-II (INORGANIC CHEMISTRY)**

**CREDIT HOURS: 3**

### **COURSE OBJECTIVES**

The program is aimed that the student should learn:

1. The Development of periodic law and properties of elements in a systematic way.
2. The principal of chemical bonding
3. The Chemistry of acid and bases
4. The Chemistry of p-block Elements
5. The Chemistry of d- block Elements
5. The fundamental principles of industrial process

### **COURSE CONTENT:**

#### **1. The Structure of the Atom**

Inner picture of an atom: Subatomic particles, models of the atom described by Rutherford and Bohr, Energy of an electron, Radius of an orbit, Origin of spectral lines in different: elements. Sommerfeld's modification.

#### **2. Periodicity**

Modern periodic table; Similarities and differences in first row elements, their diagonal and vertical relationship with other elements; Electro negativity of elements (Pauling and Mullikan scales); Polarizability and polarizing power of ions; Periodicity in the properties of transition and inner transition elements.

#### **3. Theories of Chemical Bonding**

Nature and types of chemical bonding; Modern concept of valence bond theory (VBT), molecular orbital theory (MOT) and their applications to homo and hetero di-and polyatomic inorganic molecules, explaining the conventional and modified MO diagrams; Valence shell electron pair repulsion theory (VSEPR), explaining the shapes of inorganic molecules (i.e.  $AB_2$ ,  $AB_3$ ,  $AB_2E$ ,  $AB_4$ ,  $AB_3E$ ,  $AB_2E_2$ ,  $AB_5$ ,  $AB_4E$ ,  $AB_3E_2$ ,  $AB_2E_3$ ,  $AB_6$ ,  $AB_5E$ ,  $AB_4E_2$ ) and directed valence theory (Hybridization), Metallic bonds (detailed concept).

## 1. Acid-Base Concept

General concept of acids and bases. Detail of Lewis concept of acids and bases; Soft and hard acid-base (SHAB) concept and its applications. Relative strength of acids and bases based on  $P_k$  values. Reactions of acids and bases. Relationship between redox reactions and acid base reactions. Indicators and theory of indicators.

## 5. Chemistry of d-Block Elements

Electronic configuration and oxidation states of transition elements. Metallurgy of chromium, nickel and copper. Theories of coordination compounds, valence bond theory (VBT), molecular orbital theory (MOT) and crystal field theory (CFT) for tetrahedral and octahedral complexes. Nomenclature and Isomerism in coordination compounds. Chelates. Application of coordination compounds.

## 6. Nuclear Chemistry

Phenomena of radioactivity; Natural radioactivity, Radioactive disintegration series, rate of disintegration and half life period, Mass defect and binding energy, nuclear stability; measurement of nuclear radiation, Wilson cloud chamber and Geiger-Muller counter, Carbon dating; Artificial radioactivity and nuclear transformations, Nuclear reactions (fission and fusion), Uses of radioactive isotopes; Biological effect of nuclear radiation.

## Chemical Industries

Glass, Soda ash and Soap.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Recommended Books:

1. Cotton, F, Albert, Geoffrey Wilkinson and Paul L. Gaus, "Basic Inorganic Chemistry", John, Wiley & Sons Inc, 3<sup>rd</sup> Edition (1995).
2. Lee, J.D., "Modern Inorganic Chemistry", Chapman & Hall, 5<sup>th</sup> Edition (1996).
3. Jolly, William, L., "Modern Inorganic Chemistry", McGraw Hill, 2<sup>nd</sup> Edition (1991).

4. Shriver, D.F., P.W. Atkins and C.H. Langford, "Inorganic Chemistry", Oxford, 2<sup>nd</sup> Edition (1996).
5. Sharp, A.G. "Inorganic Chemistry", Longman, 3<sup>rd</sup> Edition (1992).
6. Rayner Canham, Geiof., "Descriptive Inorganic Chemistry" & Co. (1995).
7. Jefferey, G.H., j. bassett, J.Mendham and R.C. Denney, "Vogel's text book of Quantitative Chemical analysis", 5<sup>th</sup> Edition, Benjamin Cummings, (1989).



**TITLE: CHEMISTRY LAB-II (INORGANIC CHEMISTRY)****CREDIT HOURS: 1****PAPER CHROMATOGRAPHY**

Separation & identification of cations/basic radicals of group I, II.A, II.B & III. Also calculate their  $R_f$  values.

**ARGENTOMETRY****MOHR'S METHOD**

- 1) Determine the %age purity of NaCl (rock salt)
- 2) Determine the amount of NaCl in the commercial sample of soda ash.

**VOLHARD'S METHOD**

- 1) Determination of %age purity of HCl.
- 2) Determination of silver in the given sample, using KSCN or  $\text{NH}_4\text{SCN}$ .

**REDOX TITRATIONS (By using both internal and external indicators)**

- 1) Determination of amount/ $\text{dm}^3$  of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  with  $\text{K}_2\text{Cr}_2\text{O}_7$ .
- 2) Determination of %age purity of  $\text{K}_2\text{Cr}_2\text{O}_7$  by using standard solution of Mohr's salt.
- 3) Determination of number of water molecules (x) in  $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$  using  $\text{K}_2\text{Cr}_2\text{O}_7$ .
- 4) Determination of  $\text{Ca}^{2+}$  by  $\text{KMnO}_4$ .
- 5) Determination of %age of iron in ferric alum  $(\text{NH}_4)_2\text{SO}_4 \cdot \text{Fe}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$  using  $\text{K}_2\text{Cr}_2\text{O}_7$ .

**COMPLEXOMETRY**

- 1) Standardization of EDTA solution by magnesium/zinc sulfate solution.
- 2) Find out the amount of  $\text{Ca}^{2+}$  in the given sample of marble (lime stone).
- 3) Determination of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  in the sample by using EDTA.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Vogel, "A.I.A. Text Book of Macro and Semi micro-qualitative Inorganic Analysis", Longman Green & Co., (1995).
2. Skoog, D.A., D.M. West and F.J. Holler, "Analytical Chemistry", 6<sup>th</sup> Edition, Saunders College Publications, (1994).
3. Javed Iqbal, Amin, "Theory and Practice of chromatography", Higher Education Commission, Islamabad, (2002).

**Course Title: A Course of Mathematics II [ Plane Curves & Analytic Geometry ]**  
**Course Rating: 4 Cr. Hours**

**Plane Analytics Geometry**

- Conic section and quadratic equations
- Classifying conic section by eccentricity
- Translation and rotation of axis
- Properties of circle, parabola, ellipse, hyperbola
- Polar coordinates, conic sections in polar coordinates
- Graphing in polar coordinates
- Tangents and normal, pedal equations, parametric representations of curves

**Applications of Integration**

- Asymptotes.
- Relative extrema, points of inflection and concavity
- Singular, points, tangents at the origin
- Graphing of Cartesian and polar curves
- Area under the curve, area between two curves
- Arc length and intrinsic equations
- Curvature, radius and centre of curvature
- Involute and evolute, envelope

**Analytic Geometry of Three Dimensions**

- Rectangular coordinates system in a space
- Cylindrical and spherical coordinate system
- Direction ratios and direction cosines of a line
- Equation of straight lines and planes in three dimensions
- Shortest distance between skew lines
- Equation of sphere, cylinder, cone, ellipsoids, paraboloids, hyperboloids
- Quadric and ruled surfaces
- Spherical trigonometry. Direction of Qibla

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Books**

1. Thomas, *Calculus*, 11<sup>th</sup> Edition. Addison Wesley publishing company, 2005
2. H. Anton, I. Bevens, S. Davis, *Calculus*, 8<sup>th</sup> Edition, John Wiley & Sons, Inc. 2005
3. Hughes-Hallett, Gleason, McCallum, et al, *Calculus Single and Multivariable*, 3<sup>rd</sup> Edition. John Wiley & Sons, Inc. 2002.

4. Frank A. Jr, Elliott Mendelson, *Calculus*, Schaum's outlines series, 4<sup>th</sup> edition, 1999
5. C.H. Edward and E.D Penney, *Calculus and Analytics Geometry* Prentice Hall, Inc. 1988
6. E. W. Swokowski, *Calculus and Analytic Geometry* PWS Publishers, Boston, Massachosetts, 1983.
7. Dennis G. Zill & Patric D. Shanahan, *Complex Analysis*, Jones & Barlett Publishers, 2003

**Course Title: B Course of Mathematics-II [ Mechanics (II) ]**  
**Course Rating: 4 Cr. Hours**

**Kinematics**

- Rectilinear motion of particles
- Uniform rectilinear motion, uniformly accelerated rectilinear motion
- Curvilinear motion of particle, rectangular components of velocity and acceleration
- Tangential and normal components
- Radial and transverse components
- Projectile motion

**Kinetics**

- Work, power, kinetic energy, conservative force fields
- Conservation of energy, impulse, torque
- Conservation of linear and angular momentum
- Non-conservative forces

**Simple Harmonic Motion**

- The simple harmonic oscillator, amplitude, period, frequency,
- Resonance and energy
- The damped harmonic oscillator, over damped, critically damped and under damped
- Motion, forced vibrations

**Central Forces and Planetary Motion**

- Central force fields, equations of motion, potential energy, orbits
- Kepler's laws of planetary motion
- Apsides and apsidal angles for nearly circular orbits
- Motion in an inverse square field

**Centre of Mass and Gravity**

- Discrete and continuous systems, density of rigid and elastic bodies
- Centroid: Discrete and continuous systems, solid region, region bounded by planes
- Semi-circular regions, sphere, hemisphere, cylinder and cone

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

***Recommended Books***

1. Fowles, G.R, Cassiday, G.L. *Analytical Mechanics*, 7<sup>th</sup> Edition, Thomson Brook Cole, 2005
2. Jafferson, B. Beadsdworth, T. *Further Mechanics*, Oxford University Press 2001
3. Murray R. Spiegel, *Theoretical Mechanics*, Schaum's Outline Series, Mc Graw Hill Book Company
4. D.K. Anand and P.F. Cunnif, *Statics and Dynamics*, Allyn and Becon, Inc. 1984
5. Ferdinand P.B and E.R. Johnston, *Statics and Dynamics*, Mc-Graw Hill Book Company, Inc. 1977

# Physics 2(WAVES AND OSCILLATIONS)

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**PRE-REQUISITE: FSc Level Physics**

**CREDITE HOURS: 3**

This course is one part of four that constitute the Introductory Physics program for Physics Majors. It is a stepping stone to all the upper-level Physics courses providing fundamental knowledge, mathematical techniques and laboratory practices. Many of the concepts in Waves, Optics and Thermodynamics introduced in this course will be encountered again & expanded upon in later courses.

## **COURSE OBJECTIVE:**

Thus the main objective of this course is to provide students an introduction to the fundamental concepts of Waves, Optics, and Thermodynamics along with a thorough grounding in the associated mathematical and laboratory techniques.

1. Describe wave motion, including differentiating between transverse vs longitudinal waves, and standing vs progressive waves.
2. Derive and solve the equation for a propagating wave and a standing wave.
3. Describe the energy transported by a wave and the resonance condition,
4. Explain Huygen's Principle and perform calculations involving the Doppler effect.
5. Perform calculations related to the concept of superposition, including interference & diffraction.

## **COURSE OUTLINE:**

**Simple and Damped Simple Harmonic Oscillation:** Mass-Spring System, Simple Harmonic Oscillator Equation, Simple Pendulum. Forced Damped Harmonic Oscillation, Resonance.

**Mechanical waves:** traveling waves, wave equation and power and intensity in wave motion, principle of superposition, Doppler Effect of sound waves

**Interference:** Interference from thin films, Michelson interferometer, Fresnel's biprism and its use,

**Diffraction:** diffraction from multiple slits, diffraction grating, X-ray diffraction and structure of matter,

**Polarization:** description of polarization states, rotation of plane of polarization, holography.

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **REFERENCE BOOKS:**

1. Physics Vol. I & II (extended) by Resnick, Halliday and Krane, 4th Edition, John Wiley and Sons Inc, New York, 1992.
2. Physics Vol. I & II by Resnick, Halliday and Krane, 5th Edition, John Wiley and Sons Inc, New York, 2002.
3. Fundamental of Physics by Halliday Resnick and Krane, 5th Edition, John Wiley and Sons Inc, New York, 1999.
4. University Physics 8th Edition by Sears, Zemansky and Young, Addison-Wesley, Reading (MA), USA, 2000.
5. Physics by Alonso and Finn: Addison-Wesley, Reading (MA), USA, 1999.

## PHYSICS LAB-II (GENERAL PHYSICS-II)

1. The Harmonic Oscillation of Helical springs-parallel and series connection of spring
2. Measurement of the speed of sound in air
3. Coherence & width of spectral lines
4. Diffraction intensity at slit of double slit system
5. Interference of light Fresnel Biprism
6. Measurement of wavelengths of sodium light, difference of wave lengths and thickness of thin film e.g. mica using Michelson interferometer.
7. The determination of Cauchy's constants using spectrometer.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### REFERENCE BOOKS:

1. Physics Vol. I & II (extended) by Resnick, Halliday and Krane, 4th Edition, John Wiley and Sons Inc, New York, 1992.
2. Physics Vol. I & II by Resnick, Halliday and Krane, 5th Edition, John Wiley and Sons Inc, New York, 2002.
3. Fundamental of Physics by Halliday Resnick and Krane, 5th Edition, John Wiley and Sons Inc, New York, 1999.
4. University Physics 8th Edition by Sears, Zemansky and Young, Addison-Wesley, Reading (MA), USA, 2000.
5. Physics by Alonso and Finn: Addison-Wesley, Reading (MA), USA, 1999.



## **ZOOLOGY II ANIMAL DIVERSITY-II (CLASSIFICATION, PHYLOGENY AND ORGANIZATION)**

**CREDIT HOURS: 3**

### **Aims and Objectives:**

The course aims to impart knowledge and understanding of:

- different animal groups, emphasizing their phylogenetic relationships.
- The structure and function of cell organelles and how common animal cell diversified in various tissues, organs and organ systems.
- Biochemical mechanisms eventually generating energy for animal work.

### **Echinoderms**

Evolutionary perspective: relationships to other animals; echinoderm characteristics; classification up to class. Maintenance functions, regeneration, reproduction, and development in asteroidea, ophiuroidea, echinoidea, holothuroidea and crinoidea; further phylogenetic considerations; some lesser-known invertebrates: the lophophorates, entoprocts, cycliophores, and chaetognaths.

### **Hemichordates and Invertebrate Chordates**

Evolutionary Perspective: Phylogenetic Relationships; Classification up to subphylum or class where applicable; Further Phylogenetic Considerations.

### **Fishes: Vertebrate Success in Water**

Evolutionary perspective: phylogenetic relationships; survey of super class agnatha and gnathostomata; evolutionary pressures: adaptations in locomotion, nutrition and the digestive system, circulation, gas exchange, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations.

### **Amphibians: The First Terrestrial Vertebrates**

Evolutionary perspective: phylogenetic relationships; survey of order caudata, gymnophiona, and anura. Evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction, development, and metamorphosis; further phylogenetic considerations.

### **Reptiles: The First Amniotes**

Evolutionary perspective: cladistic interpretation of the amniotic lineage; survey of order testudines or chelonia, rhynchocephalia, squamata, and crocodilia; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations.

### **Birds: Feathers, Flight, and Endothermy**

Evolutionary perspective: phylogenetic relationships; ancient birds and the evolution of flight; diversity of modern birds; evolutionary pressures: adaptation in external structure and locomotion, nutrition and the digestive system, circulation, gas

exchange, and temperature regulation, nervous and sensory systems, excretion and osmoregulation, reproduction and development; migration and navigation.

**Mammals: Specialized Teeth, Endothermy, Hair, and Viviparity**

Evolutionary perspective: diversity of mammals; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, behavior, reproduction and development.

**Cells, Tissues, Organs, and Organ System of Animals**

Structure and functions of cell membranes; various movements across membranes; cytoplasm, organelles, and cellular components: functional account of ribosomes, endoplasmic reticulum, golgi apparatus, lysosomes, mitochondria, cytoskeleton, cilia and flagella, centrioles and microtubules, and vacuoles based on their structural aspects. The nucleus: nuclear envelope, chromosomes and nucleolus. Tissues: diversity in epithelial tissue, connective tissue, muscle tissue and nervous tissue to perform various functions. Structural integrations for functions in organs and organ systems.

**How Animals Harvest Energy Stored in Nutrients**

Glycolysis: the first phase of nutrient metabolism; fermentation: “life without oxygen”; aerobic respiration: the major source of ATP; metabolism of fats and proteins; control of metabolism; the metabolic pool.

**Books Recommended**

Campbell, N. A. (2002). *Biology* (6<sup>th</sup> ed). Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

Hickman, C. P. & Kats, H. L. (2000). *Laboratory studies in integrated principles of zoology*. Singapore: McGraw Hill.

Hickman, C.P., Roberts, L.S., & Larson, A. (2004). *Integrated principles of zoology* (12<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Kent, G. C. & Miller, S. (2001). *Comparative anatomy of vertebrates*. New York: McGraw Hill.

Miller, S. A. (2002). *General zoology laboratory manual* (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Miller, S. A., & Harley, J. B. (2000). *Zoology* (6<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Pechenik, J. A. (2000). *Biology of invertebrates*, (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

**Semester-III**  
**ENGLISH-III (COMMUNICATION SKILLS)**  
**CREDIT HOURS: 3**

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**1. FORMAL LETTERS**

- The students are expected to be proficient in formal letter writing like Letters to the editor, public officials (WAPDA, WASA etc.)

**2. ADVANCED READING AND COMPREHENSION I**

- The students are required to read the given prose critically and answer the questions.

**Recommended Book:**

The St. Martin's Guide to Writing by Rise B. Axelrod, Charles R. Cooper. Pub. St. Martin's Press, 1988. (Page 18-19, 26-34, 49-55, 66-67, 77-80, 88-94, 104-105, 110-115, 129-137)

**3. ORAL PRESENTATIONS**

- Strategies for oral presentation.
- The students must learn how to give oral presentations and they should be able to give formal presentations.

**Recommended Book:**

Effective Business Communications, 7<sup>th</sup> Edition by Herta A. Murphy, Herbert W. Hildebrandt, Jane P. Thomas. Pub. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009. (Page 384-399)

**4. CONNECTED PARAGRAPH WRITING AND PICTURE DESCRIPTION**

- The students are required to practice paragraph writing with an emphasis on Topic sentence and Supporting sentences. The students are supposed to write **at least 3** connected paragraphs on a single theme (word limit: 350 words).
- The students are required to learn how to analyze and describe pictures in correct English.

**Recommended Book:**

Paragraph Development: A Guide for Students of English as a Second Language by Martin L. Arnaudet, Mary Ellen Barrett. Pub. Prentice Hall College Div. 1981 (Page 179-185)

**5. VOCABULARY BUILDING SKILLS**

WORD ROOT METHOD Unit 7-11. Page No. 103-116.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Book:**

Guide for GAT General Test. SMART BRAIN. GRE (General, Local) by Muhammad Idrees. Pub: Dogar Brothers. 2010-2011 edition.

## PAKISTAN STUDIES

### CREDIT HOURS: 2

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#### 1. Pakistan Movement: Historical and Ideological Perspective

- Muslim Revivalist Movements in India
- The Two-Nation Theory: From Sir Syed Ahmed Khan to Allama Iqbal
- Quaid-i-Azam Muhammad Ali Jinnah and the Struggle for Pakistan Creation of Pakistan: Early Challenges

#### 2. Land and People of Pakistan

- Physical features and Geo-Strategic Location of Pakistan
- Culture and Traditions: Regional Dimensions
- Social Issues and Challenges to Pakistan

#### 3. History and Politics in Pakistan (1947-2008)

- Early Parliamentary Phase
- Ayub and Yahya's Era
- Democratic Era (1971-1977)
- Zia Era (1977-88)
- Civil Rule (1988-99)
- Musharraf Era (1999-2008)

#### 4. Contemporary Pakistan

- The Constitution of 1973: Salient Features
- Foreign Policy and Relations with neighboring countries
- Salient Features of Economy, Agriculture and Industry, National Resources

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Recommended Books:

1. Muhammad Raza Kazmi, Pakistan Studies Core Texts for Colleges and universities, Oxford University Press (2006)
2. Ishtiaq Hussain Qureshi, The Struggle for Pakistan, Karachi, University of the Karachi, 1974
3. Khalid Bin Sayeed, Pakistan the Formative Phase (1857-1948), Karachi, Oxford University Press, 1968.
4. Choudhary M. Au, The Emergence of Pakistan, Lahore, Research Society of Pakistan, 2001
5. S. Qalb-i-Abid, Muslim Struggle for Independence (1857-1947), Sang-e-Med Publications, Lahore, 1997
6. M.R. Kazimi, A Concise History of Pakistan, Oxford University Press, 2009
7. Mehmood, Safdar. Pakistan Political Roots & Development. Lahore, 1994.

8. Afzal, M. Rafique, Pakistan: History and Politics 1947-1971, Karachi, Oxford University Press, 2007
9. Rizvi, Hasan-Askari, The Military State and Society in Pakistan, Lahore, 2002
10. Burke, S.M., and Qureshi, S.A.D., The British Raj in India, Karachi, Oxford University Press, 1995
11. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical Analysis. Karachi: Oxford University Press, 1993.
12. Akbar, S. Zaidi, Issues in Pakistan's Economy, Karachi: Oxford University Press, 2000
13. Jinnah of Pakistan, Karachi, Oxford University Press, 1989
14. Zuifi Bhutto of Pakistan, New York, Oxford University Press, 1989
15. Shahid, M. Amin, Pakistan's Foreign Policy: A Reappraisal, (Second Edition), Karachi, Oxford University Press, 2010
16. Abdul Sattar, Pakistan's Foreign Policy: A Concise History 1947-2009 (2<sup>nd</sup> Edition), Karachi, Oxford University Press, 2010
17. Hardy, Peter, The Muslims of British India, New Delhi, Cambridge University Press, 1998

## **Course: Critical Thinking and Reflective Practices**

**Credit Hours: 3**

### **Objectives:**

After- studying this course, the students will be able to:

- ☐ Differentiate between 'Good' and 'Bad' bent of mind
- ☐ Ask and analyze thought provoking Questions
- ☐ Understand the relationship of critical thinking with reading and writing
- ☐ Foster rational motivation among the students.
- ☐ Apply critical thinking in different Content areas
- ☐ Develop the habit of contributive thinking
- ☐ Understand the concept and role of reflection and reflective practice as a tool for raising critical consciousness
- ☐ Use reflection as a tool of inquiry into practice

### **Course Content**

#### **Unit 01 Introduction**

- 1.1 Introduction to the Fundamentals of Critical Thinking
- 1.2 Why Critical Thinking Matters?
- 1.3 Critical Thinking and the Process of Analysis
  - A. Teaching Students to Think Theoretically
  - B. Teaching Students to Think Empirically

#### **Unit 02 Strategies and Techniques to develop critical Thinking**

- 2.1 Brain Storming
- 2.2 Concept Mapping
- 2.3 Generalization and Testing the Limits
- 2.4 Venn Diagram
- 2.5 Logical Reasoning

#### **Unit 03 Critical Thinking and Art of Questioning**

- 3.1 Critical Thinking and Socratic Questioning
- 3.2
- 3.3 Teaching Students to Ask Good Questions & Follow up the Implications of Thought
- 3.4 Teaching Students to narrate, analyze, and evaluate their own 'Points'

3.5 View' and of others

3.6 Open and Close ended Questions

**Unit 04      Critical Thinking and its Applications**

4.1 Interrogating the Text

4.2 Primary and Secondary Sources

4.3 Characteristics of Academic Text

4.4 Status of Evidence

4.5 Status of The Author

4.6 Comparing and Contrasting Different Sources

**Unit 05      Introduction to Reflection**

5.1    Meaning of reflection on practice/educational issues

5.2    Significance of reflection for teacher

**Unit 06      Major Proponents of Reflective Practice**

6.1 John Dewey

6.2 L. Stanhouse

6.3 D,Schon

**Unit 07      Process and Techniques of Reflection**

7.1 Process of reflection

7.2 Major techniques and strategies (critical incident analysis, keeping reflective journals, peer coaching action research)

7.3 Skills for reflection

**Unit 08      Application of skills and approaches to reflection**

8.1 Systematic reflection throughout the coursework

8.2 Identify key questions for their own role as novice teachers

8.3 Understand the issues in becoming a reflective practitioner

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Recommended Books:

- Ayookarm, Govald (1989), *Modern Methods and Techniques of Teachings*  
Philadephia. Open University press 1
- Baron, J. and Sternberg, R, (Eds.) (1987) *Teaching thinking skills: theory and practice*, New York: Freeman.
- Barrow, R. (1990) *Understanding Skills: Thinking, Feeling and Caring*. London, Ontario: Althouse.
- Beyer. B. K. (1987) *Practical strategies for the teaching of thinking*. Boston: Allyn and Bacon.
- Chipman, S., Segat, J. and Glaser, R, (1985) *Thinking and Learning Skills*, Volume 2. Research and Open Questions. HiNsdale, New Jersey: Eribaum.
- Crawford, A. (2005). *Teaching and learning strategies for the thinking classroom*. New York, NY: International Debate Education Association.
- Costa, A.L. and Lowery, L.F. (1990) *Techniques for teaching thinking*, Melbourne: Hawker Brownlow.
- Finn, B. (1991) *Young People's Participation in Post-compulsory Education and Training*. Report of the Australian Education Council Review Committee. Canberra: Australian Government Publishing Service.
- Lau, J. Y. F. (2013). *An introduction to critical thinking and creativity: Think more, think better*. Hoboken, N.J: Wiley.
- Zwozdiak-Myers, P. (2012). *The teacher's reflective practice handbook: Becoming an extended professional through capturing evidence-informed practice*. Abingdon, Oxon: Routledge.



**COURSE TITLE: BOTANY-III (CELL BIOLOGY, EVOLUTION AND GENETICS)**

**CREDIT HOURS: 3**

**Syllabus Outline:**

An introduction to morphology and functioning of cell, cellular organelles and mechanisms of cell division. Study of genes and their inheritance patterns. Concept of evolution.

**a) Cell Biology:**

1. Structures and brief description of Bio-molecules
  - i) Carbohydrates
  - ii) Lipids
  - iii) Proteins
  - iv) Nucleic Acids
2. Cell: Physico-chemical nature of plasma membrane and cytoplasm.
3. Ultra structure of plant cell with a brief description and functions of the following organelles:
  - i) Endoplasmic reticulum
  - ii) Plastids
  - iii) Mitochondria
  - iv) Ribosomes
  - v) Dictyosomes
  - vi) Vacuole
  - vii) Microbodies (Glyoxysomes and Peroxisomes)
4. Nucleus: Nuclear membrane, nucleolus, ultrastructure and morphology of chromosomes, karyotype analysis.
5. Reproduction in somatic and embryonic 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 of Groups, Construction of Linkage Maps, Detection of Linkage. Recombination
4. DNA Replication. Nature of gene, genetic code, transcription, translation, regulation of gene expression

5. Transmission of genetic material and Bacteria: Conjugation and gene recombination in co-transduction and transformation.
6. Principles of genetic engineering/biotechnology; Basic genetic engineering techniques.
7. A brief introduction of Gene Mutation.
8. Evolution
9. **Assessment Strategies (Theory) :**

#### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### **BOOKS RECOMMENDED:**

1. Bretscher, A. (2007).Molecular Cell Biology. W. H. Freeman and Company
2. Weaver, R.F. (2005).Molecular Biology. McGraw Hill, St. Louis.
3. Griffiths, J.F., Miller, J.H., Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2003).An Introduction to Genetic Analysis. W.H. Freeman and Company.
4. Sinha, U. and Sinha, S. (2003).Cytogenesis, Plant Breeding and Evolution. Vini Educational Books, New Delhi.
5. Strickberger, M.V. (2003).Genetics. MacMillan Press Ltd., London.
6. Karp, G. (2002).Cell and Molecular Biology. Concepts and Experiments. 4<sup>th</sup> Ed. John Wiley and Sons. New York.
7. Gilmartin, P.M. and Bowler. C. (2002).Molecular Plant Biology. vol 1 & 2. Oxford University Press. UK.
8. Carroll, S.B., Grenier, J.K. and Velnerbee, S.D. (2001).From DNA to Diversity— Molecular Genetics and the Evolution of Amino Acid Design. Blackwell Science.
9. Hoelzel, A.R. (2001).Conservation Genetics. Kluwer Academic Publishers.
10. Lodish. H. (2001).Molecular Cell Biology. W.H. Freeman and Company.
11. Dyonsager, V. R. (2000).Cytology and Genetics. (3<sup>rd</sup> Ed.), Tata and McGraw Hill Publication Co. Ltd, New Delhi.

**COURSE TITLE: BOTANY LAB-III (CELL BIOLOGY, EVOLUTION AND GENETICS)**

**CREDIT HOURS: 1**

**Syllabus Outline:**

Development of concepts about cell structure, chromosomal morphology, mechanisms of cell division, extraction of protein, DNA, RNA from plant sources, genetical problems related to transmission and distribution of genetic material.

**a) Cell Biology:**

1. Study of cell structure using compound microscope and elucidation of ultra structure from electron microphotographs.
2. Measurement of cell size.
3. Study of mitosis and meiosis by smear/squash method and from prepared slides.
4. Study of chromosome morphology and variation in chromosome number.
5. Extraction and estimation of carbohydrates, proteins, RNA and DNA from plant material.

**b) Genetics:**

1. General problems related to transmission and distribution of genetic material.
  2. Identification of DNA in plant material. Carmine/Orcein staining.
- Study of salivary gland chromosomes of *Drosophila*.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Bretscher, A. (2007). Molecular Cell Biology. W. H. Freeman and Company
2. Griffiths, J.F., Miller, J.H., Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2003). An Introduction to Genetic Analysis. W.H. Freeman and Company.
3. Sinha, U. and Sinha, S. (2003). Cyto genesis, Plant Breeding and Evolution. Vini Educational Books, New Delhi.
4. Strickberger, M.V. (2003). Genetics. MacMillan Press Ltd., London.
5. Karp, G. (2002). Cell and Molecular Biology. Concepts and Experiments. 4th Ed. John Wiley and Sons. New York.

6. Gilmartin, P.M. and Bowler. C. (2002). Molecular Plant Biology. vol 1 & 2. Oxford University Press. UK.
  7. Lodish. H. (2001). Molecular Cell Biology. W.H. Freeman and Co.
- Dyonsager, V R. (2000). Cytology and Genetics. (3rd Ed.), Tata and McGraw Hill Publication Co. Ltd. New Delhi.

## **CHEMISTRY-III (ORGANIC CHEMISTRY)**

**CREDIT HOURS: 3**

### **COURSE OBJECTIVES**

The objective of the course is for students

1. To learn the fundamentals of organic chemistry.
2. To develop an understanding and appreciation of both structure and chemical transformations of organic molecules.
3. Will acquire basic concepts of electronic structure and be able to apply them to solve problems from various areas of organic chemistry, including stereochemistry, reactivity patterns and synthesis.
4. Improvements in learning strategies, critical-thinking, and problem-solving skills are an expected outcome.

### **COURSE CONTENT:**

#### **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 sulfur 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 effects 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; Heterocyclic compounds.

#### **3. Hydrocarbons**

##### **a) Alkanes and Cycloalkanes**

Preparation of alkanes from alkyl halides, coupling of alkyl halide and alkylboranes, reduction of carbonyl compounds, Kolbe's electro synthesis, Corey-house-synthesis, hydrogenation of alkenes and alkynes.

Reactions of alkanes with halogens, their mechanism and comparison of reactivities of halogens; combustion, isomerization, nitration and sulfonation.

Preparations of cycloalkanes by Freund synthesis, Hydrogenation of cyclic alkenes,; Structure and stability of cycloalkanes; Reaction of cycloalkanes.

**b) Alkenes and Alkynes** Preparation of alkenes from elimination reaction of alkyl halides and alcohols; Mechanism and orientation of eliminations; Dehalogenation of vicinal dihalides with mechanism; Pyrolytic eliminations. Reactions of alkene;

relative stability and reactivity; Addition of halogens, additions of halogen acids and the rules governing these reactions, hydration reactions, oxidation reactions including epoxidation and hydroxylation, polymerization; Simon-Smith and Diels-Alder reactions. Preparation of alkynes by carbide process, dehydrohalogenation of dihalides and alkylation of terminal alkynes. Reactions of alkynes: addition reactions with mechanisms, hydration reactions, oxidation, reduction, hydroboration, formation of metal acetylides, polymerization (linear and closed chain).

### c) **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.

Reaction of aromatic hydrocarbons: electrophilic aromatic substitution reactions i.e. nitration, halogenation, Friedel-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 chains.

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 naphthalene

### **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 and carboxylic acids;

Chemical reactions: Aliphatic nucleophilic substitution reactions,  $SN_1$  and  $SN_2$  mechanism, effects of the nature of substrate, attacking nucleophile, leaving group and the nature of solvent. Elimination reactions,  $E_1$  and  $E_2$ , 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  $CO_2$ ; Reactions with nitriles, ethylene oxide, sulphur and oxygen.

## 6. Chemistry of Hydroxyl Group containing Compounds and Ethers

**Alcohols:** Physical properties; Preparation of alcohols by the reduction of carbonyl compound; Reactions of alcohol with metals, organic and inorganic acids; Oxidation of alcohols; Distinction between primary, secondary and tertiary alcohols; Preparation of diols, triols and their important reactions and uses.

**Phenols:** Physical properties; Synthesis of phenols; Reactions of phenols such as acylation, Friedel-Crafts reaction, nitration, sulfonation, carbonation, formylation and diazo coupling.

**Ethers:** Physical properties; Preparation of ethers from alcohols, alkyl halides and alkenes; Reactions of ethers; Brief introduction of crown ethers and polyethers.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Recommended Books:

1. C.K. Ingold, "Structure and mechanism in organic chemistry", C.B.S.
2. I.L.Finlar, "Organic Chemistry", Vol. I, Pearson Education, L.P.E.
3. I.L.Finlar, "Organic Chemistry", Vol. II, 5<sup>th</sup> Edition, L.P.E.
4. Jerry March, "Advanced Organic Chemistry, Reaction, Mechanism and Structure", 5<sup>th</sup> Edition, Wiley Inter Science.
5. Morison and Boyd, "Organic Chemistry", 6<sup>th</sup> Edition, Prentice Hall.
6. Seyhan N. Ege, "Organic Chemistry Structure and Reactivity", 3<sup>rd</sup> Edition, The University of Michigan, A.I.T.B.S. Publishers & Distributors (Regd.).
7. Thomas H. Lowry, Kathleen Schueller Richardson "Mechanism and Theory in Organic Chemistry", 3<sup>rd</sup> Edition, Harper and Row Publishers, New York.
8. Alder, Baker, Brown, "Mechanism in Organic Chemistry", Wiley Publishers.
9. Atkins Carey, "Organic Chemistry", A Brief Course, 2<sup>nd</sup> Edition.
10. Peter Sykes, "A guide book to mechanism in organic chemistry", 6<sup>th</sup> Edition, Pearson Education, Singapore.
11. Carruthers, "Modern Methods of Organic Synthesis", Cambridge low Priced Edition, Cambridge.
12. Harris, Wamser, "Fundamentals of Organic Reaction Mechanism", Wiley Publishers.
13. G. Malcolm, Dyson, "A Manual of Organic Chemistry", Vol. I.
14. Canant Blat, "The Chemistry of Organic Compound", 5<sup>th</sup> Edition.
15. R. Panico, W.H.Powell, Jean-Claude Richer, "A guide to IUPAC Nomenclature of Organic Compounds", Blackwell Sci. Publication, 1993.

## CHEMISTRY LAB-III (ORGANIC CHEMISTRY)

### CREDIT HOURS: 1

#### 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, -NH<sub>2</sub>, and -CONH<sub>2</sub>

#### 2) Basic Experimental techniques used in organic chemistry

- 1) Filtration
- 2) Simple and fractional distillation
- 3) Solvent extraction
- 4) Sublimation
- 5) Re-crystallization
- 6) Column Chromatography

#### 3) Estimations (volumetric)

- 1) Determination of molecular weight of a carboxylic acid.
- 2) Estimation of amide group and glucose.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Recommended Books:

1. K.M.Ibne Raza, M.A. Rehman, Abdur Rehman, "Organic Chemistry", The Carvan Book House, Lahore.
2. B.S. Furniss, "Vogel's T.B of Practical Organic Chemistry", Addison Wesley Longman, Inc. 1989.
3. Frederick George Mann and Saunder, "Practical Organic Chemistry", The English Language Book Society, 1960.
4. Daniel R. Palleras, "Experimental Organic Chemistry , John Willey & Sons" Inc., 2000.
5. James A. Moore, "Experimental methods in Organic Chemistry", Holt-Saunders Int., 1983.
6. R.L. Shriner, R.C Fuson, D.V. Curtin and T.C Morrill "The systematic identification of organic compounds, 6th ed. John Willey & sons, 1979.



## **ZOOLOGY III ANIMAL FORM AND FUNCTION-I (A COMPARATIVE PERSPECTIVE)**

**CREDIT HOURS: 3**

### **Objectives:**

The course aims to teach the students about:

- a. Animals diversity adapted in different ways for their functions through modifications in body parts.
- b. The diversity in integumentary, skeletal, muscular, nervous and sensory, endocrine, circulatory, respiratory, nutritive,
- c. Organ systems, their specialization and coordination with each other and constantly changing internal and external environment, inside and outside the animal's body.
- d. The basic structure of each system that determines its particular function.

### **1. Protection, Support, and Movement**

Protection: the integumentary system of invertebrates and vertebrates; movement and support: the skeletal system of invertebrates and vertebrates; movement: non-muscular movement; an introduction to animal muscles; the muscular system of invertebrates and vertebrates.

#### **Communication I: Nerves**

Neurons: structure and function; neuron communication: introductory accounts of resting membrane potential, action potential (nerve impulse) and transmission of the action potential between cells; invertebrate and vertebrate nervous systems: the spinal cord, spinal nerves, the brain, cranial nerves and the autonomic nervous system.

#### **Communication II: Senses**

Sensory reception: baroreceptors, chemoreceptors, georeceptors, hygroreceptors, phonoreceptors, photoreceptors, proprioceptors, tactile receptors, and thermoreceptors of invertebrates; lateral-line system and electrical sensing, lateral-line system and mechanoreception, hearing and equilibrium in air, hearing and equilibrium in water, skin sensors of damaging stimuli, skin sensors of heat and cold, skin sensors of mechanical stimuli, sonar, smell, taste and vision in vertebrates.

#### **Communication III: The Endocrine System and Chemical Messengers**

Chemical messengers: hormones chemistry; and their feedback systems; mechanisms of hormone action; some hormones of porifera, cnidarians, platyhelminthes, nemerteans, nematodes, molluscs, annelids, arthropods, and echinoderms invertebrates; an overview of the vertebrate endocrine system; endocrine systems of vertebrates, endocrine systems of birds and mammals.

#### **Circulation, Immunity, and Gas Exchange**

Internal transport and circulatory systems in invertebrates: characteristics of invertebrate coelomic fluid, hemolymph, and blood cells; transport systems in vertebrates; characteristics of vertebrate blood, blood cells and vessels; the hearts and circulatory systems of bony fishes, amphibians, reptiles, birds and mammals; the human heart: blood pressure and the lymphatic system; immunity: nonspecific defenses,

the immune response; gas exchange: respiratory surfaces; invertebrate and vertebrate respiratory systems: cutaneous exchange, gills, lungs, and lung ventilation; human respiratory system: gas transport.

### Animal Behaviour

Four approaches to animal behaviour; proximate and ultimate causes; anthropomorphism; development of behavior; learning; control of behavior; communication; behavioral ecology; social behavior.

### Evolution: A Historical Perspective

Pre-Darwinian theories of change; Lamarck: an early proponent of evolution; early development of Darwin's ideas of evolution and evidences; the theory of evolution by natural selection; evolutionary thought after Darwin; biogeography.

### Evolution and Gene Frequencies

The modern synthesis: a closer look; the Hardy-Weinberg theorem; evolutionary mechanisms: population size, genetic drift, natural selection, gene flow, mutation, and balanced polymorphism; species and speciation; rates of evolution; molecular evolution; mosaic evolution.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Recommended Books:

Campbell, N. A. (2002). *Biology* (6<sup>th</sup> ed). Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

Hickman, C. P. & Kats, H. L. (2000). *Laboratory studies in integrated principles of zoology*. Singapore: McGraw Hill.

Hickman, C.P., Roberts, L.S., & Larson, A. (2004). *Integrated principles of zoology* (12<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Kent, G. C. & Miller, S. (2001). *Comparative anatomy of vertebrates*. New York: McGraw Hill.

Miller, S. A. (2002). *General zoology laboratory manual* (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Miller, S. A., & Harley, J. B. (2000). *Zoology* (6<sup>th</sup> ed) (International). Singapore: McGraw Hill.

Pechenik, J. A. (2000). *Biology of invertebrates*, (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

## Zoology Lab-III

### Credit Hour: 01

#### Practicals

1. Study of insect chitin, fish scale, amphibian skin, reptilian scales, feathers and mammalian skin.
2. Study and notes of skeleton of *Labeo*, *Rana tigrina*, *Varanus*, fowl and rabbit.  
*Note: Exercises of notes on the adaptations of skeletons to their function must be done.*
3. Earthworm or leech; cockroach, freshwater mussel, *Channa* or *Catla catla* or *Labeo* or any other local fish, frog, pigeon and rat or mouse and rabbits are representative animals for study in dissections.
4. Study of models or preserved brains of representative animals and notes on adaptations.
5. Study of nervous system of earthworm and a fish.
6. Study of endocrine system in an insect and a rabbit.
7. Study of different types of blood cells in blood smear of rabbit.
8. Study of heart, principal arteries and veins in a representative vertebrate (dissection of representative fish/mammals).
9. Study of respiratory system in cockroach or locust and a vertebrate representative (Model).

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Recommended Books:

- Campbell, N. A. (2002). *Biology* (6<sup>th</sup> ed). Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
- Hickman, C. P. & Kats, H. L. (2000). *Laboratory studies in integrated principles of zoology*. Singapore: McGraw Hill.
- Hickman, C.P., Roberts, L.S., & Larson, A. (2004). *Integrated principles of zoology* (12<sup>th</sup> ed) (International). Singapore: McGraw Hill.
- Kent, G. C. & Miller, S. (2001). *Comparative anatomy of vertebrates*. New York: McGraw Hill.
- Miller, S. A. (2002). *General zoology laboratory manual* (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.
- Miller, S. A., & Harley, J. B. (2000). *Zoology* (6<sup>th</sup> ed) (International). Singapore: McGraw Hill.
- Pechenik, J. A. (2000). *Biology of invertebrates*, (5<sup>th</sup> ed) (International). Singapore: McGraw Hill.

# Physics 3(Electricity and Magnetism)

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**PRE-REQUISITE: FSc Level Physics**

**CREDITE HOURS: 3**

## **INTRODUCTION:**

Understanding electromagnetic fields is essential to our understanding the world around us. The most fundamental processes in nature, from the forces that determine the structure of atoms and molecules to the phenomena of light to nerve impulses in living systems, depend on electric and magnetic fields.

It is fundamental to current and future technologies. Motors, power generation and transmission, electronics, sensors, and communication – both wired and wireless – involve the manipulation of electric or magnetic fields. There are few advances in technology that can be made without the use of electronic circuits or electric and magnetic fields.

## **COURSE OBJECTIVE:**

The objectives of this course are to teach the laws of electromagnetism from our everyday experience by specific examples of how electromagnetic phenomena manifest themselves. We want to be able to:

1. Describe, in words, the ways in which various concepts in electromagnetism come into play in particular situations
2. Represent these electromagnetic phenomena and fields mathematically in those situations
3. Predict outcomes in other similar situations
4. The overall goal is to use the scientific method to come to understand the enormous variety of electromagnetic phenomena in terms of a few relatively simple laws.

## **COURSE OUTLINE:**

Electric field of continuous charge distributions, dipole in an electric field, Applications of Gauss' law, calculating the field from the potential, capacitor with dielectric, electric current density and Ohm's law, semiconductors and superconductors, magnetic force on a charged particle, magnetic force on a current, torque on a current loop, magnetic dipole, Biot-Savart Law, Ampere's law, Faraday's Law, Lenz's Law, motional E.M.F, induced electric fields, Gauss' law for magnetism, origin of atomic and nuclear magnetism, magnetization, magnetic materials, induced magnetic fields and displacement current, Maxwell's equations, generating an electro-

magnetic wave, traveling waves and Maxwell's equations, energy transport and the Poynting vector.

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **REFERENCE BOOKS:**

1. Physics Vol. II (extended) by Resnick, Halliday and Krane, 4th Edition, John Wiley and Sons Inc, New York, 1992.
2. Physics Vol.II (extended) by Resnick, Halliday and Krane, 5th Edition, John Wiley and Sons Inc, New York, 2002.
3. Fundamental of Physics by Halliday Resnick and Krane, 5th Edition, John Wiley and Sons Inc, New York, 1999.
4. University Physics 8th Edition by Sears, Zemansky and Young, Addison-Wesley, Reading (MA), USA, 2000.
5. Physics by Alonso and Finn: Addison-Wesley, Reading (MA), USA, 1999.
6. David J. Griffiths, "Introduction to Electrodynamics, 3<sup>rd</sup> Edition",

## **PHYSICS LAB-III (Electricity and Magnetism)**

**Credit Hour: 01**

### **Practical Work**

1. To find out the equivalent resistance of unknown resistor
2. Low resistance by Carey foster bridge
3. Measurement of resistance using neon flash lamp and capacitor
4. Measurement of capacitance of capacitor using neon flash lamp and resistor
5. Conversion of galvanometer into ammeter
6. Conversion of galvanometer into voltmeter
7. Calibration of voltmeter by potentiometer
8. Calibration of ammeter by potentiometer
9. A Study of the Oscilloscope and the Audio Generator
10. To study the BH curve

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **REFERENCE BOOKS:**

1. Physics Vol. II (extended) by Resnick, Halliday and Krane, 4th Edition, John Wiley and Sons Inc, New York, 1992.
2. Physics Vol.II (extended) by Resnick, Halliday and Krane, 5th Edition, John Wiley and Sons Inc, New York, 2002.
3. Fundamental of Physics by Halliday Resnick and Krane, 5th Edition, John Wiley and Sons Inc, New York, 1999.
4. University Physics 8th Edition by Sears, Zemansky and Young, Addison-Wesley, Reading (MA), USA, 2000.
5. Physics by Alonso and Finn: Addison-Wesley, Reading (MA), USA, 1999.
6. David J. Griffiths, "Introduction to Electrodynamics, 3<sup>rd</sup> Edition",

**Course Title: Mathematics A-III [ Linear Algebra]**  
**Credits Hours: 4**

**Matrices, Determinants and System of Linear Equations**

- Definition of matrix. various types of matrices
- Algebra of matrices
- Determinant of square matrix, cofactors and minors
- Laplace expansion of determinants
- Elementary matrices, adjoint and inverses of matrices
- Rank of a matrix
- Introduction to systems of linear equations
- Cramer's rule, Gaussian elimination and Gauss Jordan method
- Solution of homogenous and non homogenous linear equations
- Net work flow problems

**Vector Spaces**

- Real vector spaces, subspaces
- Linear combination and spanning set.
- Linear independence and linear dependence, basis and dimension, row space,
- Column space and Null space

**Linear Transformations**

- Introduction to linear transformation
- Matrices of linear transformations
- Rank and nullity
- Eigen values and Eigen vectors
- Diagonalization
- Orthogonal diagonalization
- Orthogonal matrices, similar matrices

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Books**

1. Howard Anton and Chris Rorres, *Elementary Linear Algebra Applications Version*, John Wiley and Sons Inc. 9<sup>th</sup> Edition, 2005
2. W. Keith Nicholson, *Elementary Linear Algebra*, PWS-Kent Publishing Company, Boston, 2004
3. Bernard Kolman, David R. Hill, *Introduction Linear Algebra with Applications*, Prentice Hall International, Inc. 7<sup>th</sup> Edition, 2001

4. Stephen H. Friedberg Et al, *Linear Algebra*, Prentice Hall, Inc. 3<sup>rd</sup> Edition, 2000
5. Seymour Lipschutz, *Theory and Problems of Beginning Linear Algebra*, Schaum's Outline Series, Mc-Graw Hill Company, New York, 1997



**Course Title: Mathematics B-III [ Calculus (II)]****Credit Hours: 4****Sequence and Series**

- Sequences, Infinite series, Convergence of sequence and series
- The integral test, Comparison tests, Ratio test, Root test
- Alternative series, Absolute and conditional convergence
- Power series, Interval and radius of convergence

**Functions of Several Variables**

- Functions of two variables, Graphs of functions of two variables
- Contour diagrams, Linear functions, Functions of three variables
- Limit and continuity of a function of two variables
- The partial derivative, Computing partial derivatives algebraically
- The second-order partial derivative, Local linearity and the differential
- Tangent planes and normal lines
- Optimization, Maxima and minima of a function of two variables
- Lagrange multipliers
- Various methods for finding area and volume surface of revolution

**Multiple Integrals**

- Double integral in rectangular and polar form
- Triple integral in rectangular, Cylindrical and spherical coordinates
- Substitutions in multiple integrals
- Moments and centre of mass

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Books**

1. Thomas, *Calculus*, 11<sup>th</sup> Edition. Addison Wesley Publishing Company, 2005
2. H.Anton, I. Bevens, S. Davis, *Calculus*, 8<sup>th</sup> Edition, John Wiley & Sons, In. 2005
3. Hughes-Hallet, Gleason, McCalum, et al, *Calculus Single and Multivariable*, 3<sup>rd</sup> Edition John Wiley & Sons, Inc 2002
4. Frank A. Jr, Elliott Mendelson, *Calculus*, Schaum's Outline Series, 4<sup>th</sup> Edition, 1999
5. C.H. Edward and E.D Penney, *Calculus and Analytical Geometry* Prentice Hall, Inc. 1988
6. E.W.Swokoski, *Calculus and Analytical Geometry* PWS Publishers, Boston, 1983

## Semester-IV Course Outlines

**TITLE: ISLAMIAT / ETHICS**

**CREDIT HOURS: 2**

### اهداف و مقاصد

- ۱۔ طلبہ کو قرآن و حدیث سے استفادہ کے قابل بنانا۔
- ۲۔ طلبہ کے قلوب و اذہان میں قرآن و سنت کی روح اور علم کو رائج کرنا۔
- ۳۔ طلبہ میں اسوہ شتم المرسلین صلی اللہ علیہ وسلم کے اتباع اور کتب رسولیہ کا جذبہ پیدا کرنا۔
- ۴۔ اسلام کی بنیادی تعلیمات کا فہم آسان بنانا اور طلبہ کی اسلامی بنیادوں پر تربیت کرنا۔
- ۵۔ امت مسلمہ کو ورثہ حرمہ جدید کے چیلنجوں سے طلبہ کو آگاہ کرنا۔

### نصابی تفصیلات (تفصیل المنهج الدراسي)

#### 1. القرآن الکریم

##### الف۔ قواعد لغة القرآن (قرآنی گرامر)

- المضارع، المستنار، الأمر والنهي، الجملة الاسمية والفعلية، المركب الإضافي والتوصييفي، التضامن وحروف النجر
- ب۔ منتخب قرآنی آیات کا لغوی و بالمعنی ترجمہ و تفسیر (ضمیمہ "الف")
- (ترجمة و شرح نخبة من الآيات القرآنية لغة وسلاسة: ملحق "الف")

#### 2. الأحادیث النبوی

- مختب احادیث نبویہ کا لغوی و بالمعنی ترجمہ اور تفسیر (ضمیمہ "ب")
- (ترجمة و شرح نخبة من الاحادیث النبوية لغة وسلاسة: ملحق "ب")

نوٹ: اساتذہ کرام آیات و احادیث کی تعلیم و تدریس کے دوران لغوی اور بالمعنی ترجمہ کے ضمن میں مندرجہ بالا قواعد عربیہ کی تلقین کا اہتمام کریں۔

### 3. سیرۃ النبی صلی اللہ علیہ وسلم

- (۱) مطالعہ سیرت کی ضرورت و اہمیت (اہمیت و ضرورت دراستہ السیرۃ)
- (۲) نبی کریم صلی اللہ علیہ وسلم کی حکمت انقلاب (الحکمة النورية للنبي الكريم صلی اللہ علیہ وسلم)  
(ہجرت، موافقات، بیثاق مدینہ، صلح حدیبیہ، خطبہ جندہ الوداع)
- (۳) تزکیہ نفس اور تعمیر سیرت و شخصیت کا نبوی مہیا اور عملی نمونے  
(المہجج النبوی لتكوين الشخصية و السيرة و توكية النفس و نماذجها الفعلية)  
(عشر مہجرات، احصاء المؤمنین، اولاد النبی)
- (۴) تقلید اجتماعی و معاشرت اور اسوۂ حسنہ (تكوين المجتمع و المعاصرة في ضوء الاسوة الحسنة)

### 4. اسلامی تہذیب و ثقافت (الحضارة والثقافة الإسلامية)

- (الف) اسلامی تہذیب و ثقافت کے خصائص  
توحید، روحانیت، تصور مسوئیت، انسانی تعلقات و مساوات، عالمگیر اخوت،  
عادل انسانی، اخلاقی اقدار، انسانی حقوق، رواداری، اعتدال و توازن
- (ب) اسلامی تہذیب و ثقافت کے عالمی اثرات
- (ج) مغربی تہذیب و ثقافت اور اسلام  
(i) مغربی تہذیب و ثقافت کے خصائص و اثرات  
(ii) تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ

### 5. معروضی سوالات: پورے نصاب پر مشتمل ہوں گے۔

(ملحق الف: نعمة من آيات القرآن)

(i)

الَّذِينَ يُؤْمِنُونَ بِالْغَيْبِ وَيُقِيمُونَ  
الصَّلَاةَ وَمِمَّا رَزَقْنَاهُمْ يُنْفِقُونَ [3] وَالَّذِينَ يُؤْمِنُونَ بِمَا أُنزِلَ إِلَيْكَ وَمَا أُنزِلَ مِنْ قَبْلِكَ وَ  
بِالْآخِرَةِ هُمْ يُؤْمِنُونَ [4] أُولَئِكَ عَلَىٰ هُدًى مِنْ رَبِّهِمْ وَأُولَئِكَ هُمُ الْمُفْلِحُونَ [5]  
يَقُولُوا مَا فِي السَّمُوتِ وَمَا فِي الْأَرْضِ وَإِنْ تُبَدِّلُوا مَا فِي الْأَرْضِ لَوَ تَحْطُوهُ بِحُسْنِ عِلْمٍ بِوَاللَّهِ  
يَعْلَمُ الْغُيُوبَ لَمَنْ يَشَاءُ وَيُعَذِّبُ مَنْ يَشَاءُ وَاللَّهُ عَلَىٰ كُلِّ شَيْءٍ قَدِيرٌ [284] آمَنَ الرَّسُولُ بِمَا أُنزِلَ  
إِلَيْهِ مِنْ رَبِّهِ وَالْمُؤْمِنُونَ كُلٌّ آمَنَ بِاللَّهِ وَمَلَكِهِ وَكُتُبِهِ وَرُسُلِهِ لَا تَفِرُّ مِنْ أَحَدٍ مِنْ رُسُلِهِ وَ  
قَالُوا سَمِعْنَا وَأَطَعْنَا غُفْرَانَكَ رَبَّنَا وَإِلَيْكَ الْمَصِيرُ [285] لَا يَكْفُلُ اللَّهُ نَفْسًا وَلَا جُفَاءً لَهَا مَا  
كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ وَنَحْنُ أَقْرَبُ إِلَيْهَا مِنْ أَنْ تُغْفَلَ عَنْهَا وَلَا تَحْمِلَ عَلَيْهِمْ إِصْرًا  
كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِنْ قَبْلِكَ رَبَّنَا وَلَا تُحَمِّلْنَا مَا لَا كَافَّةَ لَنَا بِهِ وَالْغِيْرُ لَنَا وَ  
أَوْحِنَا أَنْتَ مَوْلَانَا فَانصُرْنَا عَلَى الْقَوْمِ الْكَافِرِينَ [286]

(ii)

(تخصصات نبوية: اسمه حسنه، ختم نبوت، مقام رسالت، ناموس وصال، ازوج النبي)  
 كَتَبَ الْوَلِيُّ بِالْمُؤْمِنِينَ مِنَ الْقِسْمِ وَأَزْوَاجَهُمْ أَهْلَهُمْ وَوَلَّوْا الْأَرْحَامَ بَعْضُهُمْ أَوْلَى بِبَعْضٍ فِي  
 رِجْسِ اللَّهِ مِنَ الْمُؤْمِنِينَ وَالْمُهَاجِرِينَ إِلَّا أَنْ تَقُولُوا إِلَى أَوْلِيَانَكُمْ مَعْرُوفًا كَانَ ذَلِكَ فِي الْكِتَابِ  
 مَسْطُورًا [6]

لَقَدْ كَانَ لَكُمْ فِي رَسُولِ اللَّهِ أُسْوَةٌ حَسَنَةٌ لِمَنْ كَانَ مِنْكُمْ مِنَ الْإِيمَانِ وَالْيَقِينِ وَذَكَرَ اللَّهُ عَجْرًا [21]  
 نِسَاءَ النَّبِيِّ لَسَنُنَّ كَأَحَدٍ مِنَ النِّسَاءِ إِنَّ الْتَّقِينَ فَلَا تَحْضَعْنَ بِالْقَوْلِ يُعْلِنَنَّ الَّذِي فِي قُلُوبِهِمْ مِنْ  
 وَقُلْنَ كَلِمًا مَعْرُوفًا [32] وَكَرَنَ فِي بَيِّنَتِكُنَّ وَلَا تَبَرَّجْنَ تَبَرُّجَ الْعِجَالِ الْأُولَى وَالْآخِرُ  
 الصَّلَاةَ وَرِجْسَ الزُّكُورِ وَأَطِيعُوا اللَّهَ وَرَسُولَهُ إِنَّمَا يُرِيدُ اللَّهُ لِيُذْهِبَ عَنْكُمُ الرِّجْسَ أَهْلَ الْبَيْتِ  
 وَيُطَهِّرَكُمْ تَطْهِيرًا [33]

مَا كَانَ مُحَمَّدٌ أَبَا أَحَدٍ مِنْ دِينِكُمْ وَلاَ جَدًّا لَكُمْ وَلاَ كُنَّا اللَّهُ وَلاَ حَافِظَهُ النَّاسُ وَكَانَ اللَّهُ بِكُلِّ شَيْءٍ عَلِيمًا [40]  
إِنَّ اللَّهَ وَرَسُولَهُ يَبْغِيَانِ الْغَيْبَاتِ الَّذِينَ آمَنُوا أَصْلَافًا مِنْهُمْ فَاعْلَمُوا [41]

إِنَّ الَّذِينَ يُؤْذُونَ اللَّهَ وَرَسُولَهُ لَعَنَهُمُ اللَّهُ فِي الدُّنْيَا وَالْآخِرَةِ وَأَعَدَّ لَهُمْ عَذَابًا مُهِينًا [57]  
وَالَّذِينَ يُؤْذُونَ الْمُؤْمِنِينَ وَالْمُؤْمِنَاتِ بَغْيٍ مَا اكْتَسَبُوا فَقَدْ احْتَمَلُوا بُهْتَانًا وَإِثْمًا مُبِينًا [58]  
يَا أَيُّهَا النَّبِيُّ قُلْ لِمَ أَوَاجِلْ وَبَيْنِكُمْ وَنِسَاءَ الْمُؤْمِنِينَ يُدْنِينَ عَلَيْهِنَّ مِنْ جَلَابِيبِهِنَّ ذَلِكَ أَدْنَى أَنْ  
يَعْرِفْنَ فَلَا يُؤْذِينَ وَكَانَ اللَّهُ عَفُورًا رَحِيمًا [59]

- (iii) الفتح (۳۸) الآية : ۲۹ (رسالت محمدیہ اور خصائص اصحاب رسول)  
مُحَمَّدٌ رَسُولُ اللَّهِ وَالَّذِينَ مَعَهُ أَشِدَّاءُ عَلَى الْكُفَّارِ رُحَمَاءُ بَيْنَهُمْ تَرَاهُمْ رُكَّعًا سُجَّدًا يَبْتَغُونَ  
فَضْلًا مِنَ اللَّهِ وَرِضْوَانًا سِيمَاهُمْ فِي وُجُوهِهِمْ مِنْ أَثَرِ السُّجُودِ ذَلِكَ مَثَلُهُمْ فِي التَّوْرَةِ وَمَثَلُهُمْ  
فِي الْإِنْجِيلِ كَزَرْعٍ أَخْرَجَ شَطْطَهُ فَازْرَعَهُ فَاسْتَغْلَظَ فَاسْتَوَىٰ عَلَىٰ سَوَافِهِ يُعْجِبُ الزُّرَّاعَ لَغِيظِ  
بِهِمُ الْكُفَّارِ وَعَدَّ اللَّهُ الَّذِينَ آمَنُوا وَعَمِلُوا الصَّالِحَاتِ مِنْهُمْ مَغْفِرَةً وَأَجْرًا عَظِيمًا [29]
- (iv) الصف (۶۱) الآية : ۱۱۴ (بشارت بعثت ختم المرسلین، ہجرت، جہاد، نصرت اور غلبہ دین)

سَبَّحَ لِلَّهِ مَا فِي السَّمُوتِ وَمَا فِي الْأَرْضِ وَهُوَ الْعَزِيزُ الْحَكِيمُ [1] يَا أَيُّهَا الَّذِينَ آمَنُوا لِمَ تَقُولُونَ  
مَا لَا تَفْعَلُونَ [2] كَبُرَ مَقْتًا عِنْدَ اللَّهِ أَنْ تَقُولُوا مَا لَا تَفْعَلُونَ [3] إِنَّ اللَّهَ يُحِبُّ الَّذِينَ يُقَاتِلُونَ  
فِي سَبِيلِهِ صَفًا كَانَهُمْ بَنِيَّانَ مَرصُوضٍ [4] وَإِذْ قَالَ مُوسَىٰ لِقَوْمِهِ يَقَوْمِ لِمَ تَقُولُونَ لِقَوْمٍ  
تَعْلَمُونَ أَنِّي رَسُولُ اللَّهِ إِلَيْكُمْ فَلَمَّا زَاغُوا أَزَاغَ اللَّهُ قُلُوبَهُمْ وَاللَّهُ لَا يَهْدِي الْقَوْمَ الْفَاسِقِينَ [5]  
وَإِذْ قَالَ عِيسَى ابْنُ مَرْيَمَ بَنِي إِسْرَائِيلَ إِنِّي رَسُولُ اللَّهِ إِلَيْكُمْ مُصَدِّقًا لِمَا بَيْنَ يَدَيَّ مِنَ التَّوْرَةِ  
وَمُبَشِّرًا بِرَسُولٍ يَأْتِي مِنْ بَعْدِي اسْمُهُ أَحْمَدُ فَلَمَّا جَاءَهُمْ بِالْبَيِّنَاتِ قَالُوا هَذَا سِحْرٌ مُبِينٌ [6]  
وَمَنْ أَظْلَمُ مِمَّنِ افْتَرَىٰ عَلَى اللَّهِ الْكُذْبَ وَهُوَ يُدْعَىٰ إِلَى الْإِسْلَامِ وَاللَّهُ لَا يَهْدِي الْقَوْمَ الظَّالِمِينَ [7]  
يُرِيدُونَ لِيُطْفِئُوا نُورَ اللَّهِ بِأَفْوَاهِهِمْ وَاللَّهُ مُتِمُّ نُورِهِ وَلَوْ كَرِهَ الْكَافِرُونَ [8] هُوَ الَّذِي أَرْسَلَ  
رَسُولَهُ بِالْهُدَىٰ وَدِينِ الْحَقِّ لِيُظْهِرَهُ عَلَى الدِّينِ كُلِّهِ وَلَوْ كَرِهَ الْمُشْرِكُونَ [9] يَا أَيُّهَا الَّذِينَ آمَنُوا  
هَلْ أَدُلُّكُمْ عَلَىٰ تِجَارَةٍ تُنْجِيكُمْ مِنْ عَذَابٍ أَلِيمٍ [10] تَوْمِنُونَ بِاللَّهِ وَرَسُولِهِ وَتُجَاهِدُونَ فِي  
سَبِيلِ اللَّهِ بِأَمْوَالِكُمْ وَأَنْفُسِكُمْ ذَلِكُمْ خَيْرٌ لَكُمْ إِنْ كُنْتُمْ تَعْلَمُونَ [11] يَغْفِرُ لَكُمْ ذُنُوبَكُمْ  
وَيُدْخِلُكُمْ جَنَّاتٍ تَجْرِي مِنْ تَحْتِهَا الْأَنْهَارُ وَمَسْكَنَ طَيِّبَةً فِي جَنَّاتٍ عَدْنٍ ذَلِكَ الْقَوْمُ الْعَظِيمُ [12]  
وَأُخْرَىٰ تُحِبُّونَهَا نَصْرٌ مِنَ اللَّهِ وَفَتْحٌ قَرِيبٌ وَبَشِيرُ الْمُؤْمِنِينَ [13] يَا أَيُّهَا الَّذِينَ آمَنُوا كُونُوا  
أَنْصَارَ اللَّهِ كَمَا قَالَ عِيسَى ابْنُ مَرْيَمَ لِلْحَوَارِيِّينَ مَنْ أَنْصَارِي إِلَى اللَّهِ قَالَ الْحَوَارِيُّونَ نَحْنُ  
أَنْصَارُ اللَّهِ فَأَمَّا تَطَائِفَةٌ مِنَ بَنِي إِسْرَائِيلَ وَكَفَرَتْ طَائِفَةٌ فَأَيَّدْنَا الَّذِينَ آمَنُوا عَلَىٰ عَدُوِّهِمْ  
فَأَصْبَحُوا ظَاهِرِينَ [14]

يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَقْدُمُوا بَيْنَ يَدَيِ اللَّهِ وَرَسُولِهِ وَاتَّقُوا اللَّهَ إِنَّ اللَّهَ سَمِيعٌ عَلِيمٌ [1] يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَرْفَعُوا أَصْوَاتَكُمْ فَوْقَ صَوْتِ النَّبِيِّ وَلَا تَجْهَرُوا لَهُ بِالْقَوْلِ كَجَهْرِ بَعْضِكُمْ لِبَعْضٍ أَنْ تَحْبَطَ أَعْمَالُكُمْ وَأَنْتُمْ لَا تَشْعُرُونَ [2] إِنَّ الَّذِينَ يَغُضُّونَ أَصْوَاتَهُمْ عِنْدَ رَسُولِ اللَّهِ أُولَئِكَ الَّذِينَ امْتَحَنَ اللَّهُ قُلُوبَهُمْ لِلتَّقْوَى لَهُمْ مَغْفِرَةٌ وَأَجْرٌ عَظِيمٌ [3] إِنَّ الَّذِينَ ينادُونَكَ مِنْ وَرَاءِ الْحُجُرَاتِ أَكْثَرُهُمْ لَا يَعْقِلُونَ [4] وَلَوْ أَنَّهُمْ صَبَرُوا حَتَّى تَخْرُجَ إِلَيْهِمْ لَكَانَ خَيْرًا لَهُمْ وَاللَّهُ غَفُورٌ رَحِيمٌ [5] يَا أَيُّهَا الَّذِينَ آمَنُوا إِنْ جَاءَكُمْ فَاسِقٌ بِنَبَأٍ فَتَبَيَّنُوا أَنْ تُصِيبُوا قَوْمًا بِجَهَالَةٍ فَتُصْحَبُوا عَلَى مَا فَعَلْتُمْ نَادِمِينَ [6] وَاعْلَمُوا أَنَّ فِيكُمْ رَسُولَ اللَّهِ لَوْ يُطِيعُكُمْ فِي كَثِيرٍ مِنَ الْأَمْرِ لَعَنِيمٌ وَلَكِنَّ اللَّهَ حَبَّبَ إِلَيْكُمُ الْإِيمَانَ وَزَيَّنَهُ فِي قُلُوبِكُمْ وَكَرَّهَ إِلَيْكُمُ الْكُفْرَ وَالْفُسُوقَ وَالْعِصْيَانَ أُولَئِكَ هُمُ الرَّاشِدُونَ [7] فَضَلَّأَ مِنَ اللَّهِ وَنِعْمَةً وَاللَّهُ عَلِيمٌ حَكِيمٌ [8] وَإِنْ طَائِفَتَيْنِ مِنَ الْمُؤْمِنِينَ اقْتَلَبَا فَاصْطَلَحُوا بَيْنَهُمَا فَإِنْ بَغَتْ إِحْدَاهُمَا عَلَى الْأُخْرَى فَقَاتِلُوا الَّتِي تَبْغِي حَتَّى تَفِيءَ إِلَى أَمْرِ اللَّهِ فَإِنْ فَاءَتْ فَاصْطَلِحُوا بَيْنَهُمَا بِالْعَدْلِ وَأَقْسِطُوا إِنَّ اللَّهَ يُحِبُّ الْمُقْسِطِينَ [9] إِنَّمَا الْمُؤْمِنُونَ إِخْوَةٌ فَاصْطَلِحُوا بَيْنَ أَخَوَيْكُمْ وَاتَّقُوا اللَّهَ لَعَلَّكُمْ تُرْحَمُونَ [10] يَا أَيُّهَا الَّذِينَ آمَنُوا لَا يَسْخَر قَوْمٌ مِنْ قَوْمٍ عَسَى أَنْ يَكُونُوا خَيْرًا مِنْهُمْ وَلَا نِسَاءٌ مِنْ نِسَاءٍ عَسَى أَنْ يَكُنَّ خَيْرًا مِنْهُنَّ وَلَا تَلْمِزُوا أَنْفُسَكُمْ وَلَا تَنَابَزُوا بِالْأَلْقَابِ بِئْسَ الْأَسْمُ الْفُسُوقُ بَعْدَ الْإِيمَانِ وَمَنْ لَمْ يَتُبْ فَأُولَئِكَ هُمُ الظَّالِمُونَ [11] يَا أَيُّهَا الَّذِينَ آمَنُوا اجْتَنِبُوا كَثِيرًا مِمَّنَ الظَّالِمِينَ إِن بَعْضُ الظَّالِمِينَ هُمْ تَجَسَّسُوا وَلَا يَغْتَب بََعْضُكُمْ بَعْضًا أَيُحِبُّ أَحَدُكُمْ أَنْ يَأْكُلَ لَحْمَ أَخِيهِ مَيْتًا فَكَرِهْتُمُوهُ وَاتَّقُوا اللَّهَ إِنَّ اللَّهَ تَوَّابٌ رَحِيمٌ [12] يَا أَيُّهَا النَّاسُ إِنَّا خَلَقْنَاهُ مِنْ ذَكَرٍ وَأُنْثَى وَجَعَلْنَاهُ شُعُوبًا وَقَبَائِلَ لِتَعَارَفُوا إِنَّ أَكْرَمَكُمْ عِنْدَ اللَّهِ أَتْقَاهُ إِنَّ اللَّهَ عَلِيمٌ خَبِيرٌ [13]

قَالَتِ الْأَعْرَابُ آمَنَّا قُلْ لَمْ تُؤْمِنُوا وَلَكِنْ قُولُوا أَسْلَمْنَا وَلَمَّا يَدْخُلِ الْإِيمَانُ فِي قُلُوبِكُمْ وَإِنْ تُطِيعُوا اللَّهَ وَرَسُولَهُ لَا يَلِتْكُمْ مِنْ أَعْمَالِكُمْ شَيْئًا إِنَّ اللَّهَ غَفُورٌ رَحِيمٌ [14] إِنَّمَا الْمُؤْمِنُونَ الَّذِينَ آمَنُوا بِاللَّهِ وَرَسُولِهِ ثُمَّ لَمْ يَرْتَابُوا وَجَاهَدُوا بِأَمْوَالِهِمْ وَأَنْفُسِهِمْ فِي سَبِيلِ اللَّهِ أُولَئِكَ هُمُ الصَّادِقُونَ [15] قُلْ أَتَعْلَمُونَ اللَّهُ بِذُنُوبِكُمْ وَاللَّهُ يَعْلَمُ مَا فِي السَّمُوتِ وَمَا فِي الْأَرْضِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ [16] يَمْسُونَ عَلَيْكَ أَنْ أَسْلَمُوا قُلْ لَا تَمْنُونَا عَلَى إِسْلَامِكُمْ بَلِ اللَّهُ يَمُنُّ عَلَيْكُمْ أَنْ هَدَّكُمْ لِلْإِيمَانِ إِنْ كُنْتُمْ صَادِقِينَ [17] إِنَّ اللَّهَ يَعْلَمُ غَيْبَ السَّمُوتِ وَالْأَرْضِ وَاللَّهُ بَصِيرٌ بِمَا تَعْمَلُونَ [18]





## ضميمه ب: منتخب احاديث نبويه

### (ملحق ب: نخبه من الأحاديث النبويه)

(١) عن عمر بن الخطاب رضى الله عنه قال: سمعت رسول الله صلى الله عليه وسلم يقول: إنما الأعمال بالنيات، وإنما لأمرى ما نوى، فمن كانت هجرته إلى الله ورسوله فهجرته إلى الله ورسوله ومن كانت هجرته إلى دنيا يصيبها أو امرأة يتزوجها فهجرته إلى ما هاجر إليه. (رواه البخارى ومسلم)

(٢) عن عثمان بن عفان رضى الله عنه عن النبى صلى الله عليه وسلم قال: خيركم من تعلم القرآن وعلمه. (رواه البخارى)

(٣) عن مالك بن انس قال، قال رسول الله صلى الله عليه وسلم: تركت فيكم أمرين لن تضلوا ما تمسكتم بهما، كتاب الله وسنة رسوله. (رواه مالك فى الموطأ مرسلًا)

(٣) عن ابن عمر رضى الله عنهما قال، قال رسول الله صلى الله عليه وسلم: بنى الإسلام على خمس، شهادة أن لا إله إلا الله وأن محمداً عبده ورسوله وإقام الصلاة وإيتاء الزكاة والحج وصوم رمضان. (متفق عليه)

(٥) عن عمر بن الخطاب رضى الله عنه قال: بينما نحن عند رسول الله صلى الله عليه وسلم ذات يوم إذ طلع علينا رجل شديد بياض الثياب شديد سواد الشعر لا يرى عليه أثر السفر ولا يعرفه منا أحد حتى جلس إلى النبى صلى الله عليه وسلم فأسند ركبتيه إلى ركبتيه ووضع كفيه على فخذيه وقال: يا محمد، أخبرني عن الإسلام؟ فقال رسول الله صلى الله عليه وسلم: الإسلام أن تشهد أن لا إله إلا الله وأن محمداً رسول الله وتقيم الصلاة وتؤتي الزكاة وتصوم رمضان وتحج البيت إن استطعت إليه سبيلاً، قال: صدقت، قال: فعبنا له يسأله ويصدقه، قال: فأخبرني عن الإيمان؟ قال: أن تؤمن بالله وملكته وكتبه ورسله واليوم الآخر وتؤمن بالقدر خيره وشره، قال: صدقت، قال: فأخبرني عن الإحسان؟ قال: أن تعبد الله كأنك تراه فإن لم تكن تراه فإنه يراك، قال: فأخبرني عن الساعة؟ قال: ما المسؤول عنها بأعلم من السائل، قال: فأخبرني عن أماراتها؟ قال: أن تلد الأمة رببتها وأن ترى الحفاة العراة العالة رعاء الشاء يتطاولون فى البنيان، قال: ثم انطلق، فلبث ملياً ثم قال لى: يا عمر أتدرى من السائل؟ قلت: الله ورسوله أعلم، قال: فإنه جبرئيل أتاكم يعلمكم دينكم. (رواه مسلم)

(٦) عن شيرمة بن معبد رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: مروا الصبيان الصلوة إذا بلغ سبع سنين وإذا بلغ عشر سنين فاضربوه عليها. أخرجه أبو داود والترمذى ولفظه: علموا الصبى الصلوة ابن سبع سنين واضربوه عليها ابن عشر. (صحيح البخارى)



- (٤) عن معاوية رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: من يرد الله به خيراً يفقهه في الدين. (رواه البخاري)
- (٥) عن أبي هريرة رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: من ملك طريقاً يلتمس فيه علماً سهل الله له به طريقاً إلى الجنة، وما اجتمع قوم في بيت من بيوت الله يتلون كتاب الله ويتدارسون بينهم إلا نزلت عليهم السكينة وغشيتهم الرحمة وحفهم الملكة وذكرهم الله فيمن عنده، ومن بطأ به عمله لم يسرع به نسبه. (رواه مسلم)
- (٦) عن أبي هريرة رضى الله عنه قال: كان رسول الله صلى الله عليه وسلم يقول: اللهم إني أعوذ بك من أربع، من علم لا ينفع، ومن قلب لا يخشع، ومن نفس لا تشبع، ومن دعا لا يسمع. (رواه أحمد، وأبو داود، وابن ماجه: منسكوة المصابيح)
- (٧) عن ابن مسعود رضى الله عنه عن النبي صلى الله عليه وسلم قال: لا نزول قلما ابن آدم حتى يمثل عن خمس عن عمره لما أفاض، وعن شبهة فيما أبلاه، وعن ماله من أين اكتسبه، وفيما أنفقته، وماذا عمل فيما علم. (جامع الترمذي)
- (٨) عن عبد الله قال: قال رسول الله صلى الله عليه وسلم: كسب الحلال فريضة بعد فريضة (نعم الإيمان لله). (رواه الترمذي)
- (٩) عن أبي سعيد رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: الشاجر الصدوق الأمين مع التائبين والصديقين والشهداء. (جامع الترمذي، سنن الدارمي، سنن تار قطنی)
- (١٠) عن أبي هريرة رضى الله عنه أن رسول الله قال: أتدرون ما المفلس؟ قالوا: المفلس فبتنا من لا درهم له ولا متاع. فقال: إن المفلس من أتى من يأتي يوم القيمة بمصلوة وصيام وزكوة، ويأتي قد شتم هذا وقذف هذا وأكل مال هذا وسفك دم هذا وضرب هذا فيعطى هذا من حسناته وهذا من حسناته، فإن هبت حسناته، فهل أن يقضى ما عليه أخذ من خطاياهم فطرحت عليه ثم طرح في النار. (مسلم: كتاب البر)
- (١١) عن أبي الدرداء رضى الله عنه أن رسول الله صلى الله عليه وسلم قال: إن أقل شيء يرضع في ميزان الميزان يوم القيامة خلق حسن، وإن الله يفيض الفاحش البذيء. (رواه الترمذي)
- (١٢) عن ابن عباس رضى الله عنهما أن النبي صلى الله عليه وسلم قال: أربع من أعطيتن فقد أعطى خير الدنيا والآخرة، قلباً شاكراً، لساناً ذاكراً، يداً على البراءة صلياً، وزوجة لا تجهى حياً في نفسها وماله. (مسلم)
- (١٣) عن أبي هريرة رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: اجتنبوا السبع الموبقات، قالوا: يا رسول الله وما هن؟ قال: الشرك بالله، والسحر، وقتل النفس التي حرم الله إلا بالحق، وأكل الربوا، وأكل مال اليتيم، والتولي يوم الزحف، وقذف المحصنات المؤمنات الفاحشات. (متفق عليه)
- (١٤) عن أبي سعيد الخدري رضى الله عنه، عن رسول الله صلى الله عليه وسلم قال: من رأى منكم منكراً فليغيره بيده، فإن لم يستطع فبلسانه، وإن لم يستطع فبقلبه، وأذلك أضاعف الإيمان. (رواه مسلم)

## مبوزه كتب (الكتب المقترحة) Recommended Books

### (عربي)

- |     |   |                          |
|-----|---|--------------------------|
| ١.  | القرآن الكريم                             | الله جلّ جلاله           |
| ٢.  | مشكوة المصابيح                            | الخطيب التبريزي          |
| ٣.  | تفسير القرآن العظيم                       | ابن كثير الدمشقي         |
| ٤.  | تفسير روح المعاني                         | شهاب الدين محمود الألوسي |
| ٥.  | في ظلال القرآن                            | سيد قطب                  |
| ٦.  | السيرة النبوية                            | ابن هشام                 |
| ٧.  | قصص النبيين (١-٥)                         | ابو الحسن علي الندوي     |
| ٨.  | النحو الواضح في قواعد اللغة العربية (١-٦) | مصطفى امين، علي الجارم   |
| ٩.  | دروس اللغة العربية                        | دكتور فاء عبدالرحيم      |
| ١٠. | دائرة المعارف الاسلامية باللغة العربية    | مجموعة من المؤلفين       |

### انجليزي (English) انگریزي

11. The Holy Quran(Text, Translation & Commentary):Abdullah Yousuf Ali.
12. The Glorious Quran:Muhammad Marma Duke Pickthall.
13. The Message of Quran: Muhammad Asad (Leopold Weiss).
14. Sahih-al-Bukhari (English Translation) Muhammad Mohsin Khan.
15. Takalam-al-Arabiyyah (تکلم العربية) Arabic-English: Mahmud Ismaeel al-Seeni.
16. al-Mawrid (المورد) English - Arabic Dictionary: Munir al-Balabakki.
17. The Road To Makkah: Muhammad Asad (Leopold Weiss).
18. Quran, Bible & Science (القرآن والانجيل والعلم) Maurice de Bouccai.
19. Towards Understanding Islam (دینیات مبادئ الاسلام) Abul Ala Maudoodi.
20. Introduction to Islam (المدخل الى الاسلام) Dr. Muhammad Hamidullah.
21. Spirit of Islam (روح اسلام) Syed Ameer Ali.
22. Purdah & Status of Woman in Islam (الحجاب) Abul Ala Maudoodi.
23. Ettiquates of Life in Islam (آسان فقہ) Muhammad Yousuf Islahi.

24. Social Justice in Islam :Sayyid Qutb.  
اسلام میں عدل اجتماعی (العدالة الاجتماعية في الإسلام)
25. Islam in Theory & Practice :Maryam Jameela.(Margrate Marcus)  
اسلام ایک نظریہ ایک تحریر (الإسلام في النظرية و التطبيق)
26. Umar the Great : (اعمارق) :Shibli Nomani (Translated by Zafar Ali Khan)

Note: The books available in two or three languages

(Arabic,English, Urdu ( have been mentioned accordingly.)

#### Urdu (اردو)

- |     |   |                                       |
|-----|---|---------------------------------------|
| ۱۔  | معارف القرآن  | مفتی محمد شفیع                        |
| ۲۔  | تفہیم القرآن  | سید ابوالاعلیٰ مودودی                 |
| ۳۔  | تذکرہ قرآن  | ابن احسن اصلاقی                       |
| ۴۔  | فضاء القرآن   | پیر کرم شاہ الازہری                   |
| ۵۔  | معارف الحدیث  | محمد منظور نعمانی                     |
| ۶۔  | ترجمان السنۃ  | ہد عالم میرٹھی                        |
| ۷۔  | اللسان العربی   | محمد نعمان طشقندی (AIQU)              |
| ۸۔  | قواعد القرآن (مختصر قرآنی عربی گریمر)                 | عبد الرحمن طاہر مدنی                  |
| ۹۔  | تعلیم اللغة العربیة: مختصر القواعد (مختصر عربی گرامر) | ڈاکٹر مظہر معین                       |
| ۱۰۔ | عربی کا معلم  | مولانا عبدالستار خان                  |
| ۱۱۔ | عرب گرامر اینڈ ٹرانسلیشن                              | ایم ڈی چوہدری                         |
| ۱۲۔ | مصباح اللغات (عربی، اردو و سنسکرت)                    | عبدالحق بلایوی...                     |
| ۱۳۔ | سیرۃ النبیؐ   | شبلی نعمانی، سلیمان ندوی              |
| ۱۴۔ | الرحیق المختوم  | صفی الرحمن مبارکپوری                  |
| ۱۵۔ | رحمۃ للعالمینؐ  | محمد سلیمان منصور پوری                |
| ۱۶۔ | انسان کاملؐ   | ڈاکٹر خالد علوی                       |
| ۱۷۔ | سیرۃ عائشہؓ   | سید سلیمان ندوی                       |
| ۱۸۔ | سیر الصحابہؓ  | شاہ معین الدین ندوی                   |
| ۱۹۔ | تاریخ اسلام   | شاہ معین الدین ندوی                   |
| ۲۰۔ | اصحابی کالغوم   | حفیظ تائب                             |
| ۲۱۔ | (الثقافة الاسلامیة) تاریخ افکار و علوم اسلامی         | راغب الطباخ (ترجمہ: افتخار احمد بخٹی) |
| ۲۲۔ | اسلامی تہذیب اور اس کے اصول و مبادی                   | سید ابوالاعلیٰ مودودی                 |

عشرہ مبشرہ	۲۳۔
سید ابوالاعلیٰ مودودی	۲۴۔
سید قطب شہید ترجمہ ساجد الرحمن صدیقی	۲۵۔
پروفیسر خورشید احمد	۲۶۔
ڈاکٹر خالد علوی	۲۷۔
اسلام اور جدید ذہن کے شبہات (شبہات حول الاسلام): محمد قطب	۲۸۔
(Islam the Misunderstood Religion)	
صدر الدین اصلاحی	۲۹۔
ڈاکٹر محمد حمید اللہ	۳۰۔
(Emergence of Islam)	

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## **ETHICS (FOR NON-MUSLIMS)**

- 1- Definition of Ethics
- 2- Different concepts of Ethics (Ancient and contemporary)
- 3- Types of Ethics
  - a. Good Ethics
  - b. Bad Ethics
- 4- Importance of Ethics in Human Life
  - a. Individual Life
  - b. Family Life
  - c. Social Life
  - d. Importance of Ethics in Economic Life
  - e. Importance of Ethics in Politics
- 5- Ethical Teachings and Values in Different Religions
  - a. Hinduism
  - b. Buddhism
  - c. Zoroastrianism
  - d. Christianity
  - e. Judaism
  - f. Sikhism
  - g. Islam
- 6- Ethical Values of the above Religions
  - a. Truthfulness
  - b. Trustworthiness
  - c. Service to Humanity
  - d. Tolerance, Endurance
  - e. Respect for others
  - f. Cooperation, Mutual Help, selflessness
  - g. Justice (Social Justice, Economic Justice)

h. Equality

- 7- Concept of virtue and Evil in different religions.
- 8- Concept of “Flah” in Different Religions.
- 9- Attitude towards other Religions.

**Recommended Books:**

- 1- J.S. Mackeuzie, A Manual of Ethics
- 2- Harold H. Titus, Ethics for Today
- 3- B.A. Dar, Quranic Ethics
- 4- Hameedullah, Dr. Introduction to Islam
- 5- Ameer Ali Syed, The spirit of Islam

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## **Course: Educational Leadership and Management**

**Credit hours: 3**

### **Objectives**

After studying the course, the students will be able to:

1. Explain the concept of school organization, management and discipline and factors affecting school discipline
2. Organized school activities (curricular and co-curricular) affectively and manage available resources (material, human and time) efficiently.
3. Differentiate between the concept of leadership and management utilizing the major indicator of effective leadership management.
4. Maintain school record and activities according to the school mandate.
5. Explain the functions of basic rules of leave pay and allowances E & D, codes of ethics

### **Course Content**

#### **Unit 01 Introduction to Management**

- 1.1 Definitions of Management and Leadership.
- 1.2 Difference between leadership and management
- 1.3 Difference between general and educational management and Leadership.

#### **Unit 02 Process of Management**

- 2.1 Planning
- 2.2 Organizing
- 2.3 Staffing
- 2.4 Communicating
- 2.5 Controlling
- 2.6 Budgeting

#### **Unit 03 Resource Management**

- 3.1 Human resources
- 3.2 Physical resources
- 3.3 Financial resources
- 3.4 Information and learning resources (Library, AV Aids and instructional material)

#### **Unit 04 Rules and Regulations**

- 4.1 Rules regarding appointment, leaves, pay and allowances.

- 4.2 Efficiency & Discipline rules
- 4.3 Terms of reference of various personals in the school
- 4.4 Code of ethics

#### **Unit 05 Records in Educational Institutions**

- 5.1 Attendance register
- 5.2 Leave register
- 5.3 Stock register
- 5.4 Cash register (fee, different kind of funds)
- 5.5 Personal files of teachers and other staff
- 5.6** Other academic record (students result, staff meetings etc.)

#### **Unit 06 Theories of Leadership**

- 6.3 Trait Theories
- 6.4** Contingencies Theories

#### **Unit 07: Leadership Style**

- 7.1 Democratic
- 7.2 Autocratic
- 7.3 Laissaiz-faire
- 7.4** Leadership style and Headship

#### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### **Recommended Books**

- Afridi, A. (1998). *School organization*: Ijaz Publishers.
- Bovee, C.L. et al. (1995). *Management*. International Edition. New York: McGraw Hill, Inc.
- Burden, R.P. (1995). *Classroom management and discipline: Methods to facilitate cooperationinstruction*. New York: Longman.
- Bush, T.B. et al. (1999). *Educational management: Re-defining theory, policy and practice*. London: Longman.
- Bush, T., & Bush, T. (2003). *Theories of educational leadership and management*. London: Sage Publications.

- Bush, T., Bell, L., & Middlewood, D. (2010). *The principles of educational leadership and management*. Los Angeles: SAGE.
- Farooq, R.A. (1994). *Education system in Pakistan*. Islamabad: Asia Society for the Promotion of Innovation and Reforms in Education.
- Lumicbry, R.P. (1995). *Classroom demonstration administration, concepts and practice*. Third Edition. London:Wadsworth
- (2004). *School and Family Partnership*. Islamabad: Children's Resources International.
- Gamage, D., & Pang, N. (2003). *Leadership and management in education*. Hong Kong: Chinese University Press.
- Razik, T., Swanson, A., & Razik, T. (2001). *Fundamental concepts of educational leadership*. Upper Saddle River, N.J.: Merrill/Prentice Hall.



## **Course: Educational Assessment and Evaluation**

**Credit Hours: 3**

### **INTRODUCTION**

In this course, the students will study the theory and apply the same for test development purposes. Thus they will understand the procedures, applications and limitations of tests, techniques of administering individual/group tests and of interpreting assessment instruments and profiles.

### **OBJECTIVES**

Upon completion of this course, the student will be able to:

1. understand the concept and nature of testing & evaluation
2. develop and analyze test items for assessing different abilities of students;
3. recognize and describe the different types of measurement instruments;
4. differentiate between standardized and classroom tests;
5. define and apply introductory analytical terms and concepts, including basic statistical knowledge;
6. analyze and explain student profiles based on various outcomes of testing; interpret scores and results of different measurement techniques

### **COURSE CONTENT**

#### **Unit 01      Introduction**

- 1.1      Nature and meaning of test, assessment, measurement and evaluation
- 1.1      Distinction between test, assessment, measurement and evaluation
- 1.2      Role of assessment in education
- 1.3      Role of evaluation in education

#### **Unit 02      Different types of test**

- 2.1      Concept of standardized and non-standardized test
- 2.2      Norm-referenced test
- 2.3      Criterion-referenced test
- 2.4      Performance assessment
- 2.5      Individual and group tests

<b>Unit 03</b>	<b>Characteristics of Test</b>
3.1	Reliability <ul style="list-style-type: none"> <li>Definition of reliability</li> <li>Types of reliability</li> <li>Use of reliability</li> </ul>
3.2	Validity <ul style="list-style-type: none"> <li>Definition of validity</li> <li>types of validity</li> <li>Evidence of validity</li> <li>Reliability and validity</li> </ul>
<b>Unit 04</b>	<b>Designing Objectives</b>
4.1	Selection of instructional objectives
4.2	Bloom Taxonomy
4.3	Solo Taxonomy
4.5	Methods of stating instructional objectives
4.6.	Preparing a table of specification
4.7	- Use the table of specification as a basis for preparing test
<b>Unit 05</b>	<b>Statistical concepts related with testing</b>
5.1	Scales of measurement
5.2	Measures of central tendency
5.3	Indices of variability
5.4	Types of distributions
5.5	Correlation
<b>Unit 06</b>	<b>Types of Tests</b>
6.1	Supply type items <ul style="list-style-type: none"> <li>-Essay type</li> <li>-Short answer</li> <li>-Completion</li> <li>-Advantages and limitations</li> </ul>
6.2	Rules for constructing supply type questions
6.3	Methods of improvement and effective use (Rules for scoring essay tests etc)
6.4	Selection types test <ul style="list-style-type: none"> <li>-Multiple choice items</li> </ul>

- True false items
- Matching items
- Completion items

6.5 Rules for constructing various types of objective test items

#### **Unit 07 Item Analysis**

7.1 Test construction

7.2 Test administration

7.3 Item analysis

#### **Unit 08 Assembling, Administering and Evaluating the Test**

8.1 Reviewing and editing the items

8.2 Arranging the items in the test

8.3 Preparing directions

8.4 The problem of guessing

8.5 Reproducing the test

8.6 Administering the test

8.7 Scoring the test

8.8 Building test file

8.9 Item bank

#### **Unit 10 Grading and Reporting**

10.1 Concept of grading

10.2 Types of grading

10.3 Reporting results to different stakeholders

#### **Unit 11 New Trends and Issues**

- Portfolio Assessment
- Dynamic Assessment
- Computer assisted assessment and evaluation

#### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Suggested Books**

- Anastasi, Ann. (1996). *Psychological Testing*. New York: Macmillan
- Carey, L.M. (1988) *Measuring and Evaluating School Learning*. Boston: Allyn and Bacon. Columbus: Merrill Publishing Co.
- Cronbach, L.J. (1984). *Essentials of Psychological Testing*. New York. Harper & Row
- Eble, Robert. L. & Frisbic, David A. (1986) *Essentials of Educational Measurement*. Englewood Cliffs: Prentice Hall.
- Gay, L.R. (1985). *Essential Evaluation and Measurement: competencies for Analysis and*
- Grunlund N.E. & Linn R.L. (1998) *Measurement and Evaluation in Teaching*. London: McMillan.
- Keeves, John P. (1988). *Educational Research, Methodology and Measurement*:
- Linn, Robert L. and M. David Miller, (2005), *Measurement and Assessment in Teaching*, 9<sup>th</sup> Ed., Upper Saddle River, N.J.: (Merrill) Prentice-Hall.
- Lissitz, Robert and William Schafer. (2002), *Assessment in Educational Reform: Both Means and Ends*, Boston, MA: Allyn and Bacon.
- Lorber, Michael A., Adel AL-Bataineh, and Barbara Meyer, (2005), *Objectives, Methods, and Evaluation in Secondary Education*, New York, Pearson Custom Publishing Co.
- McMillan, J. H. (2007), *Classroom Assessment: Principles and Practice for Effective Standards-Based Instruction* (4<sup>th</sup> ed.). Boston, MA: Allyn and Bacon.
- Mehran, W.A. and Lehman, I.J. *Measurement and Evaluation in Education and*
- Oosterhof, Albert C. (1990) . *Classroom Applications of Educational Measurement*.
- Popham, W. James, (2000), *Modern Educational Measurement: Practical Guidelines for Educational Leaders*, 3rd Ed. Boston, MA: Allyn and Bacon.

**COURSE TITLE: BOTANY-IV (PLANT PHYSIOLOGY AND ECOLOGY)**

**CREDIT HOURS: 3**

**Syllabus Outline:**

**a) Plant Physiology:**

Water relations, Mineral nutrition, Photosynthesis, Respiration, Growth.

**b) Ecology:**

Introduction, Soil, Light and Temperature, Water, Wind, Population Ecology, Community Ecology.

**c) Plant Physiology:**

1) Water relations (water potential, osmotic potential, pressure potential, matric potential), Absorption and translocation of water.

2) **Mineral Nutrition:** Soil as a source of minerals, Passive and active transport of nutrients. Essential mineral elements, role and deficiency symptoms of macronutrients.

3) **Photosynthesis:** Introduction, Oxygenic and non-oxygenic photosynthesis Mechanism: light reactions (electron transport and photophosphorylation) and dark reactions (Calvin cycle), Differences between C<sub>2</sub> and C<sub>3</sub> plants, factors affecting photosynthesis.

4) **Respiration:** Definition and respiratory substrates. Mechanism of Glycolysis, Krebs cycle. Electron transport and oxidative phosphorylation. Anaerobic respiration, Energy balance in aerobic and anaerobic respiration.

5) **Growth:** Definition; role of Auxins, Cytokinins, Abscissic acid and Ethylene in controlling growth, Gibberellins

6) **Photoperiodism:** Definition, historical background, Classification of plants based on photoperiodic response, Role of phytochromes, and hormones and metabolites in photoperiodism.

7) **Dormancy:** Definition and causes of seed and bud dormancy; methods of breaking seed dormancy. Physiological processes during seed germination.

8) **Plant Movements:** Classification. Phototropism, Nastic movements. Gravitropism and their mechanisms.

**d) Ecology:**

1) Introduction, aims and applications of Ecology.

2) Soil: Physical and chemical properties of soil (soil formation, soil texture, pH, EC, organism and organic matter etc) and their relationship to plants.

3) Light and temperature: Quality of light, diurnal and seasonal variations, Ecophysiological responses.

4) Water: Field capacity and soil water holding capacity. Characteristics of xerophytes and hydrophytes, Effects of precipitation on distribution of plants.

- 5) Wind: wind as an ecological factor and its importance
- 6) Population Ecology: Introduction to population ecology.
- 7) Community Ecology,
  - i) Ecological characteristics of plant community
  - ii) Methods of sampling vegetation (Quadrat and line intercept)
  - iii) Succession
  - iv) Major vegetation types of the local area.
- 8) Ecosystem Ecology,
  - i) Definition and components of ecosystem,
  - ii) Food chain and food web.
  - iii) Biogeochemical cycles, definition, types with emphasis on Nitrogen and Hydrological cycles.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Books Recommended:

1. Taiz, L. and Zeiger, E. (2010). *Plant Physiology*. 5<sup>th</sup> Edition. Sinauers Publishing, Company. Inc. California.
2. Illahi, I. (2009). *Plant Physiology. Biochemical Processes in Plants*. UGC Press.
3. Witham F.W, and Devlin. Blaydes, D.F. and Devline, R.M (1986) *Exercises in Plant Physiology*. Prindle, Weber and Schmidt, Boston.
4. Schultz, E. (2005). *Plant Ecology*. (2<sup>nd</sup> Ed.) Springer-Verlag, Berlin.
5. Smith, R. L. (2002). *Ecology and Field Biology*. Harper and Row Publishers, New York.
6. Salisbury F.B. and Ross C.B. (2002). *Plant Physiology*. (7<sup>th</sup> Ed.), Wordsworth Publishing Co. Belmont CA.
7. Ricklefs. R.E. (2001). *The Economy of Nature*. W.H. Freeman and Company .UK.
8. Hopkins, W.B. (2000). *Introduction to Plant Physiology*. 2<sup>nd</sup> Ed. John Wiley and Sons. New York.
9. Rick, R.E. (2000). *Ecology*. (1<sup>st</sup> Ed.) W.H. Freeman and Company, U.K.
10. Smith R. L. (2000). *Elements of Ecology*. Harper and Row Publishers, New York.

11. Subrahmanyam, N.S. and Sambamurthy. A.V.S.S. (2000). *Ecology*. Narosa Publishing House, New Delhi.
12. Townsend, C.R., Harper, J.L. and Begon, M.E. (2000). *Essentials of Ecology*. Blackwell Scientific Publications, U.K.
13. Barbour, M.O., Burke, H.J. and Pitts, D.W. (1999). *Terrestrial Plant Ecology*. The Benjamin, Cumming Publishing Co. California, USA.
14. Hussain, F. (1999). *Field and Laboratory Manual of Plant Ecology*. National Academy of Higher Education, Islamabad.
15. Krebs, C. J. (1997). *Ecology and Field Biology*. Addison Wesley Longman Inc, New York.
16. Chapman, J.L. and Reiss, M.J. (1995). *Ecology. Principles and Applications*. Cambridge University Press. U.K.
17. Odum, E.P. (1970). *Basic Ecology*. V/B. Saunders. Philadelphia.

**COURSE TITLE: BOTANY LAB-IV (PLANT PHYSIOLOGY AND ECOLOGY)**

**CREDIT HOURS: 1**

**Syllabus Outline:**

Water uptake by swelling seeds, loss of permeability by beet root cells, Rate of transpiration by means of potometer, Cobalt chloride paper method, Extraction of chlorophyll and separation of component pigments, Studies of absorption spectra, Winkler's method to determine oxygen utilization by a respiring plant, amylase from germinating seeds and its effect on starch breakdown, carbon dioxide evolution during respiration by titration method, seed germination

**a) Plant Physiology:**

1. Determination of uptake of water by swelling seeds when placed in sodium chloride solution of different concentrations.
2. Determination of the temperature at which beet root cells lose their permeability.
3. Determination of the effects of environmental factors on the rate of transpiration of a leafy shoot by means of a potometer by cobalt chloride paper method.
4. Extraction of chlorophyll from the leaves and separation of component pigments on a paper chromatogram. Study of Absorption Spectra using Spectrophotometer.
5. Estimation of oxygen utilized by a respiring plant by Winkler's method.
6. Extraction of amylase from germinating wheat seeds and *study* of its effect on starch break down.
7. Measurement of carbon dioxide evolution during respiration of germinating seeds by the titration method.
8. Effect of light and temperature on seed germination.

**b) Ecology:**

1. Determination of physical and chemical characteristics of soil.
2. Measurement of light and temperature.
3. Measurement of vegetation by Quadrat and Line Intercept Methods.
4. Measurements of wind velocity.
5. Field trips to ecologically diverse habitats.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%



**Books Recommended:**

1. Taiz, L. and Zeiger, E. (2010). *Plant Physiology*. 5<sup>th</sup> Edition. Sinauers Publishing, Co. Inc. California.
2. Illahi, I. (2009). *Plant Physiology. Biochemical Processes in Plants*. UGC Press.
3. Witham and Devlin. (2008) *Exercises in Plant Physiology* AWS Publishers, Boston.
4. Schultz, E. (2005). *Plant Ecology* (2<sup>nd</sup> Ed.) Springer-Verlag, Berlin.
5. Smith, R. L. (2002). *Ecology and Field Biology* Harper and Row Publishers, New York.
6. Salisbury F.B. and Ross C.B. (2002). *Plant Physiology* (7<sup>th</sup> Ed.), Wordsworth Publishing Co. Belmont CA.
7. Ricklefs. R.E. (2001). *The Economy of Nature* W.H. Freeman and Company. UK.
8. Hopkins, W.B. (2000). *Introduction to Plant Physiology* (2<sup>nd</sup> Ed.) John Wiley and Sons. New York.
9. Rick R.E. (2000). *Ecology*. (1<sup>st</sup> Ed.) W.H. Freeman and Company, UK.
10. Smith R. L. (2000). *Elements of Ecology* Harper and Row Publishers, New York.
11. Subrahmanyam, N.S. and Sambamurthy. A.V.S.S. (2000). *Ecology*. Narosa Publishing House, New Delhi.
12. Townsend, C.R., Harper, J.L. and Begon, M.E. (2000). *Essentials of Ecology* Blackwell Scientific Publications, UK.
13. Barbour, M.O., Burke, H.J. and Pitts, D.W. (1999). *Terrestrial Plant Ecology*. The Benjamin, Cumming Publishing Company California, USA.
14. Hussain F. (1999). *Field and Laboratory Manual of Plant Ecology* National Academy of Higher Education, Islamabad.
15. Krebs, C. J. (1997). *Ecology and Field Biology*. Addison Wesley Longman Inc, New York.
16. Chapman, J.L. and Reiss, M.J. (1995). *Ecology Principles and Applications*. Cambridge University Press. U.K.
17. Odum, E.P. (1970). *Basic Ecology* V/B. Saunders. Philadelphia.

**TITLE: CHEMISTRY-IV (GENERAL CHEMISTRY)****CREDIT HOURS: 3****COURSE OBJECTIVES**

The objective of the course is for students

1. To learn the fundamentals of all basic concepts of chemistry.
2. To develop an understanding and appreciation of both structure and chemical transformation, chemical and physical properties of matter.
3. Will acquire basic concepts of electronic structure and be able to apply them to solve problems from various areas of organic chemistry, including stereochemistry, reactivity patterns and synthesis.
4. Improvements in learning strategies, critical-thinking, and problem-solving skills are an expected outcome.

**COURSE CONTENT:****1. Quantum Mechanics and Atomic Structure:**

Elementary treatment of Compton effect and photoelectric effect; Brief discussion of result of Bohr's Model and its defects; Sommerfeld's modification and evolution of azimuthal quantum number; Dual nature of matter; Verification of dual nature by Davisson and Germer's experiment; Detail of Heisenberg's uncertainty principle; Postulates of quantum mechanics; Brief introduction of operators; Derivation of time independent Schrodinger wave equation in terms of polar coordinates and derivation of principle quantum number; Energy equation for free motion of particle in one-dimensional box; Eigen values and Eigen functions; normalization of wave function; Probability functions; radial distribution, probability density functions.

**2. Electrochemistry:**

Electrolytic conduction and its measurement; Specific, equivalent and molar conductance, Determination of resistance; Cell content, conductance ratio, conduction of strong and weak electrolytes; Ionic motilities and their determination; Kohlrausch's law and its applications; Faraday's law (first and second) and their significance; Transport number; Hittort's rule; Determination of transference number by Hittort's method. Applications of conductance measurement; EMF of the chemical cells; Electrode potential and its measurement with reference to Weston standard, glass electrode, calomel electrode and quinhydrone electrode; Nerst equation; Thermodynamics of cells; Concentration of cells with liquid junction and without liquid junction.

**3. Evaluation of Analytical Data and Essentials of Chemical Analysis:**

Some fundamental concepts like mole, activity and activity co-efficient; Concepts of mean, median, accuracy, precision, significant figures; Various types of errors, their detection and elimination; Standard deviation; Relative standard deviation; Confidence limits; Rounding off the analytical data. Law of mass action and its

applications; precipitation and solubility product; common ion effect; Co-precipitation, fractional precipitation, concept of pH, buffers, working of indicators.

#### 4. Spectroscopy:

Electromagnetic radiation and its interaction with matter; Nature of different transitions possible in atoms and molecules; Electronic, vibrational, rotational and other possible transitions by absorption of radiation by molecules and atoms. Development of spectroscopic analytical techniques employing various transitions. Classification of spectroscopic techniques on the basis of type of radiation, phenomenon occurring and the nature of the matter. Basic introduction to atomic and molecular spectroscopic techniques including flame emission, spectrophotometry, UV, IR spectroscopy.

#### 5. 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 additions of water, alcohols, ammonia and its derivatives, hydrogen cyanide, bisulfite, reduction and oxidation reactions; Aldol condensation and related reaction; Cannizzaro's reaction; Wittig reaction; Oxidation reactions, Chemical tests of aldehydes and ketones.

#### 6. 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, decarbonylation, Hunsdiecker reaction, Kochi reaction, substitution at  $\alpha$ -carbon. Preparations, properties and reactions of acid chlorides, acid anhydrides, amides, cyanides, and esters; Malonic and acetoacetic esters syntheses.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Recommended Books:

1. Adamson A. W. "Understanding Physical Chemistry" 3<sup>rd</sup> Ed. Benjamin Cummings publishing company Inc.
2. Akhtar M.N. & Ghulam Nabi, "Textbook of Physical Chemistry" ilmi kutab khana, Lahore.
3. Bhatti H.N. and K. Hussain, "Principles of Physical Chemistry"; Carwan Book House, Lahore.

4. Shriver, D.F., P.W. Atkins and C.H. Langford, "Inorganic Chemistry"; Oxford, 2<sup>nd</sup> Ed. (1996).
5. Sharp, A.G. "Inorganic Chemistry", Longman, 3<sup>rd</sup> Edition (1992).
6. Rayner Canham, Gelof, "Descriptive Inorganic Chemistry" & Co. (1995).
7. Daniel R. Paller, "Experimental Organic Chemistry, John Wiley & Sons" Inc., 2009.
8. James A. Moore, "Experimental methods in Organic Chemistry" Holt-Saunders Int. 1983.
9. R.L. Shriner, R.C. Fuson, D.IV. Curtin and T.C. Morrill "The systematic Identification of organic compounds, 6<sup>th</sup> ed. John Wiley & sons, 1979.

## CHEMISTRY LAB-IV (GENERAL CHEMISTRY)

### CREDIT HOURS: 1

- 1) Verification of first law of Faraday by electroplating of  $\text{CuSO}_4$ ,  $\text{NiSO}_4$ ,  $\text{Cr}_2(\text{SO}_4)_3$ ,  $\text{Ag}^+ \text{CN}$  and  $\text{Au}^+ \text{CN}$ .
- 2) Conductometric and potentiometric titration using conductivity bridge and pH meter.
- 3) Measurement of reduction potential using of Zn, Cu, Ag, Al etc. by using calomel electrode.
- 4) Verification of Langmuir Isotherm.
- 5) Thin layer chromatography.

### Preparations:

- 1) Ferric Alum
- 2) Potassium tri-oxalato aluminate
- 3) Sodium Thiosulfate
- 4) Amm. Coppr (II) Sulphate

### Iodometry:

- 1) Determination of iodide and KI in the given sample solution.
- 2) Standardization of  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  solution.
- 3) Determination of amount/ $\text{dm}^3$  of  $\text{Cu}^{2+}$  in  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  using  $\text{Na}_2\text{S}_2\text{O}_3$  and KI.
- 4) Determination of number water molecules (x) in  $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$ .

### Preparation of Organic Compounds:

Preparation and techniques of purification of tribromophenol, nitrobenzene, aspirin, ethyl benzoate and benzoic acid from toluene, butyl chloride, acetanilide.

### Estimations (volumetric):

- 1) Determination of molecular weight of a carboxylic acid.
- 2) Estimation of amide group and glucose.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Recommended Books:

1. Crocleford H.D. H.W. Biard F.W. Getzen & J.W. Nowell, "Laboratory Maual of Physical Chemistry" 2<sup>nd</sup> Eddition John Wiley & Sons London.

2. Skoog, D.A., D.M. West and F.J. Holler, "Analytical Chemistry" 6<sup>th</sup> Ed. Saunders College Publications (1994).
3. Javed Iqbal Amin, "Theory and Practice of Chromatography", Higher Education Commission, Islamabad. (2002).
4. James A. Moore, "Experimental methods in Organic Chemistry", Holt-Saunders Int., 1983.
5. R.L. Shriner, R.C., Fuson D.V. Curtin and T.C. Morrill "The systematic identification of organic compounds, 6<sup>th</sup> Ed. John Wiley & Sons 1979.

## SEMESTER-V

Course: Curriculum Development

Credit Hours: 3

### INTRODUCTION

In the system of education, Curriculum is designed to provide desirable learning experiences. Curriculum is a total plan for an educational setting. Curriculum development is a process in which choices of learning experiences are made and activated through co-ordinated activities. The process starts from selection of Aims, Goals and Objectives, which guide the structure and provide direction. The next stages are selection of Content and its organization, selection of instructional strategies and evaluation.

### OBJECTIVES

On the completion of the course, the student will be able to:

1. understand the concept of curriculum;
2. explain the foundations of the curriculum;
3. elaborate the needs and principles of curriculum;
4. discuss the factors affecting curriculum development;
5. understand the process of curriculum development;
6. write curriculum objectives in behavioral term;
7. examine the elements/components of curriculum development;
8. differentiate between different types of curricula;
9. Identify the problems and issues of curriculum development in Pakistan.
10. explain the concept of teaching, teaching learning strategies, and relationship among different elements;
11. examine the role of teacher in detail;
12. use various teaching learning strategies for effective classroom learning;
13. develop appropriate lesson plans according to the nature of the subject matter;  
use various teaching aids for effective teaching learning activities

### COURSE CONTENT

Unit 01 Introduction to Curriculum

- 1.1 Concept of curriculum
- 1.2 Difference between curriculum, syllabus and text book
- 1.3 Need for curriculum development,
- 1.4 Principals of curriculum development
- 1.5 Elements of curriculum: Objectives, Content, Teaching methods and evaluation.
- 1.6 Factors influencing curriculum development.
- Unit 02 Foundations of Curriculum
  - 2.1 Philosophical/Ideological foundations
  - 2.2 Historical Foundations
  - 2.3 Psychological Foundations
  - 2.4 Socio-economic & Cultural Foundations
  - 2.5 Political Foundations
- Unit 03 Curriculum Development Process
  - 3.1 Situation analysis
    - 1. Need Assessment
    - 2. Phases of need assessment
    - 3. Conducting situation analysis
  - 3.2 Selection of aims, goals and objectives
    - 1. Taxonomy of educational objectives
    - 2. Objectives of education in the current education policy
  - 3.3 Selection of Content
    - 1. Organization of Content
    - 2. Selection and organization of learning experiences
    - 3. Selection of Instructional Strategies
  - 3.4 Evaluation
    - 1. Types of evaluation
    - 2. Tools of evaluation
    - 3. Reporting
    - 4. Evaluating curriculum and multiple textbooks
- Unit 04 Curriculum Design



- 4.1 Concept of curriculum design
- 4.2 Criteria of selecting curriculum design
- 4.3 Types/ pattern of curriculum
  - 1. Subject Centered Designs
  - 2. Learner centered Designs
  - 3. Problem or topic centered Designs
  - 4. Integrated curriculum
- Unit 05 Models of Curriculum Development
  - 5.1 Tyler Model
  - 5.2 Hilda Model
  - 5.3 Lewis Model
  - 5.4 Oliva Model
  - 5.5 Wheeler Model
  - 5.6 Dynamic Model
  - 5.7 Skel Beck Model
- Unit 06 Process and Problems of Curriculum Development in Pakistan
  - 6.1 Curriculum development at elementary and secondary level
  - 6.2 Curriculum revision and role of Curriculum Wing
  - 6.3 Curriculum development at higher education level
  - 6.4 Curriculum revision and role of HEC
  - 6.5 Curriculum development of Adult Literacy
  - 6.6 Role of teacher in curriculum development
  - 6.7 Problems and issues of curriculum development in Pakistan
- Unit 07 Patterns of curriculum.
  - 7.1 Conservative liberal art
  - 7.2 Educational technology
  - 7.3 Humanistic
  - 7.4 Vocational
  - 7.5 Social re-construction
  - 7.6 De-schooling

**Unit 08 Instructional Process**

- 8.1 Concept of teaching, techniques and strategies with reference to their differences
- 8.2 Process of teaching
- 8.3 Main features/characteristics of teaching
- 8.4 Instructional design

**Unit 09 Approaches to Teaching / Methods and Techniques**

- 9.1 Teacher –led Approaches
  - 1. Lecture Method
  - 2. Demonstration Method
  - 3. Lecture-cum- demonstration
- 9.2 Child centered approaches
  - 1. Group work / Discussion
  - 2. Problem solving strategy/Inquiry
  - 3. Use of ICT / Computer Assisted Instructions
- 9.3 Questioning and feedback skill

**Unit 10 Planning and Managing Teaching**

- 9.1 Approaches to lesson planning
- 9.2 Types of effective lesson planning
- 9.3 Daily, Weekly and Yearly Plans
- 9.4 Time management

**Unit 11 Teaching Aids and Instructional Technology**

- 10.1 Concept of instructional technology and its importance
- 10.2 Selection and use of appropriate teaching aids
- 10.3 Projected & non Projected Aids

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## SUGGESTED BOOKS

1. Children Resource International (2004), Child-centered Curriculum (unit 3<sup>rd</sup>), Islamabad.
2. David Minton (1997) Teaching Skills in Further and Adult Education, (revised ed.) London, City and Guilds.
3. Farooq, R.A, (1993), Education System in Pakistan, Islamabad; Asia Society for Promotion of Innovation and Reforms in Education, Islamabad.
4. Kelly,A.V., (1999), The Curriculum and Theory and Practice, London, Paul Chapman.
5. MS Neil J.D (1990), Curriculum: A Comprehensive Introduction,4<sup>th</sup> ed. Los Angeles: Harper Collins.
6. Murry Print(1993), Curriculum Development and Design 2<sup>nd</sup> ed., St. Leonards, Allen and Unwin
7. Saxena Swarup,N.R and Oberoi, S.C (1994) Technology of Teaching, *Merrut, Royal Book Depot*
8. Sharma R.C. (2002), *Modern Methods of Curriculum Organization. New Delhi*
9. Wiles J.& Bomdi J. (1993). *Curriculum Development*. New York McMillan Publication Company.

## **Course: Environmental Education**

**Credit Hours: 3**

### **INTRODUCTION**

The purpose of this course is to provide in-depth knowledge about environment and skills to preserve the environment.

### **OBJECTIVES**

Upon completion of this course, the student will be able to:

After completing the course the students will be able to:

1. Understand the significance of Geography, Health, and Environment in education
2. Have awareness of the diseases and remedies

Critique the environmental problems affecting health

### **COURSE CONTENT**

#### **Unit 01      Understanding Geography, Health and Environment**

- 1.1      Explaining Geography, health, and environment
- 1.2      Significance of geography as a subject
- 1.3      Importance of students' health
- 1.4      Ecology and different Eco systems
- 1.5      Inter-defense and inter-relationship of living organisms and environment

#### **Unit 02      Raising Awareness**

- 2.1      The effects of wars and natural disaster on geography
- 2.2      Importance of raising health awareness
- 2.3      Method of raising health awareness
- 2.4      Method of protection of environment
- 2.5      Importance of clean environment
- 2.6      Methods for the protection of geography boundary

#### **Unit 03      Environment Problems**

- 3.1      Problems due to increase and unwise use of fertilizers and insecticides
- 3.2      Soil losses and its degradation
- 3.3      Soil conservation

- 3.4 Water logging and salinity
- 3.5 Vegetation
- 3.6 Unplanned Industrialization
- 3.7 Treatment plants for chemical effluents
- 3.8 Air pollution by smoke and chemical exhaust

**Unit 04 Preservation of World life**

- 4.1 Life span and their use
- 4.2 Need for preservation

**Unit 05 Diseases and Preventive Measures**

- 5.1 Types of disease and their causes
- 5.2 The spread of disease and preventive measures
- 5.3 Role of psycho-religious therapy in treating diseases:
  - ♦ physical
  - ♦ Mental
  - ♦ Spiritual

**Unit 06 Role of Education in Environmental Preservation**

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Readings**

Aldrich-Moodie, B., & Kwong, J. (1997). *Environmental education*. London: IEA Education and Training Unit.

Azeiteiro, U. (2008). *Science and environmental education: Towards the integration of science education, experimental science activities and environmental education*. Frankfurt am Main: Peter Lang

- Food and Agriculture Organization of the United Nations. (2005). *The state of food insecurity in the world, 2005: Eradicating world hunger - key to achieving the Millennium Development Goals*. Rome, Italy: Food and Agriculture Organization of the United Nations.
- Gazdar, M. N. (1987). *Natural resources development and environmental management in Pakistan*. Kuala Lumpur: Open Press.
- Harris, F. (2012). *Global environmental issues*. Chichester, West Sussex: Wiley-Blackwell.
- Johnson, E. A., & Mappin, M. (2005). *Environmental education and advocacy: Changing perspectives of ecology and education*. Cambridge: Cambridge University Press
- Palmer, J., & Neal, P. (1994). *The handbook of environmental education*. London: Routledge.
- Palmer, J. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise*. London: Routledge.
- Sampson, R. N., Hair, D., & American Forestry Association. (1990). *Natural resources for the 21st century*. Washington, D.C: Island Press [in cooperation with] American Forestry Association.
- Samuel, K., & Sundar, I. (2007). *Environmental education: Curriculum [i.e. curriculum] and teaching methods*. New Delhi: Sarup & Sons.
- Saylan, C., & Blumstein, D. T. (2011). *The failure of environmental education (and how we can fix it)*. Berkeley: University of California Press.
- Stevenson, R. (2013). *International handbook of research on environmental education*. New York: Routledge.
- Tomar, A. (2007). *Environmental education*. Delhi: Kalpaz Publications.
- Wilke, R. J. (1993). *Environmental education teacher resource handbook: A practical guide for K-12 environmental education*. Millwood, N.Y: Kraus International Publications.
- Whitmore, F. C., Williams, M. E., & International Centennial Symposium of the United States Geological Survey. (1982). *Resources for the twenty-first century: Proceedings*. Washington/D.C.

## **Course: School, Community & Teacher**

**Credit Hours: 3**

**Introduction** The purpose of this course is to provide Student Teachers with a strong foundation for understanding the relationship between and among teachers, the school, and the families and community that support the school. Basic conceptualizations of educational institutions and the role of the teacher in relating to these institutions will be considered. Student Teachers will also explore how cultural, social, and historical forces have shaped their understanding of the relationship teachers have with schools, communities, and families in Pakistan. The course will explore the social context of schooling and examine how the work of teachers is nested within school and community. It will provide orientation to the process of socialization in schools and how social factors affect education.

**Objectives:** Student Teacher are expected to have opportunity to put this knowledge into practice in the accompanying one-credit laboratory by studying a school and its community, so that as teachers, they can mobilize support for educational programmes and contribute positively to their communities. Practical application of the course will be emphasized as Student Teachers explore teaching and learning within both the school and the community. They will identify strategies, practices, and relationships that have proven fruitful within familiar contexts, and learn how to identify and respond to challenges in school, community, and teacher relationships. Student Teachers will identify how culture, gender, special needs, equity and equality, and collaborative working conditions affect the school and community.

### **Course Content**

#### **Society, Community, and Education**

Introduction and overview of the course, Introduction to society, community, and education

#### **Handout + Article + Discussion One page reflective note**

S. B. Carrington, Home, School and Community Relationships', in A. Ashman and J. Elkins (eds.), Education for Inclusive and Diversity (Frenchs Forest, NSW: Pearson Education Australia, 2008).

**1. Structures and functions of community and schools in Pakistan**

**(Article reading and discussion)**

Causes of Deteriorating Standard of Education in Balochistan: A Review of “Jabeen and Malik” (2003)

**Assignment**

(Article) Quality of Primary Education in Pakistan

From this article find out the answers of following questions:

What is quality?

What is the meaning of quality in the Context of EFA?

Quality of Education in Pakistan?

Which Quality Improvement Initiatives and Projects are introduced in this article?

**2. Impact of education on society**

(Article) Problems in Universalization of Primary Education in Pakistan: A Review of Khan (2010)

**3. Role of education in strengthening Pakistani communities**

Handout + Class compare the lists offered by Jabeen and Malik with the one offered by Khan.

**II. Understanding social interaction in schools and communities**

**4. Meaning of social interaction and socialization**

**Lecture + Discussion**

**Assignment**

Video Sense of Self and Self-Socialization: The Development of Self-Views on

<http://education-portal.com/academy/lesson/sense-of-self-and-self-socializationthe-development-of-self-views.html>

**5. Levels of social interaction, Elements of social interaction**



### **Social contacts, Communication, Social attitudes and values**

Article reading and discussion on “Models of the Communication Process”.

#### **Assignment**

Make posters of communication models and display these on a wall.

**6. Types of social interaction: Cooperation, Competition, Conflict**

#### **Accommodation, Assimilation**

Read ‘Assimilation Models, Old and New: Explaining a Long-Term Process’ by Susan K. Brown and Frank D. Bean from the University of California, Irvine

**7. Social groups and individual and group behaviour**

Textbook introduction to sociology such as chapter 5 of Essentials of Sociology (8th edn) by Brinkerhoff, Ortega, White, and Weitz (2011)

Chapter 7 of Introduction to Sociology by Cohen and Orbuch (1990).

**8. Meaning of social interaction and socialization**

Peace Education: Working Paper

### **III. School and Culture**

**9. Main characteristics of culture**

Pre-class reading a chapter on education in Sindh, such as R.

Qureshi, P. Pirzado, and S. Nasim, ‘Schooling in Rural Sindh, Pakistan’

Gender and Education in Pakistan (Karachi: Oxford University Press, 2007).

**10. Elementary concepts of culture**

Handout

11. Culture and cultural elements of Pakistani communities  
Write a brief essay on how culture affects different people in Pakistan?
12. **Role of education and school in the protection and transmission of culture**  
List local and public holidays and festivals.  
• Why are local holidays and festivals important? For whom are they important? • How are they celebrated? • Do schools acknowledge these holidays and festivals? • How do schools participate in these events? • Do schools teach about and value these holidays and festivals? • If schools acknowledge and celebrate local holidays and festivals, what is the impact on the transmission and protection of culture? • If schools do not acknowledge and celebrate local holidays and festivals, what is the impact on the transmission and protection of culture?
13. **Impact of media on school and culture**  
Discussion + Assignment
14. Impact of technology on school and culture

#### **IV. Relationships Between School and Community**

15. **School as a social, cultural, and community institution**  
Pre Reading of article  
**G. M. Arif's 'Production of Cognitive Life Skills in Public, Private, and NGO Schools in Pakistan'**  
Discuss the similarities and differences between the systems in terms of their social and cultural standing in Pakistani society. Which school system is culturally more acceptable? Why?

16. **Effects of schools on communities and communities on schools**  
<http://www.sedl.org/connections/resources/evidence.pdf>
17. **School as a hub for community services**  
 Pre class reading  
[http://www.policyalternatives.ca/sites/default/files/uploads/publications/ourselves/docs/OSOS\\_Summer10\\_Preview.pdf](http://www.policyalternatives.ca/sites/default/files/uploads/publications/ourselves/docs/OSOS_Summer10_Preview.pdf)
18. **A critical analysis of the effective roles of school and teachers in Pakistani communities**  
[http://www.nccrest.org/Briefs/Diversity\\_Brief.pdf](http://www.nccrest.org/Briefs/Diversity_Brief.pdf)

#### **V. Social Institutions**

19. **Definition and types of social institutions**
20. **Educational and religious institutions**  
 Handout
21. **Critical analysis of the role of social institutions in Pakistani schools**  
 Handout

#### **VI. The Teacher's Role in School and the Community**

22. **Teacher as an integral part of community**  
 Guest Lecture
23. **Teacher as a change agent in Communities and Schools**  
 Handout on 'Overcoming Exclusion through Inclusive Approaches in Education: A Challenge and a Vision'  
<http://unesdoc.unesco.org/images/0013/001347/134785e.pdf>
24. **Teachers as role models through their participation in community activities**  
 Handout
25. **Effects of teachers and schools on individual and group behaviour**

#### **VII. The Working Context of Pakistani Teachers**

26. Teacher as a social activist  
[http://www.curriculumsupport.education.nsw.gov.au/secondary/pdhpe/assets/pdf/tlsupp\\_004.pdf](http://www.curriculumsupport.education.nsw.gov.au/secondary/pdhpe/assets/pdf/tlsupp_004.pdf)
27. Teacher's leadership roles within and outside schools  
Handout
28. Teacher's role in establishing linkage among stakeholders

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Suggested Textbooks and References

A. Bashiruddin and J. Retallick (eds.), *Becoming Teacher Educators* (Karachi: Aga Khan University-

Institute of Educational Development, 2009).

S. Hafeez, *The Changing Pakistan Society* (Karachi: Royal Book Company, 1991).

S. B. Kotley, *The Basics of Sociology* (Westport, CT: Greenwood Press, 2008).

L. Marshall and F. Rowland, *A Guide to Learning Independently* (4th edn.) (French Forest, NSW: Pearson Longman, 2006).

M. J. Abdalla and R. Qureshi, 'Teacher Leadership for School-Based Professional Development: A Case Study', in R. Qureshi and F. Shamim (eds.), *Schools and Schooling Practices in Pakistan: Lessons for Policy and Practice* (Karachi: Oxford University Press, 2009).

R. Qureshi, P. Pirzado, and S. Nasim, 'Schooling in Rural Sindh, Pakistan', in R. Qureshi and J. Rarieya (eds.), *Gender and Education in Pakistan* (Karachi: Oxford University Press, 2007).

**R. Qureshi, 'Education for Inclusion: What Would It Take to Have an Inclusive Primary School in Pakistan?', *Educational Awakening*, 3: 20–31**

R. Qureshi, 'Colonial Legacy: Understanding the Historical Roots of Female Illiteracy in Pakistan', *Muslim Education Quarterly*, 23 (2006), 20–37.

R. Qureshi, 'Is Child-Friendly School on the Agenda for School Reforms? Conversations with Pakistani School Heads', Paper presented and published in the Conference Proceedings of the International Conference on the Teacher Education: Transformative Society & Teacher Education Reform, 19–20 Sept 2008, Changchun, China, 1–10.

R. Qureshi and J. Rarieya (eds.), *Gender and Education in Pakistan* (Karachi: Oxford University Press, 2007)

R. Qureshi and F. Shamim (eds.), *Schools and Schooling Practices in Pakistan: Lessons for Policy and Practice* (Karachi, Oxford University Press, 2008).

M. Shaaban and R. Qureshi, 'Teacher Leaders: Experiences of Pakistani Teachers in Leading School Improvement Activities', Conference Proceedings of the International Conference on 'Quality in Education: Teaching and Leadership in Challenging Times', 21–23 Feb 2006, Pakistan: Aga Khan University-Institute for Educational Development, 558–64.

**Course: Teaching of Biology**  
**Credit Hours: 3**

**Introduction:** This course is designed specifically to equip the prospective science teachers with the latest pedagogical knowledge required to teach the contents of Biology at secondary level. In addition, the course will also provide the prospective science teachers an acquaintance with the modern assessment techniques and use of laboratory and computers in the field of teaching of Biology.

**Objectives:**

Students will be able to

- Differentiate between method, technique and strategy in context of teaching.
- Describe various methods for teaching of Biology.
- Identify most suitable method to teach diverse topics.
- Extend their knowledge of teaching to implement various methodologies.
- Recognize the importance of teaching of Biology.
- Demonstrate the use of low cost no cost materials for teaching of Biology.
- Apply the computer technology for teaching of Biology.
- Use the laboratory apparatus effectively for disseminating biological knowledge.

**Course Contents**

**1. Teaching of Biology**

- Introduction
- The Nature of science
- Scientific literacy and its importance
- Definition of sciences: Science as product and process
- The products of science
- Processes of science
- Scientific attitudes
- The nature of scientific laws, facts, concepts and theories
- Physical sciences and limitations of science
- Definition of Biology
- Importance of Biology in everyday life

Why teach Biology

## **2. Aims and Objectives of teaching Biology**

Aims of teaching Biology

Criteria for selection of aims

Objectives of teaching Biology

Writing objectives

Difference between aims and objectives

## **3. Methods of teaching Biology**

Various methods of teaching Biology

Lecture method

Demonstration method

Heuristic method

Assignment method

Project method

Inductive method

Deductive method

Scientific method

Problem method

Choice of method

## **4. The Nature of Children and Science Teaching**

Piagetian theory of cognitive development

Stages of cognitive development

Characteristics of individual in various stages of cognitive development

Piaget's theory and science curriculum

Implications of Piagetian theory in facilitating learning of science

The process of learning according to Robert Gagne, Davis Ausubel and Bruner

## **5. Lesson Planning**

Advantages of the Lesson Planning

Feature of a lesson plan

Steps in lesson plan

## **6. Teaching aids in Biology**

Importance of teaching aids

Principles for selection of teaching aids

Principles for effective use of teaching aids

Different types of teaching aid material

## **7. Apparatus and Equipment**

Introduction

Locally produces low cost equipment

Chemicals

Charts, Diagrams, Pictures and Bulletin board

Improvised Apparatus

Text books

## **8. The Biology Teacher**

Duties and Responsibilities of a Biology teacher

Effective use of Biology Laboratory

Making Biology teaching more Interesting

## **9. Evaluation in Biology**

Introduction

Designing of Test

Evaluation of Functional skills

The Assessment of Practical work

Recent Trends in Teaching of Biology



## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## References

- Barke, H.-D., Hazari, A., & Yitbarek, S. (2009). *Misconceptions in Physics: Addressing perceptions in chemical education*. Berlin: Springer.
- Eilks, I., & Hofstein, A. (2013). *Teaching Physics-- a studybook: A practical guide and textbook for student teachers, teacher trainees and teachers*. Rotterdam: SensePublishers.
- Eilks, I., Byers, B., Royal Society of Physics (Great Britain), & European Physics Thematic Network. (2009). *Innovative methods of teaching and learning Physics in higher education*. Cambridge, UK: RSC Publishing.
- Gallagher-Bolos, J. A., & Smithenry, D. W. (2004). *Teaching inquiry-based Physics: Creating student-led scientific communities*. Portsmouth, NH: Heinemann
- In García-Martínez, J., & In Serrano-Torregrosa, E. (2015). *Physics education: Best practices, opportunities and trends*.
- Niaz, M. (2008). *Teaching general Physics*. New York: Nova Science Publishers.
- Pauling, L. (2014). *General Physics*. Newburyport: Dover Publications.
- Peterson, A. D. C. (1965). *Techniques of Teaching: Volume 1*. Oxford: Pergamon Press.

**Course: Teaching of Chemistry**  
**Credit Hours: 3**

**Introduction:** This course is designed specifically to equip the prospective science teachers with the latest pedagogical knowledge required to teach the contents of Chemistry at secondary level. In addition, the course will also provide the prospective science teachers an acquaintance with the modern assessment techniques and use of laboratory and computers in the field of teaching of Chemistry.

**Objectives:**

Students will be able to

- Differentiate between method, technique and strategy in context of teaching.
- Describe various methods for teaching of Chemistry.
- Identify most suitable method to teach diverse topics.
- Extend their knowledge of teaching to implement various methodologies.
- Recognize the importance of teaching of Chemistry.
- Demonstrate the use of low cost no cost materials for teaching of Chemistry.
- Apply the computer technology for teaching of Chemistry.
- Use the laboratory apparatus effectively for disseminating chemical knowledge.

**Course contents**

**1. Teaching of chemistry**

- Introduction
- The Nature of science
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- Definition of sciences: Science as product and process
- The products of science
- Processes of science
- Scientific attitudes
- The nature of scientific laws, facts, concepts and theories
- Physical sciences and limitations of science
- Definition of chemistry
- Importance of chemistry in everyday life

Why teach chemistry

## **2. Aims and Objectives of teaching chemistry**

Aims of teaching chemistry

Criteria for selection of aims

Objectives of teaching chemistry

Writing objectives

Difference between aims and objectives

## **3. Methods of teaching chemistry**

Various methods of teaching chemistry

Lecture method

Demonstration method

Heuristic method

Assignment method

Project method

Inductive method

Deductive method

Scientific method

Problem method

Choice of method

## **4. The Nature of Children and Science Teaching**

Piagetian theory of cognitive development

Stages of cognitive development

Characteristics of individual in various stages of cognitive development

Piaget's theory and science curriculum

Implications of Piagetian theory in facilitating learning of science

The process of learning according to Robert Gagne, Davis Ausubel and Bruner

## **5. Lesson Planning**

Advantages of the Lesson Planning

Feature of a lesson plan

Steps in lesson plan

## **6. Teaching aids in chemistry**

Importance of teaching aids

Principles for selection of teaching aids

Principles for effective use of teaching aids

Different types of teaching aid material

## **7>. Apparatus and Equipment**

Introduction

Locally produces low cost equipment

Chemicals

Charts, Diagrams, Pictures and Bulletin board

Improvised Apparatus

Text books

## **8. The Chemistry Teacher**

Duties and Responsibilities of a Chemistry teacher

Effective use of Chemistry Laboratory

Making Chemistry teaching more Interesting

## **9. Evaluation in Chemistry**

Introduction

Designing of Test

Evaluation of Functional skills

The Assessment of Practical work

Recent Trends in Teaching of Chemistry

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## References

- Computer applications in teaching of Chemistry Barke, H.-D., Hazari, A., & Yitbarek, S. (2009). *Misconceptions in chemistry: Addressing perceptions in chemical education*. Berlin: Springer.
- Eilks, I., & Hofstein, A. (2013). *Teaching chemistry-- a studybook: A practical guide and textbook for student teachers, teacher trainees and teachers*. Rotterdam: SensePublishers.
- Eilks, I., Byers, B., Royal Society of Chemistry (Great Britain), & European Chemistry Thematic Network. (2009). *Innovative methods of teaching and learning chemistry in higher education*. Cambridge, UK: RSC Publishing.
- Gallagher-Bolos, J. A., & Smithenry, D. W. (2004). *Teaching inquiry-based chemistry: Creating student-led scientific communities*. Portsmouth, NH: Heinemann
- In García-Martínez, J., & In Serrano-Torregrosa, E. (2015). *Chemistry education: Best practices, opportunities and trends*.
- Niaz, M. (2008). *Teaching general chemistry*. New York: Nova Science Publishers.
- Pauling, L. (2014). *General Chemistry*. Newburyport: Dover Publications.
- Peterson, A. D. C. (1965). *Techniques of Teaching: Volume 1*. Oxford: Pergamon Press.

**Course: Teaching of Mathematics**  
**Credit Hours: 3**

**Introduction:** This course is designed specifically to equip the prospective science teachers with the latest pedagogical knowledge required to teach the contents of Mathematics at secondary level. In addition, the course will also provide the prospective science teachers an acquaintance with the modern assessment techniques and use of modern equipment and computers in the field of teaching of Mathematics.

**Objectives:**

Students will be able to

Differentiate between method, technique and strategy in context of teaching.

Describe various methods for teaching of Mathematics.

Identify most suitable method to teach diverse topics.

Extend their knowledge of teaching to implement various methodologies.

Recognize the importance of teaching of Mathematics.

Demonstrate the use of low cost no cost materials for teaching of Mathematics.

Apply the computer technology for teaching of Mathematics.

**Course Contents**

**1. Teaching of Mathematics**

Introduction

Mathematical literacy and its importance

Physical sciences and limitations of science

Definition of Mathematics

Importance of Mathematics in everyday life

Why teach Mathematics

**2. Aims and Objectives of teaching Mathematics**

Aims of teaching Mathematics

Criteria for selection of aims

Objectives of teaching Mathematics

Writing objectives

Difference between aims and objectives

### **3. Methods of teaching Mathematics**

Various methods of teaching Mathematics

Lecture method

Project method

Inductive method

Deductive method

Scientific method

Problem solving method

Choice of best method

### **4. Lesson Planning**

Advantages of the Lesson Planning

Feature of a lesson plan

Steps in lesson plan

Distinguishing features of mathematics lesson plan

### **5. Teaching aids in Mathematics**

Importance of teaching aids

Principles for selection of teaching aids

Principles for effective use of teaching aids

Different types of teaching aid material

Charts, Diagrams, Pictures and Bulletin board

Improvised Apparatus

Text books

## 6. The Mathematics Teacher

Duties and Responsibilities of a Mathematics teacher

Effective use of Mathematics Laboratory

Making Mathematics teaching more Interesting

## 7. Evaluation in Mathematics

Introduction

Designing of Test

Evaluation of Functional skills

The Assessment of Practical work

Recent Trends in Teaching of Mathematics

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### References

Basserear, T. (2012). *Mathematics for Elementary School Teachers*: Belmont, CA: Brooks.

Donovan, S. & Bransford, J.(2005). *How Students Learn: History, Mathematics, and Science in the Classroom* Washington DC: National Academies Press. Also available at

[www.nap.edu/catalog.php?record\\_id=10126#toc](http://www.nap.edu/catalog.php?record_id=10126#toc)

Haylock, D. (2010) *Mathematics Explained for Primary Teachers*, CA: SAGE Publications.



Protheroe, N. 'What Does Good Mathematics Instruction Look Like?' available at

<http://www.naesp.org/resources/2/Principal/2007/S-Op51.pdf>

National Council of Teachers of Mathematics, 'Illuminations'. <http://illuminations.nctm.org>

New Zealand Ministry of Education, 'New Zealand Maths', Curriculum. <http://nzmaths.co.nz>

University of Cambridge, 'NRICH: Enriching Mathematics'. <http://nrich.maths.org>

Van de Walle J. A., Karp, K. & Williams, J. Bay (2013) *Elementary and Middle School*

*Mathematics: Teaching Developmentally*. Boston: Pearson Education.

**Course: Teaching of Physics**  
**Credit Hours: 3**

**Introduction:** This course is designed specifically to equip the prospective science teachers with the latest pedagogical knowledge required to teach the contents of Physics at secondary level. In addition, the course will also provide the prospective science teachers an acquaintance with the modern assessment techniques and use of laboratory and computers in the field of teaching of Physics.

**Objectives:**

Students will be able to

- Differentiate between method, technique and strategy in context of teaching.
- Describe various methods for teaching of Physics.
- Identify most suitable method to teach diverse topics.
- Extend their knowledge of teaching to implement various methodologies.
- Recognize the importance of teaching of Physics.
- Demonstrate the use of low cost no cost materials for teaching of Physics.
- Apply the computer technology for teaching of Physics.
- Use the laboratory apparatus effectively for disseminating physical knowledge.

**Course contents**

**1. Teaching of Physics**

- Introduction
- The Nature of science
- Scientific literacy and its importance
- Definition of sciences: Science as product and process
- The products of science
- Processes of science
- Scientific attitudes
- The nature of scientific laws, facts, concepts and theories
- Physical sciences and limitations of science
- Definition of Physics
- Importance of Physics in everyday life

Why teach Physics

## **2. Aims and Objectives of teaching Physics**

Aims of teaching Physics

Criteria for selection of aims

Objectives of teaching Physics

Writing objectives

Difference between aims and objectives

## **3. Methods of teaching Physics**

Various methods of teaching Physics

Lecture method

Demonstration method

Heuristic method

Assignment method

Project method

Inductive method

Deductive method

Scientific method

Problem method

Choice of method

## **4. The Nature of Children and Science Teaching**

Piagetian theory of cognitive development

Stages of cognitive development

Characteristics of individual in various stages of cognitive development

Piaget's theory and science curriculum

Implications of Piagetian theory in facilitating learning of science

The process of learning according to Robert Gagne, Davis Ausubel and Bruner

## **5. Lesson Planning**

Advantages of the Lesson Planning

Feature of a lesson plan

Steps in lesson plan

## **6. Teaching aids in Physics**

Importance of teaching aids

Principles for selection of teaching aids

Principles for effective use of teaching aids

Different types of teaching aid material

## **7 Apparatus and Equipment**

Introduction

Locally produces low cost equipment

Chemicals

Charts, Diagrams, Pictures and Bulletin board

Improvised Apparatus

Text books

## **8. The Physics Teacher**

Duties and Responsibilities of a Physics teacher

Effective use of Physics Laboratory

Making Physics teaching more Interesting

## **9. Evaluation in Physics**

Introduction

Designing of Test

Evaluation of Functional skills

The Assessment of Practical work

Recent Trends in Teaching of Physics

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## References

- Harlen, W. (1992). *Teaching of Science*. London: David Falton Publishers.
- Hassard, J. (1992). *Minds of Science: Middle and secondary methods*. New York: Harper Collins Publishers.
- Levinson, R. (2005). *Teaching Science*, London; Open University Press.
- Monier, M. (Ed.) (1995). *Learning to Teach Science*. London: Falmer Press.
- Postlethwaite, K. (1993). *Differentiated Science Teaching*. Philadelphia: Open University Press.

**COURSE TITLE: ADVANCE BOTANY-I (ENVIRONMENTAL BIOLOGY)**

**CREDIT HOURS: 3**

**Syllabus Outline:** Study of Environmental Factors and Pollutants with relation to Bio life.

**Course Outline:**

**Introduction:** Aim and Scope, Interdisciplinary Approach.

**Natural Resources:** Nature and Conservation of the following: Energy, Water, -Mineral and Land Resources. Agriculture, Forestry, Range Land, Wild Life and Aquaculture.

**Environmental Pollution:** Nature and Classification.

**Air Pollution:** Sources and Effects of Pollutants on Plant Growth viz; Fluoride, Sulphur dioxide (SO<sub>2</sub>), Ozone, Pan + Smog, Ammonia, Chlorine, Ethylene, Dusts etc.. Nature, Causes, Prevention and Control of Air Pollution (Vehicular Pollution and Industrial Chimney Wastes).

**Water Pollution:** Sources of Water Pollution, Nature of Pollutants. Ground Water and Marine Pollution, Impacts of Water Pollution, Prevention of Water Pollution.

**Radiation Pollution:** Nuclear Concepts and Terminology, Comparative Radiosensitivity of Organisms, Radiation Effects at Ecosystem level. Fate of radio-nuclides in the environment. The Fall Out Problem, Nuclear Waste Disposal. Sources, Nature and Impacts of Solid Waste Pollution, Noise and Thermal Pollution.

**Pesticides and Agro-Chemicals:** Herbicides, Insecticides and Fungicides as Plant Poisons and their Impact on Ecosystem.

**Environmental Crisis:** Major Causes and Solutions, Ozone Hole, Green House Effect, Acid Rains, Chemical and Biological Warfare.

**Biodiversity and Conservation:** Evaluation, Criteria and Values; Inventory and Measuring of Biodiversity; In-situ and Ex-situ Conservation of Plants.

**Module Aims:** Completion of this program will produce a working knowledge of ecological sampling, analysis and interpretation of biological data and prepare graduates to study and resolve the ecological consequences of environmental problems.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcome:**

The students will acquire knowledge about the hazardous effects of different Environmental Pollutants and Relative Measures for their Control/Prevention.

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended:

1. Koziol, M.J. and Whatley, F.R. (2009). Gaseous Air Pollution and Plant Metabolism. Butterworths. U.K.
2. Goodstein, E.S. (2008). Economics and the Environment. Prentice Hall Publishers. New Jersey.
3. Mitsa, W.J. and Gosselink, A. (2007). Wetlands. Johan Wiley and Sons, me. New York.
4. Simmons, I.G. (1981). The Ecology of Natural Resources. Edward Arnold.
5. Emery, M. (2005). Promoting nature in cities and towns.
6. Varshney, C.K. (2005). Water Pollution and Management, Wiley Eastern Limited.
7. Johnson, C.E. (2004) Eco-Crisis. John Wiley and Sons. me.. New York.
8. Agrawal, K.C. (2001). Environmental Biology, Agro Botanical Publishers, India.
9. Chhatwal, D.R., Mehra, M.C., Satake, M., Katyal, T., Katyal, M. and Nagahiro. T. (2001). Encyclopedia of Environmental Pollution and its Control. (6 Vols.), Anmol Publication, New Delhi, India.
10. Moriarty, F. (2001) Ecotoncology. Acadmeic Press Inc.
11. Nobel, B.J. and Kormond, Y. (2001). Environmental Science. Prentice Hall Inc. New Jersey. USA.
12. Treshow, M. (2001) Environment and Plant Response. McGraw Hill New York.
13. Usher, M. (2001). Widllife Conservation Evaluation. Chapman and Hall.
14. Rao, D.N., Ahmad, K.J., Younas, and Singh, S.N. (2000). Perspectives in Environmental Botany (Vol. I,) Print House, Lucknow, India.
15. Smith, L. and Graham, A. (2000). Impact Assessment and Sustainable Resource Management. John Wiley and Sons, New York.
16. Jeffrey, A.M. (1999). Economics and Biological diversity. International union for conservation of Nature and Natural Resources in Gland, Switzerland.
17. Owen, O.S. (1999) Natural Resources Conservation - An Ecological Approach. MacMilian Co., New York.
18. Southwick, C.H. (1997). Global Ecology, Sinauer Associates Inc. Sunderland, Massachusetts. USA.

19. Mansfield, T.A. (1990). Effect of Air Pollutants on plants. Cambridge University Press, London, New York, Melbourne.
20. Duffey, E. (1980). The Conservation of Nature, McGraw Hill Book Company, New York.
21. Odum, E.P. (1971) Fundamentals of Ecology. W.B. Saunders Company, Philadelphia, PA.



**TITLE: ADVANCE BOTANY-LAB-I (ENVIRONMENTAL BIOLOGY)**

**CREDIT HOURS: 1**

**Module Aims:** Completion of this program will produce a working knowledge of Ecological Sampling, Analysis and Interpretation of Biological Data and prepare graduates to study and resolve the Ecological Consequences of Environmental Problems.

**Learning Outcome:** The students will acquire knowledge about the Hazardous Effects of different Environmental Pollutants and the Measures for their Control/Prevention by using different Laboratory Techniques.

**Syllabus Outline:** The course include different laboratory techniques used for soil and water analysis from industrial waste and visit to different industries. Course Outline:

1. Examination of Industrial Waste Water and Municipal Sewage for
  - i) Total Dissolved Solids (IDS)
  - ii) pH and EC
  - iii) BOD and COD
  - iv) Chlorides, Carbonates, Bicarbonates and Nitrates.
2. Examination of Water Samples from different sites for the Presence and Diversity of Organisms.
3. Examination of the Effects of Automobile Exhaust on the Adjacent Vegetation.
  - i) Lead Count
  - ii) Chlorophyll Content
  - iii) Symptoms
  - iv) Soot and Particulate Matter.
4. A visit to EPA to study the Instruments used for Monitoring Pollution.
5. A visit to the Industrial Organizations to examine their Effluent Treatment System.
6. A visit to the municipal Organization to study their Sewage Treatment System.
7. A Study Tour to a National Park and a wetland site to evaluate attributes criteria and values of the area concerned.
8. Irradiation of Seeds and study of the Effects of Seed Irradiation on Seed Germination, Growth and Yield of plants.
9. Field observation on the Sources and Impacts of various Air Pollutants.

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended:

- 1. Koziol, M.J. and Whatley, F.R. (2009).** *Gaseous Air Pollution and Plant Metabolism*. Butterworths. London.
- 2. Goodstein, E.S. (2008).** *Economics and the Environment*. Prentice Hall Publishers, New Jersey.
- 3. Varshney, C.K. (2005).** *Water Pollution and Management*, Wiley Eastern Limited.
- 4. Chhatwal, D.R., Mehra, M.C., Satake, M., Katyal, T., Katyal, M. and Nagahiro. T. (2001).** *Encyclopedia of Environmental Pollution and its control. (6 vols.)*, Anmol Publication, New Delhi, India.
- 5. Mansfield, T.A. (1990).** *Effects of Air Pollutants on Plants*. Cambridge University Press, London, New York, Melbourne.
- 6. Odum, E.P. (1971)** *Fundamentals of Ecology*. W.B. Saunders Company, Philadelphia.

## **ADVANCE CHEMISTRY-I (ENVIRONMENTAL CHEMISTRY)**

**CREDIT HOURS: 3**

### **COURSE OBJECTIVES:**

From this course, the students should be able to:

- Understand the fundamental principles of environmental chemistry.
- Apply these principles in pollution related subjects.
- Demonstrate the understanding of environmental chemistry principles via experimental exercises in the laboratory.
- Various sources and types of environmental pollution
- Health hazards caused by environmental pollution
- Global warming and climate changes

### **COURSE CONTENTS:**

#### **1. Atmospheric Chemiser**

Meterology ,composition of air around us, atmospheric temperature and pressure profile, Temperature inversion and photochemical smog, particulate matter in the atmosphere, Industrial pollutants, radioactivity, atmospheric aerosols, Acid rain –major sources, mechanism, control measures and effects on buildings and vegetation, Global warming – major green house gases, mechanism, control measures and global impact, The stratospheric ozone – the ozone hole, CFCs, ozone protection, biological consequences of ozone depletion.

#### **2. Water Pollution and Water Treatment –**

sources of water pollution-industrial sources and agricultural sources, heavy metals contamination of water, Eutrophification, detergents and phosphates in water, water quality criteria, Water purification – primary, secondary and advanced treatment, Removal of nitrogen and phosphorous compounds from polluted water, organic matter in water and its decomposition.

#### **3. Soil Pollution**

soil and mineral resources, general principles of metal extraction, Heavy metals contamination of soil, toxicity of heavy metals, bio-accumulation of heavy metals, Organic matter in soil, Macro and micro-nutrients in soil, ion-exchange in soil, soil pH and nutrients availability.

#### **4. Green Revolution –pest control, pesticides, toxicity of pesticides, integrated pests management.**

#### **5. Energy Production and Environment –** liquid and gaseous fuel, hydrogen economy.

**6. Renewable Energy** – nuclear energy, solar energy, geothermal and tidal energy.

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Text Books**

1. Latest editions of the following books:
2. 1. Collin Baird, Environmental Chemistry, W. H. Freeman and company, New York, 1995.
3. 2. John W. Moore and Elizabeth A. Moore, Environmental Chemistry, Academic Press Inc., New York, 1976.
4. 3. Anil Kumar De, Environmental Chemistry, Wiley Eastern Ltd. New Delhi, 1989.
5. 4. R. W. Raiswell, P. Brimblecombe, D. L. Dent and P. S. Liss, Edward Arnold Ltd., London, 1980.
6. 5. Staneley E. Manahan, Environmental Chemistry, Brooks, California.

**ADVANCE CHEMISTRY LAB-I (ENVIRONMENTAL CHEMISTRY)****CREDIT HOURS: 1****Practicals**

- Qualitative and quantitative analysis of irrigation water
- Qualitative and quantitative analysis of drinking water
- Determination of BOD and COD in waste water
- Estimation of heavy metals in soil / plants and wastewater
- Determination of viscosity
- Determination of surface tension
- Determination of pH

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Reference Books**

Latest editions of the following books:

1. Peter O. Neill, Environmental Chemistry, Chapman and Hall, London, 1993.
2. Derek M. Elsom, Atmospheric Pollution, Blackwell Publishers, Oxford, 1992.
3. Geoffrey Lean and Don Hinrichsen, Atlas of the Environment, Helicon Publishing Ltd., Oxford, 1992.

**Recommended Journals/Periodicals Journals related to:**

1. Atmospheric Chemistry.
2. Air Pollution.
3. Water Pollution.
4. Soil Pollution/Soil sciences.
5. Environmental Technology.

**Recommended World Web: Web Sites related to:**

1. Global Warming/Green House Effect.
2. Ozone depletion.
3. Acid Rain
4. Environmental Pollution
5. Energy Conservation

## **ADVANCE ZOOLOGY I (DEVELOPMENTAL BIOLOGY)**

**CREDIT HOURS: 3**

### **Objectives:**

- The course will provide detailed knowledge about the principal features of development, cellular basis of morphogenesis, mechanisms of cellular differentiation and concepts of induction in development.
- It will provide understanding of the mechanisms of organogenesis, factors controlling growth and oncogenesis.
- The concept related to the theory in Developmental Biology will be practically demonstrated in this course.
- In the continuity of the animals during reproduction following the union of the traits from the parents in their gametes, the zygote proceeds through enormous phenomena of development up to their emergence resembling to the parents.
- The concepts of all these developmental mechanisms will be communicated to the students in this course.

### **Course Contents**

#### **Introduction:**

Principal features of development, Origin of sexual reproduction, Developmental patterns, Spermatogenesis, Oogenesis

#### **Fertilization:**

Recognition of sperm and egg, Fusion of gametes, Activation of egg metabolism, Rearrangement of egg cytoplasm

#### **Cleavage:**

Patterns of embryonic cleavage, Mechanism of cleavage

#### **Gastrulation:**

Fate maps, Gastrulation in Sea urchin, Amphibians, Birds, Mammals

#### **Early Vertebrate Development:**

Neurulation, Ectoderm, Mesoderm, Endoderm

**Cellular Basis of Morphogenesis:**

Differential cell affinity, Cell adhesion molecules

**Mechanism of Cellular Differentiation:**

RNA processing, Translational regulation of developmental process, Cell-fate by progressive determinants, Autonomous cell specification by cytoplasmic determinants, Establishment of body axes and mechanism of teratogenesis, Secondary Induction

**Organogenesis:(A brief account):**

Origin and migration of germ cells in vertebrates

**Factors, controlling growth and oncogenesis****Hormones as mediators of development****Regeneration in vertebrates.****Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Recommended Books:**

Balinsky, B. I. (1985). *An Introduction to Embryology*. Saunders.

Gilbert, S. F. (2006). *Developmental Biology*, Sunderland: Sinauer Associates.

Ham, R. G., & Veomett, M. J. (1980). *Mechanism of Development*. C. V. Mosby Co.



Klaus, K. (2001). *Biological Development* (2<sup>nd</sup>ed.). New York: McGraw Hill.

Oppenheimer, S. S. (1984). *Introduction to Embryonic Development*. Allen and Bacon.

Saunders, J. W. (1982). *Developmental Biology*. McMillan and Company.

## ADVANCE ZOOLOGY I (DEVELOPMENTAL BIOLOGY) PRACTICALS

1. Study of structure of gametes in some representative cases, i.e., frog, fish, fowl and mammal.
2. Study of cleavage and subsequent development from prepared slides and/or whole mounts in various animals i.e., frog, chick etc.
3. Study of fertilization, early development of frog through induced spawning under laboratory conditions.
4. Preparation and study of serial sections of frog or chick embryos.
5. Application of microsurgical techniques on chick embryos *in vitro*.
6. Preparation and staining of histological slides.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Recommended Books:

Balinsky, B. I. (1985). *An Introduction to Embryology*. Saunders.

Gilbert, S. F. (2006). *Developmental Biology*, Sunderland: Sinauer Associates.

Ham, R. G., & Veomett, M. J. (1980). *Mechanism of Development*. C. V. Mosby Co.

Klaus, K. (2001). *Biological Development* (2<sup>nd</sup>ed.). New York: McGraw Hill.

Oppenheimer, S. S. (1984). *Introduction to Embryonic Development*. Allen and Bacon.

Saunders, J. W. (1982). *Developmental Biology*. McMillan and Company.

**Course Title: Advance Mathematics- I (Real Analysis)**

**Course Rating: 4 Cr. Hours**

### **Real Number System**

- Ordered sets, Fields, Completeness property of real numbers
- The extended real number system, Euclidean spaces

### **Sequences and Series**

- Sequences, Subsequences, Convergent sequences, Cauchy sequences
- Monotone and bounded sequences, Bolzano Weierstrass theorem
- Series, Convergence of series, Series of non-negative terms, Cauchy condensation test
- Partial sums, The root and ratio tests, Integral test, Comparison test
- Absolute and conditional convergence

### **Limit and Continuity**

- The limit of a function, Continuous functions, Types of discontinuity
- Uniform continuity, Monotone functions

### **Differentiation**

- The derivative of a function
- Mean value theorem, Continuity of derivatives
- Properties of differentiable functions.

### **Functions of Several Variables**

- Partial derivatives and differentiability, Derivatives and differentials of composite functions
- Change in the order of partial derivative, Implicit functions, Inverse functions, Jacobians
- Maxima and minima, Lagrange multipliers

### **The Riemann-Stieltjes Integrals**

- Definition and existence of integrals, Properties of integrals
- Fundamental theorem of calculus and its applications
- Change of variable theorem
- Integration by parts

### **Functions of Bounded Variation**

- Definition and examples
- Properties of functions of bounded variation

### **Improper Integrals**

- Types of improper integrals
- Tests for convergence of improper integrals
- Beta and gamma functions
- Absolute and conditional convergence of improper integrals

### **Sequences and Series of Functions**

- Definition of point-wise and uniform convergence

- Uniform convergence and continuity
- Uniform convergence and integration
- Uniform convergence and differentiation

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### ***Recommended Books***

1. W. Rudin, *Principles of Mathematical Analysis*, (McGraw Hill, 1976)
2. R. G. Bartle, *Introduction to Real Analysis*, (John Wiley and Sons, 2000)
3. T. M. Apostol, *Mathematical Analysis*, (Addison-Wesley Publishing Company, 1974)
4. A. J. Kosmala, *Introductory Mathematical Analysis*, (WCB Company, 1995)
5. W. R. Parzynski and P. W. Zipse, *Introduction to Mathematical Analysis*, (McGraw Hill Company, 1982)
6. H. S. Gaskill and P. P. Narayanaswami, *Elements of Real Analysis*, (Printice Hall, 1988)

# ADVANCE PHYSICS 1(MATHEMATICAL METHOD OF PHYSICS-1)

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**PRE-REQUISITE: Undergraduate level Mechanics and Mathematics**

**INTRODUCTION: CREDITE HOURS: 4**

A Course in Mathematical Methods for Physicists helps students understand the mathematical techniques needed for their future studies in physics. It provides an accessible account of most of the current, important mathematical tools required in physics these days. It is assumed that the reader has an adequate preparation in general physics and calculus. The course contents bridge the gap between an introductory physics course and more advanced courses in classical mechanics, electricity and magnetism, quantum mechanics, and thermal and statistical physics. It contains a large number of worked examples to illustrate the mathematical techniques developed and to show their relevance to physics.

## **COURSE OBJECTIVE:**

To give the understanding of Differential equations and their uses in Physics, Introduction to special functions, tensors, Legendre Polynomials and solution of Boundary value problems and their uses.

## **COURSE OUTLINE:**

### **Vector Analysis:**

Divergence theorem, Stokes' theorem, cylindrical, spherical and curvilinear coordinates. orthogonal curvilinear coordinates, gradient in orthogonal curvilinear coordinates, divergence and curl in orthogonal curvilinear coordinates, Laplacian, spherical polar coordinates.

### **Tensor Analysis:**

Cartesian tensors, coordinate transformation, covariant and contravariant tensor, tensor algebra, metric tensor. Christoffel symbols

### **Special Functions:**

Legendre polynomials, Bessel functions, associated Legendre functions and spherical harmonics spherical Bessel functions, Neumann functions.

### **Boundary Value Problem:**

Boundary value problem in physics, the Sturm-Liouville problem.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### REFERENCE BOOKS:

1. Mathematical Methods for Physics and Engineering, F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press, (1997).
2. Mathematical Physics by E. Butkov, Addison-Wesley Publishing Company, (1968).
3. Mathematical Methods for Physicists by G. Arfken and H. J. Weber, Academic Press, (1995).
4. Applied Mathematics for Engineers and Physicists by L.A. Pipes and L.R. Harvill, McGraw-Hill Book Company, (1970).
5. Mathematics of Classical and Quantum Physics Volume II, By F.W. Byron Jr. and R.W Fuller Addison-Wesley Publishing Company, (1970).
6. Complex Variable by M. R. Spiegel, Schaum Publishing Company, (1970)

## **Course: Supervised School Visits**

### **Credit Hours: 2**

**Introduction:** This course provides the prospective science teachers an opportunity to embark on your teaching practice by meeting reality of life in the classroom. Observation of other teachers is an excellent way of helping oneself to become more aware of options and possibilities. The most significant theories and basic principles underlying teaching alone never produce competent teachers. This course provides an alignment between theory and practice so that students may closely observe and record the limitations and potentials of real world science classroom to get an experience which will serve their teaching practices in the days to come.

### **Objectives:**

Student teachers will be able to:

1. Observe classroom dynamics
2. Identify the limitations of various teaching methods
3. Learn to prepare teaching plans
4. Understand the students' behaviors
5. Learn classroom management strategies

## **Student Activities during School Visits**

### **1. Observation Tasks**

- a. The teacher's action-zone
- b. Conditions for learning
- c. Classroom dynamics
- d. Homework assignment schedule and kinds
- e. Giving instructions
- f. The teacher's questions
- g. Wait-time
- h. Pacing
- i. Student talk
- j. Academic learning time
- k. Unplanned classroom language
- l. Accuracy and fluency

- m. Evaluating written work
- n. Blackboard work
- o. Oral correction techniques
- p. The plan and the lesson

## **2. Lesson Plan Format**

### **3. Self-Observation Tasks**

- a. Guidelines for writing the Teaching Journal
- b. General impressions of your teaching on the video
- c. Use of voice
- d. Giving instructions
- e. The teacher's questions
- f. Wait-time
- g. Blackboard work
- h. Oral correction techniques
- i. The plan and the lesson
- j. When the mentor didn't come in
- k. Self-evaluation
- l. Getting student feedback on your teaching
- m. Final reflections

**Faculty of Federal College of Education will be responsible for submission of grades (This will be a internal activity)**



# **SEMESTER-VI**

**Course: Research Methods in Education**

**Credit Hours: 3**

## **Introduction**

This course is designed for B.S. Ed Honors candidates to prepare them to situate themselves as researching professionals and at the same time enhance their own professional practice. Students will engage in a critical analysis of different research work and relate it to their own context. The units provides students with the opportunity to engage with the research literature and to establish how different researchers techniques help improve the overall classroom situation

## **Objectives**

At the end of the course, the learners will be able to

- Discuss the meaning, nature & scope of research in education
- Situate themselves as researching professionals
- Conduct research in different educational settings
- Write research report and present it effectively

## **Course Content**

### **Unit 1 The Nature of Educational Research**

- 1.1. Definitions of Educational Research
- 1.2. Scope and importance
- 1.3. Scientific method
- 1.4. Research problem and topic
- 1.5. Characteristics of research problem

### **Unit 2 The Researching professional**

- 2.1. Qualities of a researcher
- 2.2. Teacher as researcher
- 2.3. Research ethics

### **Unit 3 Types of Educational Research**

- 3.1. Descriptive Research

3.2. Experimental Research

3.3. Historical Research

3.4. Action Research

#### **Unit 4 Techniques of Reviewing Literature**

4.1. Primary sources

4.2. Secondary sources

#### **Unit 5 Methodology**

5.1. Population

5.2. Sampling

5.3. Instrument

5.4. Data collection procedure

#### **Unit 6 Data Analysis**

6.1. Descriptive

6.2. Inferential

#### **Unit 7 Report Writing**

7.1. Writing formats & Presentation

7.2. Referencing

#### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### **Recommended Books:**

Best, J. W., & Kahn, J. V. (2003) *Research in Education*. New Delhi: Prentice Hall.

Creswell, J. W. (2014). *Research design: Quantitative, qualitative and mixed methods approaches*. London: Sage Publications.

Creswell, J. W. (2012). *Research design: Planning, conducting, and evaluating Quantitative, qualitative research*. London: Pearson.

Gay, L.R., Mills, G. E., Airsian, P.W.(2009) *Educational research: Competencies for analysis and applications*. USA: Prentice Hall.

Fraenkel, J. R., Wallen, E. N., & Hyun, H. H. (2012). *How to design and evaluate research in education*. New York: McGraw-Hill.



## **Course: Educational statistics**

**Credit hours: 2**

**Introduction:** Educational researchers are facing very demanding research questions now which need to be explored to greater depth as compared to few decades ago. Statistical techniques are a tool for analyzing the results in empirical research, which is increasingly used in present educational research. Understanding of such methods and techniques has become an integral part of conducting educational research. This course is designed to provide understanding of basic statistical concepts as they are used in educational research. It is also intended to develop the sense of selecting appropriate statistical test for appropriate research question. As a result of this course the participants will become better interpreters of educational data by mastering the statistical concept and techniques.

### **Objectives**

At the end the course students will be able to:

1. understand descriptive statistics
2. differentiate different test of statistics
3. use statistical test in educational research
4. interpret result of data analysis
5. explore new techniques in statistics research purpose

### **Course Content**

#### **1. Introduction to statistics**

- 1.1 Introduction
- 1.2 Basic concepts
- 1.3 Historical development of statistics
- 1.4 Types of Measurement Scale

#### **2. Frequency Distributions and Graphs**

- 2.1 Introduction
- 2.2 Frequency distributions
- 2.3 Introduction to graphs
- 2.4 Graphs for qualitative variables
- 2.5 Graphs for quantitative variables
- 2.6 Shapes of distributions

#### **3. Measures of central tendency**

- 3.1 Introduction
- 3.2 Mean
- 3.3 Median
- 3.4 Mode

#### **4. Measures of dispersion, skewness, and kurtosis**

- 4.1 Introduction to measures of dispersion
- 4.2 Measures of dispersion (Range, Quartile Deviation, Standard Deviation, variance)
- 4.3 Dispersion and the normal distribution
- 4.4 Skewness and kurtosis

#### **5. Correlation**

- 5.1 Introduction to correlation

- 5.2 Pearson Product-Moment correlation coefficient
- 5.3 Spearman Rank correlation
- 5.4 Other kinds of correlation coefficients
- 6. Statistical inference: one sample**
  - 6.1 Introduction to hypothesis testing
  - 6.2 One-sample t-test for a mean
- 7. Statistical inference: two samples**
  - 7.1 Introduction to hypothesis testing for two samples
  - 7.2 Two- sample t test and confidence interval for means using independent & dependent samples
- 8. Introduction to the analysis of variance and covariance**
  - 8.1 Introduction to analysis of variance
  - 8.2 Basic concepts in ANOVA
  - 8.3 Multiple comparison procedures
- 9. Statistical inference for frequency data**
  - 9.1 Chi-Square test
  - 9.2 Testing Goodness of Fit
  - 9.3 Testing independence
- 10. Statistical Inference for Ranked Data**
  - 10.1 Introduction to Assumption-Free tests
  - 10.2 Mann- Whitney U Test for two independent samples
  - 10.3 Wilcoxon test for dependent samples

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Reference Books

Bartz, A.E (1999). Basic statistical concepts (4<sup>th</sup> ed.). New Jersey: Printice-Hall

Bluman, A. G. (2009). Elementary statistics: A step by step approach. Boston: McGraw-Hill.

Garrett. & Henry E (1995). *Statistics in psychology and education*. London: Longman

Heiman, G. W. (2011). *Basic statistics for the behavioral sciences*. USA: Wadsworth

Howel, D. C. (2013). *Statistics for psychology*. USA: Wadsworth

Howel, D. C. (2011). *Fundamentals of statistics for behavioral sciences*. USA: Wadsworth

Kutz, Albert K. (1980). *Statistical method in education and psychology*. New Delhi, Narosa publishing House.

Larson, R., & Farber, B. (2012). *Elementary statistics: Picturing the world*. Delhi: Prentice Hall.

Mangal, S.K (2002). *Statistics in psychology and education*. New Delhi: Printice-Hall of India Pvt. Ltd.

Weiss, N.A. (2012). *Elementary statistics*. Boston: Addison-Wesley

**Course: Students Teaching and Observation (PRACTICAL)**  
**Credit Hours: 3 (Short Term: 4-6 Weeks)**

**Introduction:**

This course provides the experience secondary school, science teachers with carefully sequenced and supervised field experiences in all subject areas related to science disciplines. Opportunities to work with secondary level students are provided. As a student teacher it is required that they will work with students of various backgrounds and of different capabilities. The developmental

**Objectives:**

Student teachers will be able to:

1. Reflect on and learn from connecting theory to their teaching practice.
2. Collaborate with peers, cooperating teachers, other school staff and university supervisor, establishing professional relationships.
3. Invite, accept and utilize formative feedback from the cooperating teaching, peers, and the university supervisor in a non-defensive manner
4. Produce plans for teaching and learning that reflects the use of appropriate instructional methods and strategies to meet the needs of all students.
5. Utilize appropriate instruments or techniques informally and formal accessing students' learning needs
6. Recognize cognitive and affective need of students and establish learning environment and use activities appropriate to meet those needs,
7. Maintain their lesson plan and use it effectively.

**Course Activities.**

<b>Week No</b>	<b>Activities</b>
<b>1</b>	<b>Introduction to the school and Classroom context</b> <ul style="list-style-type: none"><li>• Complete school based assignments</li><li>• Complete classroom observations</li><li>• The classroom environment, placement of materials, arrangement of workspaces and traffic patterns</li><li>• Classroom interactions</li><li>• Assist the cooperating teacher as requested</li><li>• Small administrative tasks</li><li>• Helping individuals or small groups of children</li><li>• Preparation of lesson planner</li><li>• Reflection on learning of this week</li></ul>
<b>2</b>	<b>Becoming more involved in the classroom</b> <ul style="list-style-type: none"><li>• Complete school based assignments</li><li>• Complete classroom observations</li><li>• Assist the cooperating teacher as requested</li><li>• Reflection on learning of this week</li></ul>
<b>3</b>	<b>Taking an active role in co planning and co teaching section of a lesson alongside your cooperating teacher</b> <ul style="list-style-type: none"><li>• Complete school based assignments</li></ul>

	<ul style="list-style-type: none"> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>
<b>4</b>	<b>Assuming responsibility for co planning and co teaching as amany classes as a student can</b> <ul style="list-style-type: none"> <li>• Complete school based assignments</li> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>
<b>5</b>	<b>Assuming responsibility for planning, teaching and assessing in at least one subject</b> <ul style="list-style-type: none"> <li>• Complete school based assignments</li> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>
<b>6</b>	<b>Assuming responsibility for planning, teaching and any additional responsibilities as negotiated with the cooperating teacher and university supervisor</b> <ul style="list-style-type: none"> <li>• Complete school based assignments</li> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>

#### Evaluation Criteria (For Practical Activity in Schools)

Examination	Type	Marks
Internal Examination	College Supervision in Schools	40%
External Examination	Examination of Model Lessons Delivered by each student in Schools and Evaluation bu University Panel of Examiners	60%



**COURSE TITLE: ADVANCE BOTANY-II (PLANT ANATOMY)****CREDIT HOURS: 3****Introduction:**

To introduce Basic Concept of Primary Plant Body a learning Idea of Root-Shoot Transition, Secondary Growth and Anomalies, Types of Stem, Root and Leaf

**Learning Outcome:** Student will understand basic anatomical concepts of Primary Structure of Root, Stem, Leaf and Flower. They will be able to discuss the idea of secondary growth.

**Course Outline:**

**Secondary Xylem:** Axial and Ray System, Growth Layers, Reaction Wood, Gymnosperm Wood, Angiosperm Wood, Differentiation in Secondary Xylem, Strength of Wood in Relation to Structure.

**Stem:** Tissue Systems, Leaf Traces, Leaf Gaps, Branch Traces and Branch Gaps, Vascular Bundles, Concept of Stele Delimitation of Vascular Region, Endodermis, Pericycle, Origin of Vascular Cambium, Common Forms of Secondary Growth.

**Anomalous Secondary Growth:** Secondary Growth in Monocots, Grafting and Wound Healing.

**Types of Stems:** Conifer. Woody Dicotyledons, Dicotyledonous Vine, Herbaceous Dicotyledons, Herbaceous Monocotyledons.

**Leaf:** Histology of Angiosperm, Leaf, Mesophyll, Vascular System, Bundle Sheaths, Supporting Structure, Secretory Structures, Petiole, Histology of Gymnosperm Leaf, Development of Leaf, Growth of Leaf Lamina, Monocotyledonous Leaf, Development of Vascular Tissues, Abscission of Leaves.

**Root:** Concept, Origin, Morphology, Primary Structure, Root Cap, Vascular Cylinder, Development of Histogens, Primary and Secondary Growth, Development of Lateral Roots, Development of Adventitious Roots, Development of Buds on Roots, Structure in Relation to Function. **Root-Shoot Transition:** Secretory Structures, Glands, Nectaries, Hydathodes, Internal Secretory Structures, Laticifers.

**Flower:** Concept, Structure, Vascular System, Different Parts, Sepals, Petals, Stamen, Carpel, Ovule, Organogenesis, Histogenesis, Abscission.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**BOOKS RECOMMENDED:**

**Dickinson, W.C. (2000).** *Integrative Plant Anatomy*. Academic Press. London.

**Eames, E. (1990).** *An Introduction to Plant Anatomy*. New York: McGraw Hill Book Co. Inc.

**Esau, K. (2000).** *Anatomy of Seed Plants*. New York: John Wiley and Sons.

**Evert, R.F. and Esau, K. (2006).** *Esau's Plant Anatomy*. New York: John Wiley and Sons.

**Fahn, A. (2001).** *Plant Anatomy (5<sup>th</sup> Ed.)*. Oxford.:Ergamon Press.

**Robson, N.K.B., Cutler, D.F. and Gregory. M. (2000).** *New Research in Plant Anatomy*. London.: Academic Press.

**TITLE: ADVANCE BOTANY-LAB-II (PLANT DIVERSITY)****CREDIT HOURS: 1****Introduction:**

This course is designed to provide understandings about Primary and Secondary Plant Body, Secondary Growth and Primary and Secondary Anomalous Structures in plants, Leaf, Stem, Root and Flower Anatomy, Basic Structure of Root, Stem and leaf, and Wood Structure.

**Learning Outcomes:**

Student will be able to understand the Tissues Arrangement in Root, Stem, Leaf and Secondary Plant Body.

**Course Outline:**

Concept of Leaf Vascular Bundle, Mesophyll Tissue Distribution, Primary Structure of Root, Stem and Leaf, Structure of Wood. Study of Tissues from the Living and Preserved Material of Stems, Roots and leaves.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Dickinson, W.C. (2000).** *Integrative Plant Anatomy*. Academic Press. London.

**Eames, E. (1990).** *An Introduction to Plant Anatomy*. New York: McGraw Hill Book Co. Inc.

**Esau, K. (2000).** *Anatomy of Seed Plants*. New York: John Wiley and Sons.

**Evert, R.F. and Esau, K. (2006).** *Esau's Plant Anatomy*. New York: John Wiley and Sons.

**Fahn, A. (2001).** *Plant Anatomy (5<sup>th</sup> Ed.)*. Oxford: Ergamon Press.

**Robson, N.K.B., Cutler, D.F. and Gregory, M. (2000).** *New Research in Plant Anatomy*. London: Academic Press.

**COURSE TITLE: ADVANCE BOTANY-III (PALYNOLOGY)****CREDIT HOURS: 3****Introduction:**

This course is designed to understand the Importance, Scope and Applications of Palynology in other Fields, Techniques used to Isolate Palynomorphs, their Technical Description and Evaluation of Palynological Data.

**Learning Outcome:** After getting through this course students would be able to know about Palynology, its Branches and their Importance, they would be able to Isolate Palynomorphs from Sedimentary Rock samples through different Maceration Techniques. Field Study Tour would enhance their knowledge of theory and better understanding of the subject.

**Course Outline:****Neopalynology:**

Production and Dispersal of Spores and Pollen

Ultra-structure and Stratification of Exine.

Spore and Pollen Diversity, Morphology and Ornamentational Pattern, Technical Description.

Environmental Palynology, Occurrence and Significance of Airborne Pollen with respect to Allergies and Asthma, Control Measures.

Mellitopalynology, Aeropalynology and Archaeopalynology. Palynology in Medicine and Criminology. Palaeopalynology:

Ultra-structure and Chemical composition of Fossil Exine.

Palynomorphs as Sedimentary Particles, Preservation in Sediment, Post Depositional Hazards.

Palynomorphs in Oil and Gas Exploration, Geochronology, Stratigraphic Correlation, Reconstruction of Past Plant communities. Index Palynomorphs, Organic Thermal Maturity.

Technical Description of Palynomorphs.

Maceration Techniques and Field Work.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Books Recommended:**

Agashe, S.N., & Caulton, E. (2009). *Pollen and Spores: Applications with Special Emphasis on Aerobiology and Allergy*. Enfield, NH: Science Publishers.

Brooks, J. (2010). *Organic Maturation Studies and Fossil Fuel Exploration*. London: Academic Press,

Erdtman, G. (2008). *An introduction to pollen analysis*. New York: Morison Press.

Scott, A.C. (2009). *Coal and Coal-bearing strata; recent advances*. Blackwell Scientific Publishers, Oxford.

4. 260pp. ISBN-13: 978-1443723077.

5. Traverse, A. (2007). *Paleopalynology: Topics in Geobiology*. (2<sup>nd</sup> Ed.), Springer Link Publishers. 813pp. ISBN-13: 978-1402066849.

6. Harley, M., Morton, C.M. and Blackmore, S. (2000). *Pollen and Spores: Morphology and Biology*, Royal Botanic Gardens, Kew. 530pp.

7. Kapp, P.O., Davis, O.K. and King, J.E. [Illustrated by Hall, R.C.] (2000). Ronald O. Kapp's *Pollen and Spores*. (2<sup>nd</sup> ed.), AASP Found. 279 pp. ISBN 931871-05-0.

8. Kurmann, M.H. and Doyle, E. (1994). *Ultrastructure of Fossil Spores and Pollen*. Royal Botanic Gardens, Kew. 227pp. ISBN-13: 978-0947643607.

9. Collinvaux, P.A., De Oliveira, P.E. and Moreno, E. (1999). *Amazon: Pollen Manual and Atlas*. Harwood Academic Publishers. 344pp. ISBN-13: 978-9057025877.

10. Traverse, A. (1996). *Nomenclature and Taxonomy: Systematics*. In: Jansonius, J. and McGregor, D.C. Eds., *Palynology: Principles and Applications*, American Association of Stratigraphic Palynologists Foundations, 11-28, Publishers Press.

11. Jones, G.D., (1995). *Pollen of the Southeastern United States: with Emphasis on Melissopalynology and Entomopalynology*. AASP Foundation Contribution Series No. 30: 76 pp., 104 photographic plates. ISSN 0160-8843.

12. Punt, W., Blackmore, S., Nilsson, S. and Thomas, A.L. (1994). *Glossary of Pollen and Spore Terminology*. LPP Contributions Series No. 1: 71pp. LPP Foundation, Laboratory of Palaeobotany and Palynology, University of Utrecht, Utrecht, The Netherlands. ISBN 90-393-0230-8.

### **TITLE: ADVANCE BOTANY-LAB-III (PALYNOLOGY)**

#### **CREDIT HOURS: 1**

**Syllabus Outline:** Extraction of Pollen and Spores, Preparation of Strew Mount Slides, Single Grain Manipulation and their Technical Description, Field Study Tour for the Collection of Rock Samples from Salt Range, Pakistan and a Comprehensive Field Report of Study Tour.

#### **Course Outline:**

1. Extraction of pollen and spores from Anther/Strobili/Sori, their Identification and Technical Description.
2. Palynological Analysis of Paleozoic, Mesozoic and Cenozoic Rock samples through Standard Procedures.
3. Preparation of Strew Mount Slides and Single Grain Manipulations).

4. Field Tour to the Salt Range, Pakistan to study Paleozoic, Mesozoic and Cenozoic Outcrops including Sample Collecting Techniques. Each student shall be required to submit a comprehensive Field Tour Report at the time of Practical Examination. Specific marks shall also be allocated for such a report.

**Module aims:**

This course is designed to understand the Importance, Scope and Applications of Palynology in other Fields, techniques used to Isolate palynomorphs, their Technical Description and Evaluation of Palynological Data.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcome:** After getting through this subject, students would be able to study Extant and Extinct Palynomorphs extracted through different Standard Techniques, to describe the Data Technically and Preparation of Permanent Mounts of this material. Field Study Tour would enhance their knowledge pertaining to the Preparation of Comprehensive Field Report and presentation of the data scientifically.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Hesse, M., Halbritter, H., Weber, M., Buchner, R., Frosch-Radivo, A. and Ulrich, S. (2010). Pollen Terminology: An Illustrated Handbook. (1<sup>st</sup> Ed.), Springer Link Publishers. 264pp. ISBN-13: 978-3211999356.
2. Icon Group International, (2010). Microtechnique: Webster's Timeline History, 1893 - . 2005. 24pp. ICON Group International, me. ASIN: B003L5DP80.
3. Phipps, D. and Playford, G. (2010). Techniques for Extracting Palynomorphs from Sediments. Department of Mineralogy and Geology, sp. pub. Univ. Queensland, Brisbane, Australia.
4. Shah, S.M.I. (1977). Stratigraphy of Pakistan. Memoirs of the Geological Survey of Pakistan, v. 22, pp. 381.
5. Traverse, A. (2007). Palaeopalynology: Topics in Geobiology. (2<sup>nd</sup> Ed.), Springer Link Publishers. 813 pp. ISBN-13:978-1402066849.
6. Punt, W., Blackmore, S., Hoen, P.P., Nilsson, S. and Thomas, A. Le (2007). Glossary of Pollen and Spore Terminology. Review of Palaeobotany and Palynology, 143(1): 1-81.

7. Armstrong, H. and Brasier, M. (2005). *Microfossils*. (2<sup>nd</sup> Ed.). J. Wiley-Blackwell Scientific Publishers. 304pp. ISBN-13: 978-0632052790.
8. Harley, M., Morton, C.M. and Blackmore, S. (2000). *Pollen and Spores: Morphology and Biology*, Royal Botanic Gardens, Kew. 530pp.
9. Gee, E R. (2000). *Geological Maps of Salt Range*. Geological Survey of Pakistan.
10. Kurmann, M.H. and Doyle, E. (1994). *Ultrastructure of Fossil Spores and Pollen*. Royal Botanic Gardens, Kew. 227pp. ISBN-13: 978-0947643607.
11. Soil Survey of Pakistan (2000). *Topographic Sheets of Salt Range, Pakistan*.
12. Collinvaux, P.A., De Oliveira, P.E. and Moreno, E. (1999). *Amazon: Pollen*

## **ADVANCE CHEMISTRY-II (PHYSICAL CHEMISTRY)**

**CREDIT HOURS: 3**

### **COURSE OBJECTIVES**

The objective of the course is for students:

1. Understand and apply the laws of thermodynamics and kinetics.
2. Understand the role that thermodynamics and kinetics play in chemical equilibrium.
3. Understand how mathematics, models and approximations are used to explain chemical phenomena and fundamental properties of matter.
4. Use concepts of thermodynamics/kinetics/equilibrium to make predictions and give explanations about chemical systems and fundamental properties of matter.
5. Develop skills in making decisions in the lab, in data acquisition, and critical evaluation of data.
6. Appreciate the role physical chemistry plays in chemical (physical, biological, etc. systems.

### **COURSE CONTENT:**

#### **1. Electrochemistry:**

Idea of conductance of electrolytes, Debye-Huckel equation and limiting law, ionic strength, weak electrolyte and Debye-Huckel theory, Activity and activity coefficients of electrolytic solution, determination of activities, concentration cells, Types of concentration cells, derivation of E.M.F of concentration cells with and without transference, Fuel cells and hydrocarbon cells.

#### **2. Quantum Chemistry:**

Postulates of quantum theory, Eigen functions, operators, Schrödinger's wave equation, particle in one dimensional box, Normalized wave function and orthogonality, Quantum mechanical tunneling, motion of particle in three dimensional box and idea of degeneracy, separation of variables and derivation of quantum numbers, Mathematical treatment of rigid rotator and calculation of bond length of simple molecules, harmonic oscillator and calculation of bond length of simple molecules, harmonic oscillator and calculation of vibrational frequencies, formation of covalent bond, Mathematical treatment of  $\text{He}^+$  and  $\text{H}_2$  molecules, discussion of overlapping integrals, molecular orbital theory and formation of  $\text{H}_2$  and  $\text{O}_2$  molecules.

#### **3. Chemical kinetics:**

Concept of rate law and order of reaction, Kinetics of 3rd order reaction with different concentrations and molecular identity, kinetics of opposing, parallel and consecutive reactions, basic experimental methods, Kinetics of thermally excited chain reactions like reaction of  $\text{H}_2$  and  $\text{Br}_2$ , kinetics of thermal decomposition of ozone,  $\text{N}_2\text{O}_5$  and  $\text{CH}_3\text{CHO}$ .



**4. Kinetics of bimolecular reactions:**

Mathematical treatment of collision and transition state theory of bimolecular reactions, effect of temperature of reaction rates, the interpretation of bimolecular reactions in solution, ionic reaction in solution, unimolecular gas phase reactions, fast reactions and their methods of study.

**5. Classical Thermodynamics:**

Maxwell's relations and thermodynamics formula, second law of thermodynamics, Clausius inequality, the entropy of non ideality of a gas, Nerst heat theorem, its applications to solid and gases, Nerst approximation formula, third law of thermodynamics and determination of entropy by third law, Experimental verification of third law. Adiabatic demagnetization.

**6. Statistical Thermodynamics:**

Sterling's approximation, statistical treatment of entropy, partition function and its physical significance, absolute entropy and partition functions, interpretation of thermodynamic functions in terms of translational, rotational vibrational and

electronic partition functions, Free energy and equilibrium constant from partition function.

**7. Kinetic theory of Gases:**

Introduction, Maxwell distribution of molecular velocities and energies, Derivation of average velocity and most probable velocity, Barometric formula, effect of altitude, molar mass and temperature on vertical distribution of particles.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**RECOMMENDED BOOKS:**

1. Physical Chemistry, Samuel Glasstone, 1995. Macmillan and Co. Ltd. St. marlins Street, London.
2. Principles of Physical chemistry, Maron and Prutton, 1965 the Macmillan Company, Collier Macmillan Ltd. London.
3. Physical Chemistry, Barrow, 1973, McGraw Hill, Tokyo.
4. Physical Chemistry, Moore, 1972, Rentice Hall, Englewood cliffs, Jersey.
5. Physical Chemistry, Alberty and Daniels, 1962, McGraw Hill Book Company Ltd London.
6. Physical Chemistry, Castellan, 1972, Addison Westey Publishing Company, Menla Park, California, London.
7. Physical Chemistry by Kundu, N and Jain, S.K., S. Chand and Company Ltd. 1984.
8. Fundamentals of Chemical kinetics by Logan, S.R., Longman Group Ltd. 1996.
9. Elementry reaction kinetics by Latham. J.L. and burgess, A.E., 3rd Ed., Butterworths, London, 1997.
10. Physical Chemistry by Atkins, P.W., 5th Ed., W.H. Freeman and Company, New Yark, 1994.
11. Physical Chemistry by Alberty, R.A. and Silbey, R.J., John Wiley, New York, 1995.
12. Physical Chemistry by Engel, T. and Ried, P., 1st Ed., Pearson education, Inc. 2006.
13. Electrochemical Methods and applications by bard, A. and Faulkner, L.R., John

- Wiley, New York, 1980. Elements of classical and statistical thermodynamics by Nash, L.K. Addison Wesley Co. Ltd., 1979.
14. Hand book of surface and Colloid Chemistry by Birdi, K.S., CRC Press, 1997.
  15. Heterogeneous Catalysis: Principles and applications by Bond, G.C., 2nd Ed., Oxford Clarendon press, 1987.
  16. Surfactants and interfacial Phenomena by Rosen, Milton J., John Wiley, New York 1978.

**ADVANCE CHEMISTRY LAB-II (PHYSICAL CHEMISTRY) CREDIT  
HOURS: 1**

*Physical Chemistry*

**Physical Chemistry (Practical)**

**SYLLABUS OUTLINE:**

**1. Basic Concepts:**

Preparation of standard molar and Normal solutions and percentage compositions of different compounds.

**2. Chemical Kinetics:**

To investigate the kinetics of hydrolysis of ethyl in the presence of an acid.

To determine the relative strength of acids (HCl and H<sub>2</sub>SO<sub>4</sub>) studying the hydrolysis of an ester.

**3. Electric conductance of electrolytes:**

To determine the cell constant of given cell.

To determine the equivalence conductance of solution of weak electrolyte.

At a no. of dilution at room temperature and from this result to verify Oswald's law.

To determine the solubility of sparingly soluble salt.

To determine the solubility of weak base of NH<sub>4</sub> OH by titrating it against Standard solution of HCl by using conductivity method.

To determine the strength of given base by titrating it against standard Acetic acid solution and HCl solution using conductivity meter.

To determine the strength of HCl and CH<sub>3</sub> COOH in the given mixture of both by titrating it against NaOH conductometrically.

To determine the equivalent conductance of a weak electrolyte at infinite dilution using Kohlraush law.

**4. Phase Equilibria:**

To determine the partition coefficient of benzoic acid and iodine between CCl<sub>4</sub> and H<sub>2</sub>O.

**5. Refractrometry:**

To determine the unknown concentration of sucrose solution and ethanol solution.

**6. Molar mass determination (Colligative properties):**

To determine the molecular weight of a substance by cryoscopic method and Ebullioscopic method.

**7. Spectrophotometry:**

To determine the wavelength of maximum absorption of compounds using spectrophotometer.

To determine the unknown concentration of a compound using spectrophotometer.

**8. Phase Equilibrium:**

To determine the phase diagram of Naphthalene and diphenyl system.

To determine the phase diagram of urea and phenol.

To determine the phase diagram of Benzoic acid and Naphthalene.

**9. Optical activity measurement:**

To determine the unknown percentage composition of the following by using polarimeter (Sucrose, glucose).

To determine the specific and molar rotation of optically active compound (sucrose, glucose).

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**RECOMMENDED BOOKS:**

1. Advanced Experimental Physical Chemistry by Ayodhya Sing.
2. Experimental Physical Chemistry by Daniel
3. Experimental Physical Chemistry by G.Peter Matthews.
4. Experiments in Physical Chemistry by Shoemaker.

## ADVANCE CHEMISTRY- III (APPLIED/INDUSTRIAL CHEMISTRY)

### CREDIT HOURS: 3

**Course Objectives:** Students will gain understanding about the importance of water and its quality requirements for the industrial uses in addition to learning about water treatment techniques. They will also learn about the composite materials.

#### 1. Chemical Industrial Unit Operations and Processes:

Brief introduction to Chemical Industry with reference to Pakistan, Elementary treatment of general unit operations commonly used in Industry such as heat transfer; Evaporation; size Reduction; Screening; Filtration and Distillation. Chemical; Unit processes, Nitration; Sulphonation; Halogenation; Hydration; Oxidation and Hydrogenation.

#### 2. Basic Chemical Industries

Raw materials; Chemical processes involved; flow sheet diagrams with all the important parameters concerned with the manufacturing of Sulphuric acid; Hydrochloric acid; caustic Soda; Washing soda; Oxalic Acid, Formic acid, Phthalic anhydride. Applications of these chemicals in industry.

#### 3. Cement Industries:

Cement raw materials used for cement manufacturing, dry process, wet process, semi wet process, special cement, chemistry involved in hydration of cement, setting of cement, setting time.

#### 4. Water Softening and Scale Removing:

Water hardness; its measurement and removal; methods used for water softening including ion-exchange and reverse osmosis, distillation and precipitation. Types of boiler scales. Chemical and mechanical methods to eliminate the scaling.

#### 5. Glass Industries:

History of glass, raw materials used for glass, methods of manufacturing, various types of furnaces and crucibles used for the manufacture of glass, special types of glass, their manufacture and properties.

#### 6. Soap and Detergent Industries:

Processes involved in soap manufacturing, methods used for manufacture of laundry soap, typical soaps. Recovery of glycerine. Detergents or surface active agents, cationic, anionic and non-ionic agents.

### RECOMMENDED BOOKS:

1. Industrial Organic Chemicals, by H.A.Witcoff and B.J.Reuben, John Wiley & Sons Inc. New York.
2. Water Supply and Sewerage, T.J.McGhee, McGraw Hill Book Co. New York.(1991)
3. Unit operations in Chemical Engineering, Chattopadhyay, Khanna Publishers, Delhi-6 (1993).
4. Chemical Process Design, Robin Smith, McGraw Hill Book Co. New York. (1995).

5. Hand Book of Industrial Chemicals, By SIRI Board of Consultants and Engineers, Small Industries Research Institute, New Delhi (1995)
6. Small Medium and large Scale Industries, A.K. Sirivastawa, Small Industries Research Institute, New Delhi (1996).
7. The Chemistry of Cement, H.F.W. Taylor, Academic Press, London, 1964.
8. Shereve's Chemical Process Industries, 5th Ed.1975, By G.T.Austin, McGraw Hill Book Co. New York.
9. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
10. Chemistry of glass manufacturing, F.W.Hunter, Dower Publications, New York, 1950.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## ADVANCE CHEMISTRY LAB- III (APPLIED/INDUSTRIAL CHEMISTRY)

**CREDIT HOURS: 1**

**1. Preparations:**

Detergent and cosmetics (Cold cream, shampoo and vanishing cream), Dentrifrice, Thermosetting and thermoplastic resins (alkyd and urea formaldehyde)

**2. Titrimetry:**

Estimation of water hardness by complexometry  
Estimation of acetic acid contents in the vinegar sample  
Determine the acidity of the sulphuric acid and its normality.  
Determination of acidity, alkalinity, Free CO<sub>2</sub> in water  
Assay of bleaching powder by free chlorine method.  
Determine the %age purity of the Commercial sample of sodium chloride.  
Determination of Residual Chlorine in water.  
%age of reducing sugars.  
Soap analysis for free and combined alkali.  
Determining the %age purity of sodium bicarbonate and sodium carbonate.

**3. Flamephotometry:**

Estimation of Potassium in the tap water.  
Estimation of Sodium in the Commercial Sodium Chloride.  
Estimation of Calcium in milk.

**4. Spectrophotometry:**

Determination of the of KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and CoCl<sub>2</sub>  
Estimation of nickel in vanaspathi ghee.  
Estimation of chloride in the tannery effluent.  
Estimation of Iron in Pharmaceutical Products.  
Estimation of Phosphates in fertilizers.

**5. Chromatography:**

Separation of mixture of ink by circular paper chromatography.  
Separation of mixture of metal ions by paper chromatography.  
Coating of TLC plates and separation of mixture of dyes.  
Separation of different pigments of plant extract by TLC chromatography.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%



**RECOMMENDED BOOKS:**

1. Perfumes Cosmetics and Soaps, W.A. Poucher, Chapman and Hall 7th Ed. (1974).
2. Applied Chemistry Theory and Practice, O.P. Vermani & A.K. Narula, Wiley Eastern Limited (1989).
3. T. B. of Quantitative Inorganic Analysis, Vogel's Ed-4<sup>th</sup>, Longman Group Limited (1978).
4. Practical Statistics for the Analytical Scientist, A Bench Guide, RSC Publishing LGC Ltd 2009.



## **COURSE TITLE: ADVANCE ZOOLOGY II (CELL & MOLECULAR BIOLOGY)**

Credit Hours: 3

### **Aims and Objectives:**

Objectives of the course are to impart knowledge about

- The animal cell and its complex organization of architecture
- The unified role it plays for the ultimate sustainability of the organisms
- The various ultra- structural
- Molecular and functional aspects of the cells

### **Course Contents**

#### **Introduction to prokaryotic and eukaryotic cells:**

Plasma membrane, Chemical composition, structure and functions of plasma membranes cell permeability, active transport, endocytosis, phagocytosis.

#### **Cytoskeleton:**

Microfilaments, Microtubules, Intermediate filaments

#### **Cytoplasmic Organelles:**

Membrane system, Structural Commonalities, Functional Commonalities  
Ultrastructure Chemical Composition And Functions Of Endoplasmic Reticulum (with special reference to their role in protein synthesis and drug metabolism)  
Golgi Apparatus (with reference to its role in synthesis of glycoprotein)  
Mitochondria (with reference to its role in cellular respiration, and its significance as semi-autonomous organelle)  
Lysosome (with reference to its diverse roles due to hydrolytic activity of enzymes)  
Peroxisome (with reference to metabolism of hydrogen peroxide)  
Glyoxysome (with reference to glyoxylic acid cycle).  
Nucleus chromatin, heterochromatin, euchromatin, chromosome structure with reference to coiling and nucleosome during different phases of cell cycle, Replication (mechanism, DNA replication in prokaryotes specially with reference to variety of DNA polymerases and other proteins involved, DNA replication in Eukaryotes with special reference to DNA polymerases, concept of Replicons etc.), Transcription (variety of RNA and their characteristics, synthesis of mRNA, rRNA and tRNA with special reference to enzymes, involved, RNA splicing, split genes, concept of Ribozymes and posttranscriptional processing), RNA transduction, Genetic code, point mutations, Translation (with reference to the specific role of Ribosomes, various factors, and posttranslational processing). Control of Gene expression in Prokaryotes.

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## Books Recommended

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., & Watson, J. D. *Molecular Biology of the Cell*. New York: Garland Publishing Inc.

Damell, Jr. J., Lodisch, H., & Baltimore, D. (1990). *Molecular Cell Biology*. New York: Scientific American Inc.

DeRobertis, E. D. P., & DeRobertis, Jr. E. N. F. (1987). *Cell and Molecular Biology*. New York: Lea & Febiger.

Geoffrey, M. C., & Robert, E. H. (2007). *The Cell: A Molecular Approach*. Sunderland: Sinauer Associates, Inc.

Karp, J. (2005). *Cell and Molecular Biology: Concepts and Experiments*. United States of America: John Wiley and Sons, Inc.

## ADVANCE ZOOLOGY Lab-II (CELL & MOLECULAR BIOLOGY)

Credit Hour-I

1. Detection and quantitative determination of chromosomal DNA and RNA.
2. Cultural and staining of bacteria and yeast.
3. Identification of different type of blood cells in human blood through smear technique.
4. Counting of prokaryotic cells (bacteria) and blood cells by using haemocytometer.
5. Isolation and characterization of proteins on polyacrylamide gel electrophoresis (native and sub-unit molecular weights).
6. Separation of different sized DNA fragments on agarose gel.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., & Watson, J. D. *Molecular Biology of the Cell*. New York: Garland Publishing Inc.

Damell, Jr. J., Lodisch, H., & Baltimore, D. (1990). *Molecular Cell Biology*. New York: Scientific American Inc.

DeRobertis, E. D. P., & DeRobertis, Jr. E. N. F. (1987). *Cell and Molecular Biology*. New York: Lea & Febiger.

Geoffrey, M. C., & Robert, E. H. (2007). *The Cell: A Molecular Approach*. Sunderland: Sinauer Associates, Inc.

Karp, J. (2005). *Cell and Molecular Biology: Concepts and Experiments*. United States of America: John Wiley and Sons, Inc.

## **COURSE TITLE: ADVANCE ZOOLOGY III (PHYSIOLOGY)**

Credit Hours: 3

### **Aims and Objectives:**

- The basic functional expression in animals is the membrane irritability understood in the form of nerve impulse.
- This course particularly imparts the concepts and mechanisms of integration in the different functional systems of the animals. These mainly constitute the mechanisms of nervous system and the hormonal system for the coordination. The motility and locomotion also contributes in the integration of the animal to its environment, therefore, also included in this section.

### **Course Contents**

1. **Central themes in Physiology:** Structure-function relationship, Adaptations, Homeostasis, Conformity and Regulation.
2. **Physiological basis of Membrane Function:** Mechanisms in resting membrane potentials: Electrogenic ion pump, Donnan equilibrium, Diffusional potentials, Ion channels, Ionic mechanisms in action potentials: Roles of ion channels, Properties of action potential. Propagation of action potential in neurons; Synaptic transmission; Structure and function of electrical synapse structure and function of chemical synapse; Neurotransmitters; Synaptic receptors; Excitatory postsynaptic potentials; Inhibitory postsynaptic potentials; Presynaptic inhibitions; Integration at synapses: Facilitation, Posttetanic Potentiation.
3. **Receptors Physiology:** Transduction; Sensory coding; Range fractionation; Sensory adaptations; Mechanoreception: Hair cell mechanism particularly in acoustico-lateralis system of vertebrates; Cutaneous receptors; Cellular and molecular mechanisms in taste and olfactory reception; Photoreception: Ultrastructure of photoreceptors, Photochemistry, Phototransduction and physiological basis of color vision; Physiological mechanisms in electroreception.
4. **Chemical Messenger and Regulators/Endocrine Physiology:** Types and functions of secretions. An overview of invertebrate endocrine structures, their hormones and physiological roles. An overview of hormones, their chemistry and physiological roles of Hypothalamus, Pituitary, Thyroid, Parathyroid and associated structures, Endocrine pancreas, Gastropancreatic system, Adrenal medulla (Chromaffin Tissue), Adrenal cortex, Ovary, Testis and Placenta. A generalized model account of hormone synthesis, storage and secretion (a peptide hormone model and steroid hormones); Hormonal interactions in metabolic and developmental function; Water and electrolyte balance and reproduction. Integrated endocrine and neural responses in glycemia and calcium homeostasis and reproductive cycles; General account of hormonal regulations, hormonal turnover, recognition; Mechanisms of action in hormones involving membrane receptors and nuclear modulated gene expression; Endocrine functions of kidneys, heart and pineal gland.

5. **Movements and Muscles:** Structural basis of muscle contraction: molecular structures of contractile components and their interaction, sarcoplasmic reticulum, calcium and membrane mechanisms in regulation of contraction.
6. **Cardiovascular Mechanisms:** Electrical activity of heart: Automaticity, Rhythmicity, Electrocardiography, Kymography; Hemodynamics, Blood flow, pressures and resistance and their interrelationships. Control of cardiac activity (cardiac output) and peripheral circulation.
7. **Exchange of Gases:** Transport of O<sub>2</sub> and CO<sub>2</sub> between respiratory surface (the lungs) and body cells. Regulation of lungs respiration; Gas transfer in water (gills) and its regulation. Respiratory responses in extreme conditions as hypoxia; Hypercapnia in air breathing divers.
8. **Excretion and Osmoregulation:** Osmoregulation in aquatic and terrestrial environment. Vertebrate nephron as osmoregulatory organ: Physiological anatomy, Glomerular filtration, Tubular absorption and secretion; Nitrogenous waste products; Patterns of nitrogenous excretion and their phylogenetic development.
9. **Nutrition:** Regulation of digestive secretions; Physiological anatomy of digestive tract (mammalian model), Absorption of water, ions and nutrients; Potential and Movements in gastrointestinal tract; Control of motility.
10. **Temperature Relations:** Temperature classification of animals; Temperature relation of ectotherms in freezing and cold and warm and hot environment; Costs and benefits of ectothermy; Temperature relations of heterotherms and endotherms; Dormancy: Sleep, Torpor, Hibernation, Estivation.
11. Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

- Berne, R. M. & Levy, M. N. (2000). *Principles of Physiology*. (3<sup>rd</sup>ed.). Mosby: St. Louis.
- Bullock, J., Boyle, J., & Wang, M. B. (2001). *Physiology*. (4<sup>th</sup>ed.). Philadelphia: Lippincott, Williams and Wilkins.

- Guyton, A. C. & Hall, J. E. (2000). *Textbook of Medical Physiology*. (10<sup>th</sup>ed.). Philadelphia: W.B. Saunders Company.
- Randall, D., Burggren, W., French, K., & Fernald, R. *Eckert Animal Physiology: Mechanisms and Adaptations* (5<sup>th</sup>ed.). New York: W.H. Freeman and Company.
- Schmidt-Nelsen, K. (1997). *Animal Physiology, Adaptation and Environment*. Cambridge: Cambridge University Press.
- Withers, P. C. (1992). *Comparative Animal Physiology*. Philadelphia: Saunders College Publishing.

## ADVANCE ZOOLOGY Lab-III (PHYSIOLOGY) PRACTICALS

1. **Muscle and Neuromuscular Activity:** Nerve muscle preparation, Muscle twitch, Comparison of muscle and nerve irritability, effect of stimulus strength, effect of stimulus frequency (tetany), effect of load or stretch, effect of prolonged activity (fatigue), neuromuscular fatigue, stimulation of motor points in human.
2. **Excitability, Sensation and Behaviour:** Recording of action potential by oscilloscope and demonstration of its various features. Experiments to demonstrate characteristic of reflex arc. Experiment in human (students themselves) to demonstrate some aspect of sensory physiology.
3. **Cardiovascular Activity:** Normal cardiac activity, effect of temperature, effect of drug, heart block, tetanization of heart. Measurement of blood pressure.
4. **Respiration and Exercise:** Oxygen consumption in fish and effect of temperature (by dissolved oxygen meter) and terrestrial animal (mouse). Oxygen consumption (by respirometer), heart rate, blood pressure glycemia altered by exercise.
5. **Endocrine and Reproductive Mechanisms:** Effect of insulin on glycemia, study of stages in estrous cycle.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

Tharp, G., & Woodman, D. (2002). *Experiments in Physiology*. (8<sup>th</sup> ed.). London: Prentice Hall.

# ADVANCE PHYSICS 2(QUANTUM MECHANICS-1)

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**PRE-REQUISITE: Undergraduate level Mechanics and Mathematics**

**INTRODUCTION: CREDITE HOURS: 4**

This course covers the experimental basis of quantum physics. It introduces wave mechanics, Schrödinger's equation in a single dimension, and Schrödinger's equation in three dimensions.

## **COURSE OBJECTIVE:**

It covers fundamental concepts of quantum mechanics: wave properties, uncertainty principles, Schrödinger equation, and operator and matrix methods. Basic applications of the following are discussed: one-dimensional potentials (harmonic oscillator), three-dimensional centro symmetric potentials (hydrogen atom), and angular momentum and spin. The course also examines approximation methods: variational principle and perturbation theory.

## **COURSE OUTLINE:**

**Breakdown of Classical Concepts and Old Quantum Theory:**  
Particle aspects of radiation and Planck's hypothesis, wave aspects of matter and de Broglie's hypothesis, discrete levels and Bohr's hypothesis.

**Farmulation of Quantum Mechanics:**  
Mathematical preliminaries, quantum mechanical wavefunction, Hilbert space, observables and operators, operator equations, the eigenvalue equation, commutation relations, expectation value, postulates of quantum mechanics, correspondence principle, complimentarity principle, Schrodinger equation and discrete energy levels, state functions and overlap integral, uncertainty principle.

**One Dimensional Systems:**  
The potential step, reflection and transmission coefficients, potential well and bound states, potential barrier, tunneling, tunneling through thin films, alpha decay, one-dimensional models of molecules and delta function potential, Kronig-Penny model, harmonic oscillator, raising and lowering operators.

**Angular Momentum:**  
Angular momentum operator, z-component, total angular momentum; eigenvalues, eigenfunctions and vector diagram, parity.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%



## **REFERENCE BOOKS:**

1. Introductory Quantum Mechanics by R. L. Lieboff` Holden-Day, San Francisco (1980)
2. Qunatum Mechanics Vol I,II by C.Cohen-Tannoudji, B. Diu, F. Laloe, Wiley (1977).
3. Quantum Physics by S. Gasiorowicz, Wiley (1996).
4. Introduction to Quantum Mechanics by Dicke, Wittke, Addison-Wesley (1974).
5. Quantum Mechanics by Sokoev, Ternou, Holt, Rinehart & Winston (1996).
6. Quantum Mechanics by J. L. Powell and B. Crasemann, Addison-Wesley, (1961).

# ADVANCE PHYSICS 3(ELECTRONICS)

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**PRE-REQUISITE:** Undergraduate level Physics and Mathematics

**INTRODUCTION: CREDITE HOURS: 3**

This course provides physics students with the fundamental electronic principles needed for advanced study in physics laboratories and graduate school. An introduction to digital electronics, the physics of semiconductors, p-n junctions, transistors and integrated circuits.

## **COURSE OBJECTIVE:**

Upon successful completion of the course material, students will be able to: Qualitatively and quantitatively describe the operation of operational amplifiers in a variety of signal processing applications. Demonstrate the ability to use and to analyze circuits containing digital to analog (DAC) and analog to digital converters (ADC). Learn the proper use of modern test equipment and be able to write simple computer programs which will interface the computer (transfer data to and from) to ADC's, DAC's and registers. Build and analyze the basic digital circuits which become the building blocks for more complex circuits which are used in computers and digital instruments. Demonstrate basic knowledge of the physics of semiconductors, diodes and transistors.

## **COURSE OUTLINE:**

### **The Semiconductor Diode:**

The junction diode, the diode voltage-current equation, Zener diode, light-emitting diodes, capacitance effects in the pn diode.

### **The Diode as Rectifier and Switch:**

The ideal diode model, the half-wave rectifier circuit, the full-wave rectifier circuit, the bridge rectifier circuit, measurement of the ripple in the rectifier circuit, the capacitor filter, the filter;  $\pi$  filter, regulated power supply.

### **Models for Circuit:**

The black box concept; active one-port models: the voltage-source circuit; active one-port models, the current-source circuit: the two-port network, the h-parameter equivalent circuit, power in decibels.

### **Junction Transistor as Amplifier:**

The junction transistor, the volt-ampere curves of a transistor, the current amplification factors, relations between the amplification factors, the load line and Q point, the basic transistor amplifiers, simplification of the equivalent C-E circuit, the transconductance,  $g_m$ , the common-emitter amplifier, conversion of the h parameters, the common-collector amplifier, performance of the C-C amplifier, comparison of amplifier performance.

**DC Bias for the Transistor:**

Choice of the quiescent point, variation of the Q point: fixed transistor bias, the four-resistor bias circuit, design of a fixed-bias circuit, design of the bias-stabilized C-E amplifier, voltage feedback bias, design of voltage-feedback bias circuit, bias for the emitter follower, design of the emitter follower circuit.

**The Field Effect Transistor:**

The junction field-effect transistor; the MOS field-effect transistor, the load line for the FET, obtaining bias for the FET, the FET as an amplifier.

**Frequency Response of RC Amplifiers:**

Cascaded amplifier, the amplifier passband, the frequency plot, low-frequency response, the low-frequency limit, the unbypassed emitter resistor, high-frequency equivalent circuits and the Miller effect, high-frequency response, the frequency limit of the transistor, the common-base connection at high frequencies, bandwidth of cascaded amplifiers.

**Negative Feedback in Amplifiers:**

The black box with feedback, stabilization of gain by negative feedback, bandwidth improvement with negative feedback, reduction of nonlinear distortion, control of amplifier output and input resistances, a current series-feedback circuit, voltage shunt-feedback circuit, voltage feedback with the FET.

**Integrated Amplifiers:**

The integrated amplifier, the differential amplifier, the Darlington compound transistor, introduction to operation amplifier.

**Power Amplifiers:**

Classification of power amplifier, power relations in the class A amplifier, voltage limitations, determination of output distortion, the push-pull circuit and class B operation, performance of a class B push-pull amplifier, output circuits without transformers, phase inverters for push-pull input.

**Oscillators:**

Oscillator feedback principles, the Hartley and Colpitts oscillators, practical transistor oscillators, crystal control of frequency, resistance-capacitance feedback oscillator.

**Waves Shaping and Switching Circuits:**

Diode clipper, diode clamper, differentiator, integrator. Multivibrators, the bistable multivibrator, the one-shot or monostable multivibrator and astable multivibrator.

**Digital Circuits:**

Binary numbers, Binary codes, Logic switches and gates, Logic Circuits.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## **REFERENCE BOOKS:**

1. Electronic Circuits and Systems by J.D. Ryder/Charles M. Thomson, (1976).
2. Electronics devices and Circuits by Millman and Halkies (1978).
3. Electronics Devices by Thomas L. Floyd, Prentice-Hall Inc., Englewood Cliffs, (1996).
4. Electronic Principles by Albert P. Malvino, Glencoe McGraw-Hill Book Co. (1993).
5. Digital Fundamentals by Thomas L. Floyd, Prentice-Hall International Inc. Englewood Cliffs, (1994).
6. Electronic Devices and Circuit Theory by Boylestad and Nashhelsky, 7th Edition A. Published by Prentice-Hall, (1997).
7. Electronic Devices and Circuits, by Theodore F. Bogart, Jr. 4th Edition, Prentice-Hall, Upper Saddle River, NJ (USA) 1997.

## Advance Physics Lab II (Electronics):

**Note:** The candidate must perform at least EIGHT experiments from the list given below.

50% weightage must be given to viva-voce about apparatus, theory of experiments and estimation of errors.

1. To construct a power supply and study the rectified wave form (measurement of peak value), ripple factor and regulation (without regulator).
2. To construct a voltage-regulated power supply with Zener diode.
3. To construct a single stage CE transistor voltage amplifier and study gain, input impedance, output impedance, half power points by sine/square wave testing and effect of bias on the output and measurement of distortion.
4. To construct a source follower FET voltage amplifier and study gain, input impedance, output impedance, half power points by sine/square wave testing.
5. To construct an R-C oscillator and compare it with a standard frequency.
6. To construct a Hartley or Colpitts oscillator and measure its frequency.
7. To construct and study the wave forms at the base and collector of the transistors of a free running a multivibrator.
8. To construct and study of the height, duration and time period of the output pulses in a monostable and bistable multivibrators with reference to the input Trigger.
9. To construct from discrete components OR, AND, NOT, NAND, NOR exclusive OR Circuits and verify their truth tables.
10. Study of wave shaping circuits of diode, integrators and differentiators.
11. To construct the operational amplifier (741) by using discrete components and study its frequency response.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### REFERENCE BOOKS:

1. Electronic Circuits and Systems by J.D. Ryder/Charles M. Thomson, (1976).
2. Electronics devices and Circuits by Millman and Halkies (1978).
3. Electronics Devices by Thomas L. Floyd, Prentice-Hall Inc., Englewood Cliffs, (1996).
4. Electronic Principles by Albert P. Malvino, Glencoe McGraw-Hill Book Co. (1993).
5. Digital Fundamentals by Thomas L. Floyd, Prentice-Hall International Inc. Englewood Cliffs, (1994).

6. Electronic Devices and Circuit Theory by Boylestad and Nashhelsky, 7th Edition  
A. Published by Prentice-Hall, (1997).
7. Electronic Devices and Circuits, by Theodore F. Bogart, Jr. 4th Edition, Prentice-Hall, Upper Saddle River, NJ (USA) 1997.

**Course Title: Advance Mathematics- II [Algebra (Group Theory and Linear Algebra)]**

**Course Rating: 4 Cr. Hours**

**Groups**

- Definition and examples of groups
- Subgroups lattice, Lagrange's theorem
- Cyclic groups
- Groups and symmetries, Cayley's theorem

**Complexes in Groups**

- Complexes and coset decomposition of groups
- Centre of a group
- Normalizer in a group
- Centralizer in a group
- Conjugacy classes and congruence relation in a group

**Normal Subgroups**

- Normal subgroups
- Proper and improper normal subgroups
- Factor groups
- Isomorphism theorems
- Automorphism group of a group
- Commutator subgroups of a group

**Permutation Groups**

- Symmetric or permutation group
- Transpositions
- Generators of the symmetric and alternating group
- Cyclic permutations and orbits, The alternating group
- Generators of the symmetric and alternating groups

**Sylow Theorems**

- Double cosets
- Cauchy's theorem for Abelian and non-Abelian group
- Sylow theorems (with proofs)
- Applications of Sylow theory
- Classification of groups with at most 7 elements

**Ring Theory**

- Definition and examples of rings
- Special classes of rings
- Fields
- Ideals and quotient rings
- Ring Homomorphisms

- Prime and maximal ideals
- Field of quotients

### **Linear Algebra**

- Vector spaces, Subspaces
- Linear combinations, Linearly independent vectors
- Spanning set
- Bases and dimension of a vector space
- Homomorphism of vector spaces
- Quotient spaces

### **Linear Mappings**

- Mappings, Linear mappings
- Rank and nullity
- Linear mappings and system of linear equations
- Algebra of linear operators
- Space  $L(X, Y)$  of all linear transformations

### **Matrices and Linear Operators**

- Matrix representation of a linear operator
- Change of basis
- Similar matrices
- Matrix and linear transformations
- Orthogonal matrices and orthogonal transformations
- Orthonormal basis and Gram Schmidt process

### **Eigen Values and Eigen Vectors**

- Polynomials of matrices and linear operators
- Characteristic polynomial
- Diagonalization of matrices

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

1. J. Rose, *A Course on Group Theory*, (Cambridge University Press, 1978)
2. I. N. Herstein, *Topics in Algebra*, (Xerox Publishing Company, 1964)
3. G. Birkhoff and S. MacLane, *A Survey of Modern Algebra*, (Macmillan, 1964)
4. Seymour Lipschutz, *Linear Algebra*, (McGraw Hill Book Company, 2001)
5. Humphreys, John F. *A Course on Group Theory*, (Oxford University Press, 2004)
6. P. M. Cohn, *Algebra*, (John Wiley and Sons, 1974)
7. J. B. Fraleigh, *A First Course in Abstract Algebra*, (Pearson Education, 2002)



**Course Title: Advance Mathematics- III (Complex Analysis and Differential Geometry)**

**Course Rating: 4 Cr. Hours**

**The Concept of Analytic Functions**

- Complex numbers, Complex planes, Complex functions
- Analytic functions
- Entire functions
- Harmonic functions
- Elementary functions: Trigonometric, Complex exponential, Logarithmic and hyperbolic functions

**Infinite Series**

- Power series, Derived series, Radius of convergence
- Taylor series and Laurent series

**Conformal Representation**

- Transformation, conformal transformation
- Linear transformation
- Möbius transformations

**Complex Integration**

- Complex integrals
- Cauchy-Goursat theorem
- Cauchy's integral formula and their consequences
- Liouville's theorem
- Morera's theorem
- Derivative of an analytic function

**Singularity and Poles**

- Review of Laurent series
- Zeros, Singularities
- Poles and residues
- Cauchy's residue theorem
- Contour Integration

**Expansion of Functions and Analytic Continuation**

- Mittag-Leffler theorem
- Weierstrass's factorization theorem
- Analytic continuation

**Theory of Space Curves**

- Introduction, Index notation and summation convention
- Space curves, Arc length, Tangent, Normal and binormal
- Osculating, Normal and rectifying planes
- Curvature and torsion
- The Frenet-Serret theorem

- Natural equation of a curve
- Involutives and evolutes, Helices
- Fundamental existence theorem of space curves

### **Theory of Surfaces**

- Coordinate transformation
- Tangent plane and surface normal
- The first fundamental form and the metric tensor
- The second fundamental form
- Principal, Gaussian, Mean, Geodesic and normal curvatures
- Gauss and Weingarten equations
- Gauss and Codazzi equations
- **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

1. H. S. Kasana, *Complex Variables: Theory and Applications*, (Prentice Hall, 2005)
2. M. R. Spiegel, *Complex Variables*, (McGraw Hill Book Company, 1974)
3. J. W. Brown, R. V. Churchill, *Complex Variables and Applications*, (McGraw Hill, 2009)
4. Louis L. Pennisi, *Elements of Complex Variables*, (Holt, Linehart and Winston, 1976)
5. W. Kaplan, *Introduction to Analytic Functions*, (Addison-Wesley, 1966)
6. R. S. Millman and G.D. Parker, *Elements of Differential Geometry*, (Prentice-Hall, 1977)
7. E. Kreyzig, *Differential Geometry*, (Dover Publications, 1991)
8. M. M. Lipschutz, *Schaum's Outline of Differential Geometry*, (McGraw Hill, 1969)
9. D. Somasundaram, *Differential Geometry*, (Narosa Publishing House, 2005)

## **SEMESTER-VII**

### **Course : Contemporary Issues and Trends in Science Education Credit Hours: 3**

#### **Introduction**

Competent teachers are usually knowledgeable in their respective Content areas. Being part of the education system, teachers need to be aware of the contemporary issues and trends in education. Issues such as population explosion, HIV/AIDS, Gender Development, sustainable development require a broad based knowledge approach for teacher preparation. Therefore, a course on contemporary issues and trends in education is considered significant to develop an insight among teachers.

#### **Objectives**

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

- argue on the positive and negative impact of the information explosion
- explore the gap between madrassah and mainstream education and identify appropriate government responses
- identify barriers to the achievement of universal literacy and how these may be removed at the local level
- discuss the gradually reducing gender disparity in education in Pakistan and its likely consequences
- analyze the relationship between national curriculum structure and career opportunities
- consider how best environmental awareness can be enhanced through schools
- consider the consequence of the growing privatization of education

#### **Course Content**

##### **Unit 01 Education as a Complex Enterprise**

- 1.1 Diversity of aims and approaches in education.
- 1.2 Variety of philosophical approaches to education.
- 1.3 Education in different periods and societies

##### **Unit 02 Madrassah Education**

- 2.1 Madrassah: origin, aims and objectives
- 2.2 Role of madrassah in 21st century
- 2.3 System of education in madrassah
- 2.4 Madrassah reforms in Pakistan

##### **Unit 03 Universal Literacy**

- 3.1 Literacy and individual rights
- 3.2 Factors affecting program for universal literacy: medium of instruction
- 3.3 Formal and Non formal education: Advantages and disadvantages

##### **Unit 04 Gender Disparity**

- 4.1 Concept of gender equality
- 4.2 Factors affecting the status and role of women
- 4.3 Steps towards reducing gender disparity.

##### **Unit 05 Population Education:**

- 5.1 Concept of Population Education.
- 5.2 Factors affecting Population Education.
- 5.3 Impact of Population Growth on National Development.
- 5.4 Roles and responsibilities of family, school, mosque and community in population education.
- 5.5 Steps towards population planning and welfare.

##### **Unit 06 Environmental Awareness**

6.1 Types of pollution

6.2 Causes of pollution

6.3 Environmental education

### **Unit 07 Privatization of Education**

7.1 Government resources and multiple demands

7.2 Need of private sector education

7.3 Challenges of quality education

### **Unit 08 Information in Education**

8.1 New concept of information explosion

8.2 Expanding learning resources

8.3 Information and communication technology (ICT) literacy

8.4 Technology in education

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

AIU, (2006) *Population Education Course* MA EPM 584, Islamabad: AIU.

Badran, M. (2005). *The Gender of Islam*, Al-Ahram: Cairo.

Haltak, J. (1990). *Investing in the Future, Setting Educational Priorities in the Developing World*, Paris, UNESCO. McGraw-Hill Kogakusha.

Ministry of Education, Curriculum Wing (2010), *13 Modules on Various Core Themes of Population Education*, Islamabad.

Modhukar Indira (2003). *Changing Demands of Technical and Vocational Education*, Annual Publication New Delhi.

Mohantry, Jagannath. *Primary and Elementary Education*, Deep & Deep Publication Private Ltd.

Pakistan, Govt: (2003). *Education for All*, Ministry of Education Curriculum Wing Islamabad.

Rao, V. K. (2004). *Population Education* efficient Printer, New Delhi.

Sylvester, C. (1994). *Feminist Theory and International Relation*, in Post Modern Era, Cambridge University Press.

UNESCO, Pakistan (2004). *Quality of education in Pakistan*, UNESCO Office, Islamabad.

## **Course Title: Research project**

**Credit Hours: 03**

### **Goals and Objectives**

The objectives of the course are:

- To provide students with the tools and skills required to understand research terminology and assess published research.
- To identify the types of methods best suited for investigating different types of problems and questions
- To develop research questions that are based on and build upon a critical appraisal of existing
- To design a research proposal
- To begin initial preparation for embarking on a new research project.
- To accomplish and learn all stages of research
- To complete research and learn the skills of writing research thesis technically.

### **Course details**

#### **Planning a good research project**

##### **1. How to choose a good research topic?**

**Stage 1: What are the broad themes? , Stage 2: What are the interesting topics within those themes? , Stage 3: What questions might can be asked about those topics? Stage 4: Choose a question and check its viability, Stage 5: Making final choice.** The last stage is to making final choice of project. Start project with a research question.

##### **2. Administration of the research project**

Ist most important step is approval of the topic

##### **I- Making the research proposal**

Components of the research proposal.

- 1- Research title/problem and justification.
- 2- Research hypothesis/ Question.
- 3- The main research question that the student will be focusing on, with, perhaps, a number of sub-questions.
- 4- The background to the study – why it is an important and interesting topic to study.
- 5- A brief background literature review. This should show that the student have read a number of relevant books and papers so that student understand how his topic relates to the current knowledge and issues in the field.
- 6- A proposed methodology, that is, how student intend to undertake the study, what methods he will use, what data he will collect and how he will analyse the data. If this includes any form of experimental work or the use of any data collection or analysis equipment you need to provide a detailed and precise list of what he will need. He also needs to explain why this methodology and this instrument is the best way to study this topic.

- 7- A proposed time schedule for the project, with key dates and the timing of each phase of the project.

**NOTE:** What if student's proposal is rejected? He should regard a rejection as saving him from big problems later on. Teachers have a very good idea of what will 'work' and what will not, what is achievable and what is not. If they suggest student think again it is because they believe he cannot produce a thesis or dissertation of the required standard from what he is proposing. So, take the advice they give, and submit another proposal.

## **I- Stages of the Research (process of the project)**

Student need to start by thinking through what are the stages of his project. For most research projects there are ten stages:

### **Stage 1 – Choosing the project / Introduction**

Topic has already been selected. Introduction related to the research topic briefly will be given in this section.

### **Stage 2 – Initial literature review**

The literature review is a critical early stage in students' project. A literature review has many purposes. It enables student to find out what research has been undertaken in the field, what is 'known' and what the important questions are that others are investigating or have suggested for research. It helps student to understand the history of his field, to know how ideas have developed, changed, appeared and disappeared over time. Student will become aware of the range of methodologies that have been used to research his field, both in the past and in the present, and he should start to develop a critical view of the advantages and disadvantages of different approaches. It will also enable the student to discover who else is working in the field and what they are working on. Most importantly, though, it will help the student to look at his initial ideas for his research and develop and refine them to produce the project that he will undertake. It is almost the most important stage of the project, for if he does this thoroughly and well he will be saved many potential problems later on.

### **Stage 3 – finalize the research questions**

Ideally student's research questions will emerge from the literature review. The literature review will have shown him what is already known in the field and what important topics need to be researched.

### **Stage 4 – Choosing and developing the methodology**

Whatever his subject and field, there will be a range of different research methods available to him. At this stage he needs to choose the best approach to enable him to answer his research question. Many students though, unfortunately, start with an idea of the methods they want to use and then apply them to their research question whether or not they are the best way forward. The correct way forward, of course, is to read and reflect very broadly on possible research methods and then choose what is most appropriate, even if this involves him in learning new approaches or techniques.

### **Stage 5 – Piloting the methodology**

Whatever method the student use, he will need to his methodology. Piloting is practising, checking that he can use the method correctly and that it will work in the

circumstances in which he is using it to provide usable data. Piloting usually suggests changes and modifications to the methods he is using, sometimes large, sometimes small, and so is an essential process.

### **Stage 6 – Organising the data collection**

Do not be put off by the word ‘data’. By “data” it is meant is the evidence the student will use to arrive at his conclusions, and there are many types of data. His data could be experimental results, field data or survey data or they could come from direct observations of social situations. The data could be quantitative, qualitative or a combination of both types. Stage 6 involves making the arrangements to collect that data.

### **Stage 7 – Data collection**

Collecting the data can be a short or a long process – for example a project on the behaviour of kindergarten students may take many months of detailed observation and recording, while some experimental projects may take only a few weeks or even days to complete.

### **Stage 8 – Data analysis**

Data analysis includes the systematic organising of the data and its presentation in a form that readers of the students’ project can understand. It also includes the interpretation of the data to identify the important ideas or new bits of knowledge that they reveal. Each discipline will have descriptive and analytical techniques, ranging from statistical analysis to computer modelling to presentational methods to qualitative analysis. Student will need to choose the methods best suited to the data he has collected, and will need to be able to justify his choice of methods.

### **Stage 9 – Drawing conclusions and interpretations**

Stage 8 involved very detailed analysis and interpretation, working with the detail of the data and drawing out important ideas about every part of the topic that has been studied. Stage 9 is the ‘big picture’ stage of the research, where the detailed interpretations are drawn together to try to ‘answer’ the overall research question. It will certainly involve a critical reflection on the conclusions student has drawn and the methods he has used, and will probably make recommendations for future research in the field. In social science fields it may include recommendations for policy-makers and practitioners about future practice and policy.

### **Stage 10 – Preparing the final thesis**

Writing of the thesis is covered in more detail in writing a thesis. The final stage of the project, though, is assembling the final version of the thesis. Student will produce drafts of individual chapters throughout the project, and these can be assembled into the first draft of the overall thesis or dissertation. At this stage, though, the work needs to be prepared for submission – making sure the whole work is coherent; writing, re-writing and editing; assembling diagrams, tables or charts; completing and checking the bibliography and appendices; preparing the contents and the abstract; printing and binding the work. This all takes a significant amount of time, which needs to be built into the planning of the project. Student will see from reading through the stages of the project that there is much to plan and prepare for. While it is not possible to plan precisely how long each stage will take, and unforeseen things may arise, it is very helpful to plan as carefully as student can.

There are two simple techniques student can use to plan his time and his project – a time line and a Gantt chart.

### Points to remember

This looks a straightforward path to understand and follow, but there are a number of important points to remember with this model. First, real project will not follow this path in a neat sequence:

- Some stages will overlap – for example, student will certainly start to develop interpretations and conclusions as soon as he starts collecting data, and he may of course want to test some of his conclusions by collecting further data.
- Student may need to return to earlier stages – for example, piloting may indicate his need to make changes to the methodology.
- Some stages will continue throughout the project – for example, student will need to keep reviewing the literature throughout the project to be sure that he has not missed anything important or that there have not been new publications on the topic. Even while student is preparing the final thesis he will need to do a last-minute literature check so that he dose not miss the latest publications.

Secondly, student will need to be writing the thesis/dissertation from as early in the project as possible. Stage 10 is preparing the final version, not starting to write. It is very important to recognise that student must start writing as soon as he can, otherwise it may become a major psychological barrier for him

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Internal Examiner (Supervisor/s)	40%
External Examination	External Examiner	60%

### RECOMANMDED BOOKS

Berry, R. (2004), *The research project: how to write it*. London: Routledge.

Nicholas S. R. Walliman (2005), *Your research project: a step-by-step guide for the first-time researcher*, SAGE publication, London.

Dr. A. K. Khan (2008), *Research Methodology*, APH publishing Corporation, New Delhi.

Thomas, G. (2013), *How to do your research project: a guide for students in education*, SAGE publication, London.

Yogesh Kumar Singh (2006), *Fundamental Of Research Methodology And Statistics*, New Age International Publishers Ltd.-new Delhi.



**COURSE TITLE: ADVANCE BOTANY-IV( SOIL AND AGRICULTURAL MICROBIOLOGY)**

**CREDIT HOURS: 3**

**Syllabus Outline:** Study of Soil Microbes in relation to Soil Formation and Plant-Microbes nitrification.

**Course Outline:**

Elements of Soil Formation and Conservation, Soil Microbial Population and Methods of Study with their Advantages and Disadvantages, Role of Microorganisms in Mineral Transformations with special and detailed emphasis on Carbon and Nitrogen Transformations, Brief Introduction to Sulphur and Phosphorus Transformation, Introduction to Soil Ecology, Plant Microbe Interactions and Microbe-Microbe Interactions and their Impact on Soil Fertility, Biotechnological Potentials of Soil Microorganisms, Importance of the Subject in the Agricultural Development of Pakistan, Problems of Salinity and Water Logging and the Methods of their Reclamations, Microbial Activities in Saline Soil. Biochemical, Physiological, Genetic, Ultra-Structural and Molecular Aspects of interaction between Plants and their Beneficial and Harmful Symbionts, Microbe's Role in Regulatory Mechanism of Plant Gene Expression.

**Module aims:**

Course is designed to provide essential knowledge about soil structure and composition and learning about soil biodiversity.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcomes:**

Students are expected to have knowledge about Soil Microflora and then-effects on Soil Composition and Information about Agriculture Soils of Pakistan.

**Assessment Strategies (Theory) :**

The student will be assessed according to the following criteria

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Berthelin, J., Bollag, J.M., Page, A.L., Huang, P.M., McGill, W.B. and Huang, P.M. (1999). Environmental Impacts of Soil Component Interactions: Natural and Anthropogenic Organics. Vol.1, Lewis Publishers.
2. Wang, K., Estreua, A.H. and Montagu, M.V. (2004): Transformation of Plants and Soil Microorganisms (Plant and Microbial Biotechnology Research). No.3, Cambridge University Press.
3. Charles, J., Delecluse, A., Lerou, N. and Roux, C.N. (2000). Entomopathogenic Bacteria: From Laboratory to Field Application (1<sup>st</sup> Ed.), Kluwer Academic Publishers.
4. Rao, N.S.S. and Dommergues, Y.R. (2001). Microbial Interactions in Agriculture and Forestry. (2<sup>nd</sup> Ed.), Science Publishers
5. Glick, B.R., Patten, C.L., Holguin, G. and Penrose, D.M. (1999). Biochemical and Genetic Mechanisms Used by Plant Growth Promoting Bacteria. Imperial College Press.
6. Rao, N.S.S. and Dommergues, Y.R. (2000). Microbial Interactions in Agriculture and Forestry. (1<sup>st</sup> Ed.), Science Publishers.

**TITLE: ADVANCE BOTANY-LAB-IV ( SOIL AND AGRICULTURAL MICRO BIOLOGY)****CREDIT HOURS: 1**

**Syllabus Outline:** Study of Soil Microbes in Relation to the Formation of Soil, Interaction with Plants and Enhancement of Soil Fertility.

**Course Outline:**

1. Study of role of Microbes in Soil Structure and Improvement.
2. Symbiotic and Antagonistic effects of microbes.
3. Soil/Crop improvement by microbes.
4. Reclamation of Saline and Water Logged Soils.
5. Determination of Genetic and Biochemical Molecular Aspects of Microbial Interaction with plants.
6. Use of Azospirillum and Azospirillum as Natural Fertilizers.

**Module Aims:** The course designed to guide Laboratory Techniques for study of Soil Microflora and their Interaction. Parameters and Spillers are provided for Study of Types of Soils and Their Composition.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcome:** Students are expected to have knowledge about Soil Microbial Population, their Role for Enrichment Soil Composition and its Productivity.

**Assessment Strategies (Practical) :**

The student will be assessed according to the following criteria

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Berthelin, J., Bollag, J.M., Page, A.L., Huang, P.M., McGill, W.B. and Huang, P.M. (2005). Environmental Impacts of Soil Component Interactions: Natural and Anthropogenic Organics. Vol.1, Lewis Publishers.
2. Wang, K., Estrella, A.H. and Montagu, M.V. (2004): Transformation of Plants and Soil Microorganisms (Plant and Microbial Biotechnology Research No. 3, Cambridge University Press.
3. Charles, J., Delecluse, A., Lerou, N. and Roux, C.N. (2001). Entomopathogenic Bacteria: From Laboratory to Field Application (1<sup>st</sup> Ed.), Kluwer Academic Publishers.
4. Rao, N.S.S. and Dommergues, Y.R. (2001). Microbial Interactions in Agriculture and Forestry. (2<sup>nd</sup> Ed.), Science Publishers
5. Glick, B.R., Patten, C.L., Holguin, G. and Penrose, D.M. (2000). Biochemical and Genetic Mechanisms Used by Plant Growth Promoting Bacteria. Imperial College Press.
6. Rao, N.S.S. and Dommergues, Y.R. (2000). Microbial Interactions in Agriculture and Forestry. (1<sup>st</sup> Ed.), Science Publishers.

**COURSE TITLE: ADVANCE BOTANY-V (MUSHROOM CULTIVATION)****CREDIT HOURS: 3**

**Syllabus Outline:** Occurrence of Mushroom, Diversity Status in Pakistan, Cultivation, Knowledge of Edible and Poisonous Mushrooms, Pleurotus and its Status, their Diseases. Course Outline:

1. History of Mushrooms.
2. History of Mushroom Cultivation.
3. Present status and Future Prospects of Mushroom Cultivation in Pakistan.
4. Mushroom Farms and Commercial Mushroom Farming.
5. Food Value of Mushrooms.
6. Morphology of Mushrooms.
7. Poisonous and Edible Mushrooms.
8. Major species Cultivated for Food.
9. Cultivation of white Button Mushroom (*Agaricus bisporus*).
10. Factors suitable for Cultivation, Compost and Methods of Composting, Spawn and Methods of Spawning, Casing, Cropping and Harvesting, Preservation.
11. Cultivation of *Pleurotus* Species.
12. Methods of Cultivation, Preparation of Spawn.
13. Diseases of Mushrooms.
14. Uses of Mushrooms.

**Module Aims:** This includes learning all and Medical Techniques of Cultivation of Edible Mushrooms of Pakistan using Agriculture Waste etc. Aim of this course is to train the students practically as Mushroom Growers.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcome:** By reading this course students would be able to recognize Edible and Poisonous Mushrooms and utilize these information for earning their livelihood.

**Assessment Strategies (Theory) :**

The student will be assessed according to the following criteria

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended:

1. Svreck, M. (2010). The Hamlyn Book of Mushrooms and Fungi. Hamlyn, N.Y. London.
2. Chang, S.T. and Miles, P.G. (2004). Mushrooms, Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact. (2<sup>nd</sup> Ed.), CRC Press, New York, Washington, D.C.
3. Dickinson, C. and Lucas, J. (2003). Encyclopedia of Mushrooms. Qrbis Pub. London.
4. Singer, R. (1999). The Agaricales in Modern Taxonomy. 3. Grammer, Leber, Germany.
5. Rebman, T. and Shakir, A. (1997). Mushroom Ki Kasht. PARC Publications, Pakistan.
6. Bahl, N. (1988). Handbook on Mushrooms. Oxford and IBH Pub. New Delhi.
7. Mahmood, S.K., Khatoon, A.Y. and Sarfraz, K.R. (1988). Pakistan Mushrooms and Their Cultivation Technology. PARC Publications, Pakistan.

### TITLE: ADVANCE BOTANY-LAB-V (MUSHROOM CULTIVATION)

#### CREDIT HOURS: 1

**Syllabus Outline:** Learning Morphology and Anatomy of Edible Mushrooms. Media for their culturing, Optimization of Conditions for Growth and Harvest.

#### Course Outline:

- i) Anatomical study of Agaricus and Pleurotus species.
- ii) Cultivation of Agaricus and Pleurotus species.
- iii) Preparation of Compost using different Basic Materials (different Vegetable and Animal Matters).
- iv) Preparation of Spawn (Grain Spawn and Brick Spawn).
- v) Preparation of Casing.
- vi) Cropping (Bags, Columns and Trays).
- vii) Harvestings.
- viii) Preservation.

**Module Aims:**

This includes learning all and Medical Techniques of Cultivation of Edible Mushroom of Pakistan using Agriculture Waste etc. Aim of this course is to train the students practically as Mushroom Growers.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcome:** By reading this course students would be able to recognize Edible and Poisonous Mushrooms and utilize this information for earning their livelihood.

**Assessment Strategies (Practical) :**

The student will be assessed according to the following criteria  
Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Svreck, M. (2010). The Hamlyn Book of Mushrooms and Fungi. Hamlyn, N.Y-London.
2. Chang, S.T. and Miles, P.G. (2004). Mushrooms, Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact. (2<sup>nd</sup> Ed.), CRC Press, New York, Washington, D.C.
3. Dickinson, C. and Lucas, J. (2003). Encyclopedia of Mushrooms. Orbis Pub. London.
4. Singer, R. (1999). The Agaricales in Modern Taxonomy. J. Grammer, Leber, Germany.
5. Rehman, T. and Shakir, A. (1997). Mushroom Ki Kasht. PARC Publications, Pakistan.
6. Bahl, N. (1988). Handbook on Mushrooms. Oxford and IBH Pub. New Delhi.
7. Mahmood, S.K., Khatoon, A.Y. and Sarfraz, K.R. (1988). Pakistan Mushrooms and Their Cultivation Technology. PARC Publications, Pakistan.

**COURSE TITLE: ADVANCE BOTANY-VI (PLANT NUTRITION & SOIL FERTILITY)**

**CREDIT HOURS: 3**

**Syllabus Outline:** To study composition of different nutrients, absorption, translocation and assimilation of various nutrients. Nitrogen fixation.

**Course Outline:**

Introduction, Scope and History of Mineral Plant Nutrition. The Inorganic Components of Plants, Water, Dry Matter, Mineral Competition,

Essential and other Mineral Elements, Macronutrient and Micronutrient Elements, Comparative Macronutrient and Micronutrient Elements; Comparative Elemental Requirements of Higher Plants; Deficiencies and Tissue Analysis, Deficiency Symptoms of Individual Elements. The Media of Plant Nutrition, The Variety of Nutrient Media: Soil; Solution Culture;

Chemical Composition of Nutrient Solutions; Modified Solution Culture, Culture Solutions compared with Soil Solutions.

The Acquisition of Nitrogen Absorption of Nitrate and Ammonium Ions; Nitrogen Fixation, Physiology of Formation of Root Nodules, Physiology of Symbiotic Nitrogen Fixation.

Mineral Metabolism, The Functions of Nutrients, Nutrient Elements as Constituents of Metabolites and Complexes, Nutrient Elements as Activators, Cofactors or Regulators of Enzymes, Nutrient Elements in Physiological Processes. Ecological Aspects of Plant Nutrition, Phenotypic Plasticity, The Concept of the Ecotype, Role of Mineral Elements in Plant Ecology, Interplay between Plants and their Mineral Media. Soil Fertility Evaluation.

Soil and Fertilizer N, P, K, Ca, Mg, S, Fe and Trace Elements. Liming and Use of Gypsum. Fertilizers and Efficient Use of Water.

**Module Aims:** The students will be able to get an update on issues related to Plant Nutrition and Soil Fertility Integrated on Sustainable Land Use and Natural Resource Management.

**Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory Work ,
4. Seminar/ Workshop

**Learning Outcome:** The students will develop an insight into the Mineral Requirements, Media Preparations and Mineral Metabolism. All Agriculture Practices based on fertilization will be analyzed.

**Assessment Strategies (Theory) :**

The student will be assessed according to the following criteria

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended:

1. Taiz, L.D. and Zeiger, E. (2010). Plant Physiology. (5<sup>th</sup> Ed.), Sierauer Associates.
2. Barker, A.V. and Pilbeam, D.J. (2007). Hand Book of Plant Nutrition. CRC Press Washington D.C.
3. Epstein, E. and Bloom, J.A. (2005) Mineral Nutrition of Plants: Principles and Perspectives. (2<sup>nd</sup> Ed.), Sierauer Associates.
4. Tisdale, S. and Nelson, W. (2005). Soil Fertility and Fertilizers. (3<sup>rd</sup> Ed.), Mchillans.
5. Wallace, T. (2005). The Diagnosis of Mineral Deficiencies in Plants. Her Majesty's Stationery Office, London.

### **TITLE: ADVANCEBOTANY-LAB-VI (PLANT NUTRITION AND SOIL FERTILITY)**

### **CREDIT HOURS: 1**

**Syllabus Outline:** Study of different media for plant growth, macro and micronutrients, determination of total water requirements.

### **Course Outline:**

1. Sand and Water Culture Methods.
2. Study of Deficiency Symptoms of Macro and Micronutrient Elements.
3. Phenotypic Adaptations of plants to Nutrients, Deficiency and Methods of Growth Analysis.
4. Plant Tissue Analysis for Principle Inorganic Ions.
5. Determination of P, Ca and Mg Content of Soil.
6. Preparation of Fertilizer Mixtures.
7. Determination of total Water Requirements of a Crop by using Climatic Data (Blaney and Criddle Formula will be used).
8. Preparation of Standard Acid, Alkali and Indicator Solutions.

**Module Aims:** This Laboratory Course will help students to solve problems related to Soil Fertility and Fertilizers. Students will learn about various techniques of growing plants.

### **Learning Strategies:**



1. Lectures
2. Group Discussion
3. Laboratory Work
4. Seminar/ Workshop

**Learning Outcome:** Experiments based on Theory Syllabus will be explored. Students will be able to grow plants in different media. Students will be able to observe different symptoms due to deficiency of various nutrients in the media

**Assessment Strategies (Practical) :**

The student will be assessed according to the following criteria

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Books Recommended:**

1. Taiz, L.D. and Zeiger, E. (2010). Plant Physiology. (5<sup>th</sup> Ed.), Sierauer Associates.
2. Barker, A.V. and Pilbeam, D.J. (2007). Hand Book of Plant Nutrition. CRC Press Washington D.C.
3. Epstein, E. and Bloom, J.A. (2005) Mineral Nutrition of Plants: Principles and Perspectives. (2 Ed.), Sierauer Associates.
4. Tisdale, S. and Nelson, W. (2005). Soil Fertility and Fertilizers. (3<sup>rd</sup> Ed.), McMillans.
5. Wallace, T. (2005). The Diagnosis of Mineral Deficiencies in Plants. Her Majesty's Stationery Office, London.

## ADVANCE CHEMISTRY- IV (INORGANIC CHEMISTRY)

### CREDIT HOURS: 3

**Course Objectives:** Students will acquire knowledge about the physical and chemical properties of d- & f- block elements on the basis of their electronic configurations and will be able to work out structures of coordination compounds through development of understanding of coordinate compounds and chemical bonding.

#### 1. Pi- acceptor Ligands:

Transition metal carbonyls (Mononuclear, Binuclear, Polynuclear), synthesis, bonding situation based on spectroscopic evidences; Theoretical rationalization of molecular structures, (close, nido, erachno), Synthesis. Characteristics and reactivity of derivatives of metal carbonyls (carbonylate anions, carbonyl hydrides and carbonyl halides); Metal nitrosyls including halonitrosyl and their derivatives.

#### 2. Chemical bonding:

Metallic bond on the basis of band model, X-ray spectra and  $N(E)$  curves,  $n(E)$  curves. Binding energy in metals, conductors, semi-conductors and insulators. Effect of temperature and impurities on conductivity.

#### 3. Coordination Compounds: (Structure & Bonding)

Development of coordination compounds, Rules of inorganic nomenclature for acids, salts, radicals, ions, iso and heteropoly anions & compounds. Hybridization in coordination compounds with coordination number from 2 to 9. MO diagrams for metal complexes of common geometry. Important features of CFT, d-orbitals splitting for various common geometries, measurement of  $10 Dq$ , factors effecting  $10 Dq$ . CFSE, factors influencing magnitude of variation in lattice and hydration energy for ions of first transition series.

#### 4. The Covalent Bond (Structure & Reactivity):

- (a) VSEPR model followed by VB theory (Hybridization, Resonance etc.,) explanation of the structure of  $AB_2$ ,  $AB_3$ ,  $AB_2E$ ,  $AB_4$ ,  $AB_3E$ ,  $AB_2E_2$ ,  $AB_5$ ,  $AB_3E_3$ ,  $AB_6$ ,  $AB_5E$ ,  $AB_4E_2$ ,  $AB_7$ ,  $AB_6E$ ,  $AB_8$  and  $AB_9$  type molecules.
- (b) Discussion of molecular orbitals and molecular structures of homonuclear molecules and ions, heteronuclear diatomic and polyatomic molecules and ions.
- (c) Bent bond, bridge bond, four electrons-three centre bond.
- (d) Shielding effect and effective nuclear charge, Factors affecting the magnitude of  $\sigma$  and  $Z_{eff}$  and their variation in the period table, Applications of Slater's rules, Polarization of ions, Fajan's rules and its applications.

#### 5. Co-ordination compounds: (synthesis and properties)

Preparative methods. Techniques of studying complexes, stability constants. The spectrochemical series and colour of metal complexes. Diamagnetism and Paramagnetism, stereochemistry, John-Teller Theorem, Isomerism. Role of metal complexes in analytical chemistry, industry and nature.

#### 6. Chemistry of the Lanthanides and Actinides

Nomenclature, Position in periodic table, occurrence, Separation, and electronic configuration, oxidation States, Complex Formation, shapes of f-orbitals, applications.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### RECOMMENDED BOOKS:

1. J H Huheey, Inorganic Chemisry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008)
2. J. D. Lee, Concise Inorganic Chemistry, Elbs with Chapman and Hall, London
3. Introduction to Chemical Nomenclature by R.S. Cahn and O.E. dermer 2001. Butterworth (London).
4. Stereochemistry and bonding in Inorgnaic Chemistry by J.E. Ferguson 2001, Prentice Hall, New Jersey.
5. Chemical Bonds, and introduction to atomic and molecular structure by H.B. Gray 1973, W.A. Benjamin, Inc., London
6. Advanced Inorganic Chemistry F.A. Cotton and G.Wilkinson 6th Ed. 2001, Interscience, Publishers, London.
7. Coordination Compounds by S.F.A. Kettle, 1999, Nelson , (Nauohi Kenya).
8. Coordination Chemistry by B.A. Basallo and R. Johnson 1972 W.A. Benhamen, London.

#### ADVANCE CHEMISTRY LAB- IV (INORGANIC CHEMISTRY)

#### **CREDIT HOURS: 1**

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##### 1. Chromatographic Techniques:

- (a) Separation of metal ions by paper chromatography and their identification with the help of locating agents and comparison of R<sub>f</sub> values.
- (b) Separation of anions by paper chromatography and their identification.

##### 2. Aqueous acid-base Titrations:

- (a) Estimation of SO<sub>2</sub> and SO<sub>3</sub> in air and discharged from an industrial process.
- (b) Estimation of CO<sub>2</sub>
- (c) Estimation of oxalic acid and H<sub>2</sub>SO<sub>4</sub> in a mixture.
- (d) Estimation of H<sub>3</sub>BO<sub>3</sub> and NaH<sub>2</sub>BO<sub>3</sub> in a mixture.
- (e) Determination of %age composition of a mixture containing H<sub>3</sub>BO<sub>3</sub> and CH<sub>3</sub>COOH.

##### 3. Precipitation Titrations:

- Estimation of following anions with the help of adsorption indicators:
- (i) Chloride (ii) Bromide (iii) Sulphate (iv) Chloride and Iodide in a mixture.

##### 4. Complexometric Titrations:

- (a) Estimation of Mg<sup>+2</sup> Zn<sup>+2</sup> with EDTA (Direct titration).
- (b) Estimation of Ni<sup>+2</sup> with EDTA (Back titration).
- (c) Determination of Ca<sup>+2</sup> and Zn<sup>+2</sup> in mixture (Masking)
- (d) Determination of Cd<sup>2+</sup> and Zn<sup>+2</sup> in a mixture (Demasking).

(e) Determination of  $\text{SO}_4^{2-}$  and  $\text{PO}_4^{3-}$  with EDTA (Indirect titration).

**5. Redox Titrations:**

(a) Use of Ceric sulphate solution for the estimation of the following:-

- i). Determination of iron in an iron ore.
- ii). Determination of nitrites.

(b) Use of potassium iodate for the determination of the followings:

- (i) Copper
- (ii)  $\text{H}_2\text{O}_2$
- (iii) Commercial Hypochlorite

**6. Preparations:**

- (a) Tris (ethylenediamine ) nickle (II) Chloride 2-hydrate.
- (b) Sodium Cobaltinitrite.
- (c) Pot. Trioxalato Aluminate.
- (d) Ammonium sulphate Nickel (II) Sulphate.
- (e) Hexa aqua Chromium (III) Chloride.
- (f) Ammonium Sulphate Copper (II) Sulphate Pentahydrate.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**RECOMMENDED BOOKS:**

1. J. Bassett, R. C. Denny, G. H. Jeffery and J. Mendham, Vogel's Text Book of qualitative Inorganic Analysis, the English Language Book Society and Longman, New York, (2008)
2. Quantitative Analysis Chemistry, James S. Pritz, George H. Sehenk, 2001 Alby and Becon Inc. London.
3. Theory and practice of chromatography by Prof. Dr. Javed Iqbal (2002).
4. Instrumental analysis by Gary D. Christian and James E.O., Reilly, 2007, Allyn and bacon Inc., London.
5. Hand Book of Organic reagents in Inorganic Analysis by ZAVIX Holzbecher and other 1976 Ellis Hurwod Limited, London.
6. Experimental Inorganic Chemistry - W. G. Palmer, 2005.
7. The analysis of minerals and ores of the rarer elements – W. R. Schoeller, and A. R. Powell, Charles, Griffin and Company Limited, 2004.

## ADVANCE CHEMISTRY- V (ANALYTICAL CHEMISTRY)

### CREDIT HOURS: 3

**Course Objectives:** The main objectives of this course are to introduce the students to the basic principles, instrumental aspects and applications of separation and spectrophotometric analytical methods

#### 1. Introduction / Assessment of Analytical Data

Introduction and scope of Analytical Chemistry: Analytical problems and their solutions; The nature of analytical methods; trends in analytical methods; Different units of concentration and their conversion; Definition and basic concepts: nature and origin of errors, Classification of errors; Accuracy and Precision; Limits of detection, Confidence limits; Deviation, Standard deviation, Application of statistical tests; Rounding off analytical data; Quality control charts; Computation of analytical data. Significance of sampling, weighing and measuring in Analytical chemistry.

#### 2. Basic Chromatography Techniques

Classifications of Chromatographic Techniques, Paper and Thin Layer Chromatographic Techniques; their instrumentation, applications and limitations, Column Adsorption Chromatography.

#### 3. Introduction to Spectroscopy / Spectrophotometry

Introduction to Molecular spectroscopy, absorption in UV and Visible range; Basic principle of Spectrophotometry; Beer-Lambert's law; Deviations; Instrumentation and application.

#### 4. Ion Exchange Chromatography:

Cation Exchange resin, Anion Exchange resin, Cross-linkage, Effect of pH-separation of Amino Acids, Separation of metal ions on Anions Exchange Columns, Applications of ion Exchange Chromatography.

#### 5. Solvent Extraction:

Basic principle of solvent extraction, The Distribution Coefficient, The Distribution Ratio, The Percent Extracted Solvent Extraction of Metals, Analytical Separations, Multiple Batch Extractions, Countercurrent Distribution, Solid-Phase Extraction, Solvent Extraction by Flow Injection Analysis.

#### 6. Electrophoresis:

Capillary Zone Electrophoresis, Application of traditional Electrophoresis Gel Chromatography.

#### 7. Flame Emission:

Basic principle of atomic spectroscopy; Use of atomic spectra for detection and determination of elements; flame as a source of atomization and excitation; Instrumentation involved in FES; applications and limitations.

#### 8. Atomic Absorption Spectroscopy:

Basic Principle of AAS; Flameless AA spectroscopy including graphite furnace and hydride generation.



## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### RECOMMENDED BOOKS:

1. Analytical Chemistry by J.D. Dick, McGraw Hill, 1973, N.Y. also available in International students edition McGraw Hill, Mogakusha, 1973.
2. Instrumental Methods by W.Ewing, Mc Graw Hill Book Co. N.Y. (Third/Fourth Edition) also available in International students edition.
3. Chromatography by R.K Sharma, Gogel publishing home Meerut
4. Introduction to chromatography by Nasir-ud-din, Published by author
5. Paper chromatography by Dr. Friedrich Cramer, London Macmillan and Co Ltd
6. Thin-layer chromatography by Marini, Elsevier publisher
7. Modern analytical chemistry by David Harvey, Roohani-art press, Islamabad
8. Principle and Practice of analytical chemistry by Fillfield, Blackwell Science Ltd
9. Spectroscopy by Browning, Mcgraw Hill London
10. Fundamentals of Chromatography by H.G. Cassidy, Inter Science Publisher, London, N.Y.
11. Fundamentals of Analytical Chemistry by Douglas Skoog and Donald M. W. West, Holt Reinchart and Inc, London.

## ADVANCE CHEMISTRY LAB- V (ANALYTICAL CHEMISTRY)

### CREDIT HOURS: 1

#### 1. Calibration

Calibration of glassware (pipette, burette and flask) used for volumetric analysis. Use of analytical balance and calculation of standard deviation. Calibration of pH meter and determination of pH of various acidic and basic solution.  
Calibration of conductometer and determination of conductance of tap water, distilled water, conductivity water and canal water.  
Calculation of dissociation constants of various acids.  
Calculation of variance, mean, median, coefficient of variance of the data.

#### 2. Basic Chromatography

Separation of ink components by paper chromatography.  
Separation of amino acids by thin layer chromatography.  
Separation of dyes by column chromatography.  
Separation of mixtures by circular paper chromatography.

#### 3. Flame Emission / Spectrophotometry:

Determination of Sodium in tap water by using Flame Photometer.  
Determination of Potassium in tap water by using Flame Photometer.  
Find out the calcium in chalk sample by flame photometry.  
Determination of Ba by flame photometry.  
Estimation of purity of various compounds on the base of flame emission Spectrophotometry.  
Indirect determination of various compounds by flame photometric techniques.  
Determination of  $\lambda_{\text{max}}$  of  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  by using spectrophotometer.

Verification of Beer and Lambert Law.

Ultraviolet spectrophotometric determination of Aspirin, Phenacetone and Caffeine in APC tablet using Solvent Extraction.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### RECOMMENDED BOOKS:

1. Vogel's text book of quantitative inorganic analysis by J. Bassett. The English language book Society and Longman.
2. Introduction to chromatography by Nasir-ud-din, Published by author.
3. Paper chromatography by Dr.Friedrich Cramer, London Macmillan and Co Ltd.
4. Thin- layer chromatography by Marini, Elsevier publisher.

## ADVANCE CHEMISTRY- VI (ORGANIC CHEMISTRY)

### CREDIT HOURS: 3

**Course Objectives:** Students will gain knowledge about the stereochemical behavior of organic molecules and acquire an ability to propose mechanism of simple reactions.

**1. Acid-base strength:**

pKa and Ka values, electronic effects (Inductive and resonance effects), field effect, solvent effect, hyper-conjugation, hydrogen bonding, steric and stereo-chemical effects, and hybridization.

**2. Stereochemistry**

**(a) Conformation Analysis**

The concept of conformational analysis in ethane, propane, n-butane, pentane, cyclopentane, cyclohexane, substituted alkanes, substituted cycloalkanes and decalins.

**(b) Optical isomerism:**

Configuration, Chirality and symmetry, optical isomerism upto three chiral carbon atoms, enantiomers and diastereomers, R and S nomenclature, Racemates, Racemization and Resolution of Racemates, epimerization. Walden inversion, Stereoisomerism in biphenyls, allenes and spiro-compounds

**(c) Geometrical isomerism**

Cis & Trans, and Z & E conventions, Determination of configuration, Geometrical isomerism in cyclic compounds.

**3. Active Methylene Compounds:**

Alkylation, arylation, and acylation of active methylene compounds, Acid and base catalysed aldol condensation. Conditions, mechanism and synthetic applications of the following reactions; Claisen, Claisen Schmidt, Knoevenagel, Perkin, Reformatsky, and Stobbes condensations, Darzen's glycosidic ester synthesis, Mannich and Wittig reactions.

**4. Free radical Reactions:**

Introduction, generation methods, relative stability, structure, free radical reactions and industrial applications.

**5. Oxidation and Reduction reactions:**

**a. Oxidation Reactions:**

Introduction, Oxidation of saturated hydrocarbons, olefinic double bonds, aromatic rings, systems containing oxygen such as alcohols, aldehydes, ketones, oxidative decarboxylation, of acids, oxidation of systems containing nitrogen such as amines, hydrazines etc..]

**b. Reduction Reactions:**

Introduction, Reduction of alkenes, alkynes, and aromatic rings, hydrogenolysis, reduction of benzylic and allylic systems, aldehydes and ketones, alcohols, pinacols, epoxides, acids and their derivatives, Reduction of system containing nitrogen such as imines, oximes and nitro compounds

**6. Spectroscopy:**

**a. IR Spectroscopy:**

Electromagnetic radiations: IR; modes of vibration, sampling techniques, factors influencing the vibration frequencies and industrial applications

**b. UV Spectroscopy:**

Ultraviolet (UV) or electronic spectroscopy: electronic transition; factors influencing the  $\lambda_{\text{max}}$  value.



#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### RECOMMENDED BOOKS:

1. Organic Chemistry, Volume I (6th ed.) & II (5th ed.) by I.L. Finar, Pearson Education (singapore) Pte Ltd, 2008.
2. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 6th ed. by Michael B. Smith, Jerry March, Wiley, 2007.
3. Organic Chemistry, 6th Ed.; by S. H. Pine, McGraw Hill: New York, 1987.
4. Organic Chemistry 6th ed. by Francis A. Carey, McGraw Hill, 2005.
5. Organic Chemistry 6th ed. by R. T. Morrison, R. N. Boyd, and R. K. Boyd, Benjamin Cummings, 1992.
6. Modern Synthetic Reactions 2nd ed. by H.O. House, W.A. Benjamin Inc., Menlo Park, CA
7. Principles in Organic Synthesis by R.O.C Norman & J. M. Coxon, 1993, Chapman and Hall, 1993.
8. Organic Chemistry by Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press 2000.
9. Spectroscopic Methods in Organic Chemistry 6th ed. by D. Williams and I. Fleming. Wiley-VCH, 1991.
10. Spectrometric identification of Organic Compounds 6th ed. by R. M. Silverstein and F. X. Webster, Wiley, 2007.
11. Organic Spectroscopy and Chromatography by M Younas, ILMI, Pakistan, 2007.

### ADVANCE CHEMISTRY LAB- VI (ORGANIC CHEMISTRY)

#### CREDIT HOURS: 1

#### 1. Organic Preparations:

- a. Benzyl alcohol; Ethyl benzene; benzilic acid, p-Nitrophenol, acetophenone oxime, acetophenone arylHydrazone.
- b. Synthesis of compounds containing nitro, halogeno, amino, carboxylic and carbonyl functionalities (depends upon the availability of chemicals).

#### 2. Quantitative and Qualitative Analysis of Organic compounds:

- a. Estimation of glucose, and Number of acetyl groups,
- b. Physical/ Chemical separation of mixture containing two compounds, identification and derivitization.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**RECOMMENDED BOOKS:**

1. Practical Organic Chemistry by F. G. Mann and B. C. Saunders, Longman, UK, 1978
2. Vogel's Textbook of Practical Organic Chemistry (5th ed.) by A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, 1989, Longman UK, 1989.
3. The Systematic Identification of Organic Compounds, (8th ed.) by Ralph L. Shriner et al., Wiley, 2003.
4. Advanced Practical Organic Chemistry, by J. Leonard, B. Lygo, G. Procter, CRC, 1994.
5. Advanced Practical Organic Chemistry (2nd ed.) by N. K. Vishnoi, Vikas Publishing House Pvt Ltd , India, 1996.

**Course Title: Advance Mathematics- IV (Mechanics)**

**Course Rating: 4 Cr. Hours**

**Vector Integration**

- Line integrals
- Surface area and surface integrals
- Volume integrals

**Integral Theorems**

- Green's theorem
- Gauss divergence theorem
- Stoke's theorem

**Curvilinear Coordinates**

- Orthogonal coordinates
- Unit vectors in curvilinear systems
- Arc length and volume elements
- The gradient, Divergence and curl
- Special orthogonal coordinate systems

**Tensor Analysis**

- Coordinate transformations
- Einstein summation convention
- Tensors of different ranks
- Contravariant, Covariant and mixed tensors
- Symmetric and skew symmetric tensors
- Addition, Subtraction, Inner and outer products of tensors
- Contraction theorem, Quotient law
- The line element and metric tensor
- Christoffel symbols

**Non Inertial Reference Systems**

- Accelerated coordinate systems and inertial forces
- Rotating coordinate systems
- Velocity and acceleration in moving system: Coriolis, Centripetal and transverse acceleration
- Dynamics of a particle in a rotating coordinate system

**Planar Motion of Rigid Bodies**

- Introduction to rigid and elastic bodies, Degrees of freedom, Translations, Rotations, instantaneous axis and center of rotation, Motion of the center of mass
- Euler's theorem and Chasle's theorem
- Rotation of a rigid body about a fixed axis: Moments and products of inertia of various bodies including hoop or cylindrical shell, circular cylinder, spherical shell
- Parallel and perpendicular axis theorem

- Radius of gyration of various bodies

### **Motion of Rigid Bodies in Three Dimensions**

- General motion of rigid bodies in space: Moments and products of inertia, Inertia matrix
- The momental ellipsoid and equimomental systems
- Angular momentum vector and rotational kinetic energy
- Principal axes and principal moments of inertia
- Determination of principal axes by diagonalizing the inertia matrix

### **Euler Equations of Motion of a Rigid Body**

- Force free motion
- Free rotation of a rigid body with an axis of symmetry
- Free rotation of a rigid body with three different principal moments
- Euler's Equations
- The Eulerian angles, Angular velocity and kinetic energy in terms of Euler angles, Space cone
- Motion of a spinning top and gyroscopes- steady precession, Sleeping top

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

1. G. E. Hay, *Vector and Tensor Analysis*, (Dover Publications, Inc., 1979)
2. G. R. Fowles and G. L. Cassiday, *Analytical Mechanics*, (Thomson Brooks/Cole, 2005)
3. H. Goldstein, C. P. Poole and J. L. Safko, *Classical Mechanics*, (Addison-Wesley Publishing Co., 2001)
4. M. R. Spiegel, *Theoretical Mechanics*, (McGraw Hill Book Company, 1980)
5. M. R. Spiegel, *Vector Analysis*, (McGraw Hill Book Company, 1981)
6. D. C. Kay, *Tensor Calculus*, (McGraw Hill Book Company, 1988)
7. E. C. Young, *Vector and Tensor Analysis*, (Marcel Dekker, Inc., 1993)
8. L. N. Hand and J. D. Finch, *Analytical Mechanics*, (Cambridge University Press, 1998)

**Course Title: Advance Mathematics- V (Topology & Functional Analysis)**  
**Course Rating: 4 Cr. Hours**

**Topology**

- Definition and examples
- Open and closed sets
- Subspaces
- Neighborhoods
- Limit points, Closure of a set
- Interior, Exterior and boundary of a set

**Bases and Sub-bases**

- Base and sub bases
- Neighborhood bases
- First and second axioms of countability
- Separable spaces, Lindelöf spaces
- Continuous functions and homeomorphism
- Weak topologies, Finite product spaces

**Separation Axioms**

- Separation axioms
- Regular spaces
- Completely regular spaces
- Normal spaces

**Compact Spaces**

- Compact topological spaces
- Countably compact spaces
- Sequentially compact spaces

**Connectedness**

- Connected spaces, Disconnected spaces
- Totally disconnected spaces
- Components of topological spaces

## **Metric Space**

- Review of metric spaces
- Convergence in metric spaces
- Complete metric spaces
- Completeness proofs
- Dense sets and separable spaces
- No-where dense sets
- Baire category theorem

## **Normed Spaces**

- Normed linear spaces
- Banach spaces
- Convex sets
- Quotient spaces
- Equivalent norms
- Linear operators
- Linear functionals
- Finite dimensional normed spaces
- Continuous or bounded linear operators
- Dual spaces

## **Inner Product Spaces**

- Definition and examples
- Orthonormal sets and bases
- Annihilators, Projections
- Hilbert space
- Linear functionals on Hilbert spaces
- Reflexivity of Hilbert spaces

## **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## **Recommended Books**

1. J. Dugundji, *Topology*, (Allyn and Bacon Inc., 1966)
2. G. F. Simmon, *Introduction to Topology and Modern Analysis*, (McGraw Hill Book Company, 1963)
3. Stephen Willard, *General Topology*, (Addison-Wesley Publishing Co., 1970)
4. Seymour Lipschutz, *General Topology*, (Schaum's Outline Series, McGraw Hill Book Company, 2004)

5. E. Kreyszig, *Introduction to Functional Analysis with Applications*, (John Wiley and Sons, 2006)
6. A. L. Brown and A. Page, *Elements of Functional Analysis*, (Van Nostrand Reinhold, 1970)
7. G. Bachman and L. Narici, *Functional Analysis*, (Academic Press, 1966)
8. F. Riesz and B. Sz. Nagay, *Functional Analysis*, (Dover Publications, Inc., 1965)

Course Title: Advance Mathematics- VI (**Advanced Analysis**)  
 Course Rating: 4 Cr. Hours

### **Advanced Set Theory**

- Equivalent Sets
- Countable and Uncountable Sets
- The concept of a cardinal number
- The cardinals  $\aleph_0$  and  $c$
- Addition and multiplication of cardinals
- Cartesian product, Axiom of Choice, Multiplication of cardinal numbers
- Order relation and order types, Well ordered sets, Transfinite induction
- Addition and multiplication of ordinals
- Statements of Zorn's lemma, Maximality principle and their simple implications

### **Measure Theory**

- Outer measure, Lebesgue Measure, Measureable Sets and Lebesgue measure, Non measurable sets, Measureable functions

### **The Lebesgue Integral**

- The Rieman Integral, The Lebesgue integral of a bounded function
- The general Lebesgue integral

### **General Measure and Integration**

- Measure spaces, Measureable functions, Integration, General convergence theorems
- Signed measures, The  $L_p$ -spaces, Outer measure and measurability
- The extension theorem
- The Lebesgue Stieltjes integral, Product measures

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

1. D. Smith, M. Eggen and R. ST. Andre, *A transition to Advanced Mathematics*, (Brooks Cole, 2004)
2. Seymour Lipschutz, *Set Theory and Related Topics*, (McGraw Hill, 1964)
3. Frankel, A. *Abstract Set theory*, (North Holland Publishing Co., 1961)
4. Royden, H. L. *Real Analysis*, (Prentice Hall, 1988)
5. Suppes, P. *Axiomatic Set Theory*, (Dover Publications Inc., May 1973)
6. Halmos, P. R. *Naive Set Theory*, (Springer, 1974)
7. Halmos, P. R. *Measure Theory*, (Springer, 1974)



8. Rudin, W. *Real and Complex Analysis*, (McGraw-Hill Higher Education, 1987)

# ADVANCE PHYSICS 4(MATHEMATICAL METHOD OF PHYSICS-2)

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**PRE-REQUISITE: Mathematical Method of Physics I**

**INTRODUCTION: CREDITE HOURS: 4**

A Course in Mathematical Methods for Physicists helps students understand the mathematical techniques needed for their future studies in physics. It provides an accessible account of most of the current, important mathematical tools required in physics these days. It is assumed that the reader has an adequate preparation in general physics and calculus. The course contents bridge the gap between an introductory physics course and more advanced courses in classical mechanics, electricity and magnetism, quantum mechanics, and thermal and statistical physics. It contains a large number of worked examples to illustrate the mathematical techniques developed and to show their relevance to physics.

## **COURSE OBJECTIVE:**

To give the understanding of Differential equations and their uses in Physics, Introduction to special functions, Fourier series, Fourier Transforms, Solution of Boundary value problems and their uses.

## **TOPICS COVERED:**

**Green's Function:**

**Functions of Complex Variable:**

**Fourier Series and Transforms:**

## **COURSE OUTLINE:**

**Green's Function:**

Definition, Green's functions for the Sturm-Liouville operator Green's functions in electrodynamics.

**Functions of Complex Variable:**

Complex functions, analyticity, Cauchy-Riemann equations, multivalued functions, Cauchy's integral formula, Taylor and Laurent series, the residue theorem and its applications.

**Fourier Series and Transforms:**

Fourier series and its complex form, applications of Fourier series, representations of a function, properties of Fourier transforms, Fourier integral theorem, Fourier sine and cosine transforms, applications of Fourier transforms, Laplace transform.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**REFERENCE BOOKS:**

1. Mathematical Methods for Physics and Engineering, F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press, (1997).
2. Mathematical Physics by E. Butkov, Addison-Wesley Publishing Company, (1968).
3. Mathematical Methods for Physicists by G. Arfken and H. J. Weber, Academic Press, (1995).
4. Applied Mathematics for Engineers and Physicists by L.A. Pipes and L.R. Harvill, McGraw-Hill Book Company, (1970).
5. Mathematics of Classical and Quantum Physics Volume II, By F.W. Byron Jr. and R.W Fuller Addison-Wesley Publishing Company, (1970).
6. Complex Variable by M. R. Spiegel, Schaum Publishing Company, (1970)

# ADVANCE PHYSICS 5(QUANTUM MECHANICS-2)

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**PRE-REQUISITE: Quantum Mechanics I**

**INTRODUCTION: CREDITE HOURS: 4**

This course covers the experimental basis of quantum physics. It introduces wave mechanics, Schrödinger's equation in a single dimension, and Schrödinger's equation in three dimensions.

## **COURSE OBJECTIVE:**

It covers fundamental concepts of quantum mechanics: wave properties, uncertainty principles, Schrödinger equation, and operator and matrix methods. Basic applications of the following are discussed: one-dimensional potentials (harmonic oscillator), three-dimensional centro symmetric potentials (hydrogen atom), and angular momentum and spin. The course also examines approximation methods: variational principle and perturbation theory.

## **TOPICS COVERED:**

- 1. Central Potential:**
- 2. Spin and Statistics:**
- 3. Approximation Methods in Quantum Mechanics:**
- 4. Formal Theory of Quantum Systems:**

## **COURSE OUTLINE:**

### **Central Potential:**

Motion in a central potential, the hydrogen atom, energy spectrum, quantum numbers and degeneracies.

### **Spin and Statistics:**

The Zeeman effect, matrix operators, spin statistics and exclusion principle, Pauli's two components formalism, identical particles, fermions and bosons, symmetry and antisymmetry of wavefunctions.

### **Approximation Methods in Quantum Mechanics:**

Time independent perturbation theory, simple applications, damped linear harmonic oscillator, hydrogen like atoms in magnetic field, time dependent perturbation theory, transition probability, emission and absorption of radiation, WKB approximation and its applications, variational method and its applications.

### **Formal Theory of Quantum Systems:**

Hilbert space, operators and state vectors, bras and kets, orthonormality, Dirac delta-function, completeness, expectation value, degeneracy, compatible and incompatible observables, discrete and continuous spectra generalized uncertainty relation,

harmonic oscillator, ladder operators, Schrodinger's equation of motion, Heisenberg's equations of motion, constants of motion, parity, conservation laws and invariance.

#### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### **REFERENCE BOOKS:**

1. Introductory Quantum Mechanics by R. L. Lieboff` Holden-Day, San Francisco (1980)
2. Qunatum Mechanics Vol I,II by C.Cohen-Tannoudji, B. Diu, F. Laloe, Wiley (1977).
3. Quantum Physics by S. Gasiorowicz, Wiley (1996).
4. Introduction to Quantum Mechanics by Dicke, Wittke, Addison-Wesley (1974).
5. Quantum Mechanics by Sokoev, Ternou, Holt, Rinehart & Winston (1996).
6. Quantum Mechanics by J. L. Powell and B. Crasemann, Addison-Wesley, (1961).

# ADVANCE PHYSICS 6 (CLASSICAL ELECTRODYNAMICS)

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**PRE-REQUISITE:** Undergraduate level Electricity and Magnetism

**INTRODUCTION: CREDITE HOURS: 3+1**

Understanding electromagnetic fields is essential to our understanding the world around us. The most fundamental processes in nature, from the forces that determine the structure of atoms and molecules to the phenomena of light to nerve impulses in living systems, depend on electric and magnetic fields.

It is fundamental to current and future technologies. Motors, power generation and transmission, electronics, sensors, and communication – both wired and wireless – involve the manipulation of electric or magnetic fields. There are few advances in technology that can be made without the use of electronic circuits or electric and magnetic fields.

## **COURSE OBJECTIVE:**

The objective of the course is to present a theory of classical electrodynamics. Thus, Maxwell equations and their consequences are considered in great detail and presented pedagogically following Griffiths textbook.

## **TOPICS COVERED:**

**Electrostatics:**

**Electric Current:**

**Magnetic Properties of Matter:**

**Maxwell's Equations and their Applications:**

## **COURSE OUTLINE:**

**Electrostatics:**

Electric dipole, potential energy of a dipole in an electric field, mutual energy of two dipoles, force and couple on the dipole placed in an external electric field, multipole expansion of electric fields external field of a dielectric displacement vector, electric susceptibility and dielectric constant, boundary conditions on the field vectors, potential energy of a group of point charges, electrostatic energy of a charge distribution, energy of an electrostatic field, energy of a system of charged conductors, stress in the electrostatic field and dielectric media, coefficients of potential, capacitance and inductance.

Equation of Poisson and Laplace, applications of Laplace's equation to problems (conductors and dielectrics) having spherical cylindrical and cartesian symmetry,

electrical images (conductors and dielectrics).

### **Electric Current:**

Nature of the current, current density and equation of continuity, Ohm's law, steady current in media without sources of e.m.f., approach to electrostatic equilibrium.

Magnetic induction, force on current carrying conductors, Biot-Savart law, Ampere's circuital law, the magnetic vector and scalar potentials, the magnetic field of a distant circuit.

### **Magnetic Properties of Matter:**

Magnetisation, vectors  $M$  and  $H$  produced by magnetized materials field equation, boundary conditions on the field vectors.

### **Maxwell's Equations and their Applications:**

Maxwell's equations and the generalization of the Ampere's law, electromagnetic energy, vector and scalar potentials, gauge transformations (Lorentz gauge, coulombs guage). pressure of radiations, Green's function for time dependent wave equation, retarded scalar and vector potentials, radiation from an oscillating dipole, plane electromagnetic wave, plane waves in a conducting and non-conducting media, linear and circular polarization, and superposition of waves in one dimension, boundary conditions, reflection and refraction of electromagnetic waves at a plane interface between dielectrics, waves polarization by reflection and total internal reflection, reflection from a conducting medium, covariant formulation of electrodynamics, transformation laws of electro magnetic fields, the field of a uniformly moving and accelerated electron.

### **Practical:**

1. To study some aspects of Ferromagnetism by drawing B. H. curve.
2. Measurement of speed of light using laser source rotating mirror method.
3. To determine  $e/m$  of an electron using a fine beam tube.
4. To determine charge of an electron by Millikan's oil drop method.

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **REFERENCE BOOKS:**

1. Classical Electrodynamics by Jackson, John Wiley & Sons, (1975).
2. Electricity and Magnetism by W. J. Duffin , McGraw-Hill, (1990).
3. Electromagnetism by I.S. Grant and W. R. Phillips, John Wiley & Sons (1990).
4. Introduction to Electrodynamics by D. Griffiths Prentice Hall, (1989).
5. Foundation of Electromagnetic Theory, 4th edition by Reitz, Milford and Christy, Addison Wesley, (1993).

## ADVANCE ZOOLOGY IV (EVOLUTION AND PRINCIPLES OF SYSTEMATICS)

**CREDIT HOURS: 3+1**

### **Objectives:**

- The course is designed to provide in depth knowledge or origin of life, and about forces responsible for evolutionary changes.
- The students will be taught basic rules and regulations about the identification and naming of organisms.

*Note: Evolution and Principles of Systematic Zoology 60% and 40% weightage, respectively. Three questions from Evolution and two questions from Systematic will be attempted by the students.*

### **Course Contents**

**Evolution:** The nature and origin to life. Evidences of evolution. (molecular, embryological & paleontological). Theories to explain the diversity of life - Modern synthetic theory. Factors initiating elementary evolutionary changes (micro-evolution) by changing gene frequencies, mutation pressure, selection pressure, immigration and crossbreeding, genetic drift. Role of isolation in evolution. Factors of large evolutionary changes (macro/mega evolution)- allometry, orthogenesis, adaptive radiation.

**Modern concept of Natural Selection:** Levels of selection, selection patterns, laboratory and field example regarding action of Natural Selection. Action of Natural Selection leading to convergence, radiation, regression and extinction, Batesian mimicry, Mullerian mimicry. Sexual selection: Darwin's concept, Fisher's view, Zahavi's handicap theory. Recapitulation theory, Trend and rates in evolution.

**Systematic Zoology:** Contribution of systematics to Biology: History of Taxonomy (Downward classification, upward classification, impact of the origin of species, population systematics, current trends); Microtaxonomy, phenon, Taxon; Taxonomic categories: specific category, infraspecific category, higher categories; species concepts (Typological concept; nominalistic concept, Biological concept, evolutionary concept), species mate recognition concept; non- dimensional species concept; Multidimensional species concept; Cohesion species concept; Difficulties in the application of biological species concepts; polytypic species, subspecies, super species, sibling species; study of major type of variation within a single population. Speciation and taxonomic decision, various types of characters, cladistic analysis, Macrotaxonomy; different kinds of taxonomic characters; Taxonomic collection and identification; definitions of Synonym, Homonym, Keys; Evolution of the theory of Nomenclature; interpretation and application of the code (stability, priority, first revisor principle) range of authority of code; concept of availability, type method formation of specific names.



### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Books Recommended Evolution**

Dobzhansky, T. (1951). *Genetics and the Origin of Species*, New York: Columbia University Press.

Dobzhansky, T., Ayala, F. J., Stebbins, G. L., & Valentine, J. W. (1973). *Evolution*. W.H. Freeman and Company.

Mayr, E. (1965). *Populations, Species and Evolution*. Harvard University Press.

Moody, P. A. (1989). *Introduction to Evolution*. New York: Harper and Row Publishers.

Ridley, M. (1993). *Evolution*. Blackwell Scientific Publications.

Strickberger, M. W. (2000). *Evolution*. Jones & Barrett Publishers.

### **Systematic Zoology**

Heywood, V. H. (1975). *Taxonomy and Ecology*. London: Academic Press.

Mayer, E. & Asblock, P. D. (1991). *Principles of Systematic Zoology*. New York: McGraw Hill.

Mayer, E. (1994). *Principles of Systematic Zoology*. New York: McGraw Hill.

Mayr, E. (1985). *Animal Species and Evolution*. Harvard University Press.

Whili, M. J. D. (1978). *Modes of Speciation*. San Francisco: W.H. Freeman and Co.

## ADVANCE ZOOLOGY IV (EVOLUTION AND PRINCIPLES OF SYSTEMATICS)

### PRACTICALS

1. Study of preserved invertebrate species and their classification upto class level.
2. Collection, preservation and identification of common species with the help of keys. Methods of statistical analysis of samples from populations T-test, Analysis of variance etc.
3. Preparation of keys for the identification of specimens.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Books Recommended Evolution

Dobzhansky, T. (1951). *Genetics and the Origin of Species*, New York: Columbia University Press.

Dobzhansky, T., Ayala, F. J., Stebbins, G. L., & Valentine, J. W. (1973). *Evolution*. W.H. Freeman and Company.

Mayr, E. (1965). *Populations, Species and Evolution*. Harvard University Press.

Moody, P. A. (1989). *Introduction to Evolution*. New York: Harper and Row Publishers.

Ridley, M. (1993). *Evolution*. Blackwell Scientific Publications.

Strickberger, M. W. (2000). *Evolution*. Jones & Barrett Publishers.

#### Systematic Zoology

Heywood, V. H. (1975). *Taxonomy and Ecology*. London: Academic Press.

Mayer, E. & Asblock, P. D. (1991). *Principles of Systematic Zoology*. New York: McGraw Hill.

Mayer, E. (1994). *Principles of Systematic Zoology*. New York: McGraw Hill.

Mayr, E. (1985). *Animal Species and Evolution*. Harvard University Press.

Whili, M. J. D. (1978). *Modes of Speciation*. San Francisco: W.H. Freeman and Co.

## ADVANCE ZOOLOGY V (BIOCHEMISTRY)

CREDIT HOURS: 3+1

### Objectives:

The course will provide in depth knowledge about the polymerized organic compounds of life. The dynamism of the life proceeds with inter- conversion of the chemicals from feeding to the liberation of energy for work. It will deal with the inter-conversion is performed by various tools called as enzymes. Thus, in this course the concepts of the chemical basis of life and all the mechanisms involved in harvesting of energy for growth, duplication etc., are given.

### Course Contents

**Amino acids, peptides and proteins:** standard amino acids, their structure and classification; acid/base properties of amino acids and their titration curves; natural modifications of amino acids in proteins; non- standard amino acids, their structure and role; peptides, their ionic behavior and amino acid composition, cytochrome c; Macromolecular separation techniques in biochemistry; ion exchange chromatography; isoelectric focusing; density gradient centrifugation.

**Enzymes:** introduction; important characteristics of enzymes; immobilized enzymes; how enzymes work; example of enzymatic reaction; enzyme kinetics, enzyme rate of reaction and substrate concentration, how ph and temperature effect enzyme activity; kinetics of bisubstrate and multisubstrate reactions.

**Carbohydrates:** classification, types, important characteristics and structure of carbohydrates; history of developments in structure of glucose; monosaccharides; cyanohydrin formation; disaccharides their types structure and function; polysaccharides, storage and structural types; structure and major functions of polysaccharides.

**Lipids:** fatty acids, their types and major characteristics; storage lipids, acylglycerols; waxes; structural lipids in membranes; major functions of lipids; lipoproteins, their types and major functions.

**Vitamins and cofactors:** occurrence, structure and biochemical function of vitamins of b-complex group.

**Bioenergetics:** concept of free energy; standard free energy change: energy rich compounds.

**Metabolism:** detailed description of glycolysis and catabolism of other hexoses;

regulation and bioenergetics of glycolysis. Anabolic role of glycolysis; fate of pyruvate under aerobic and anaerobic conditions, lactate, acetyl CoA and ethanol formation; alcoholic fermentation; gluconeogenesis, its regulation and significance in the tissues; feeder pathways in glycolysis; utilization of other carbohydrates in glycolysis; phosphorylation of glycogen and starch; regulation of glycogen metabolism; utilization of dietary polysaccharides (starch) and disaccharides (sucrose and galactose). Biosynthesis of glycogen, starch and sucrose.

**Citric acid (TCA) cycle:** conversion of pyruvate to acetyl CoA, pyruvate dehydrogenase, a multi-enzyme complex; detailed description of citric acid cycle; bioenergetics and conservation of energy produced in the cycle. Anabolic or biosynthetic role of citric acid cycle intermediates; replenishing or anaplerotic reactions and their role; regulation of citric acid cycle

**Lipid metabolism:** oxidation of fatty acids; digestion, mobilization and transport of fats; biosynthesis of triacylglycerol; utilization of triacylglycerol; activation of fatty acids and their transportation to mitochondria; beta-oxidation; bioenergetics of beta-oxidation; oxidation of unsaturated and odd chain fatty acids; omega oxidation pathway; biosynthesis of saturated fatty acid, supply of raw material for palmitic acid synthesis; fatty acid synthetase (FAS) multienzyme complex; biosynthesis of unsaturated fatty acids. Ketone bodies their biosynthesis, utilization and role in the tissues; cholesterol metabolism: cholesterol biosynthesis and its regulation; steroid hormones.

**Nitrogen metabolism:** metabolic fate of amino acids; catabolism of amino acids; deamination and transamination; nitrogen excretion and urea cycle; regulation of urea cycle; Biosynthesis of some amino acids; incorporation of ammonia in glutamate and glutamine; purine and pyrimidine.

#### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### Books Recommended

Lubert, S. (1995). *Biochemistry*, (4<sup>th</sup> ed.), New York: W.H. Freeman & Company.

McKee, T. & McKee, J.R. *Biochemistry*, (2003). *The molecular basis of life*. (3<sup>rd</sup> ed.), McGraw Hill.

Murray, R. K., Granner, D.K., Mayer, P.A. & Rodwells, V.W. (2000). *Harper's Biochemistry*, (25<sup>th</sup> ed.), New York: McGraw Hill.

Nelson, D. L. & Cox, M.M. *Lehninger*, (2000). *Principles of Biochemistry*, (3<sup>rd</sup> ed.),

New York: McMillan Worth Publishers.

Voet. D., Voet, J.G., & Pratt, C.W. (1999). *Fundamentals of Biochemistry*, New York: John Wiley and Sons, Inc.

Zubay, G. (1995). *Biochemistry*, (4<sup>th</sup> ed.), Oxford, England: Wm. C. Brown Publishers, Inc.

## ADVANCE ZOOLOGY V (BIOCHEMISTRY) PRACTICALS

1. Preparation of standard curve for glucose by *ortho*-Toluidine method.
2. Tests for detection of carbohydrates in alkaline and acidic medium.
3. Tests for detection of Disaccharides.
4. Detection of Non-Reducing sugars in the presence of Reducing sugars.
5. Demonstration of Acid Hydrolysis of Polysaccharide.
6. Separation and identification of various types of sugars, fatty acid and amino acid ThinLayer Chromatography (TLC).
7. Determination of pKa values of an amino acid by preparation of titration curves.
8. Biochemical tests for detection of different amino acids.
9. Separation of various protein fractions by precipitation method.
10. Demonstration of differential solubility of lipids in various solvents.
11. Quantitative analysis of phospholipids by estimation of inorganic phosphorous.
12. Quantitative analysis of Amylase activity from blood serum or liver.
13. Study on the effect of temperature on the enzymatic rate of reaction

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

Plummer, David T.(1990). *An introduction to practical biochemistry*, (4<sup>th</sup>ed.), London: McGraw-Hill Book Company.

Wilson,K&Walker, J.(1994). *Practical Biochemistry: Principles and Techniques*,(4<sup>th</sup>ed.), Cambridge University Press.

## ADVANCE ZOOLOGY VI (ENVIRONMENTAL BIOLOGY)

**CREDIT HOURS: 3+1**

### Objectives:

The aim of this course is to make the students aware that all the living organisms including human beings are part of the environment, which consists of biotic and abiotic factors. The abiotic factors consist of all the physical factors while biotic factors include all the living things. However with the increase in population densities increase in productivity is also needed. High technology measures used for this purpose have caused various problems like pollution.

### Course Contents

An overview of concepts of ecosystem with emphasis on interaction and homeostasis. Basic global ecosystems (atmosphere, hydrosphere, lithosphere, ecosphere). Biogeochemical cycle: nitrogen, phosphorus, sulphur, water, carbon, nutrient. Limiting factors: basic concepts, temperature, soil, water and humidity, light, fire. Energy: laws of thermodynamics, primary and secondary productions, trophic levels and energy variation with increasing trophic levels, energy flow, food chains and food webs. Population ecology: basic population characters, growth and growth curves, population dynamics and regulations. Community ecology: basic concepts, community analysis, ecotones, inter-population interactions. Ecological niche: basic concepts and types. An overview of major biomes of the world. Applied Ecology: Resources and their ecological management (mineral, agricultural and forest, range management, desalination and weather modification, landscape and land use); Pollution (definition, types, cost, origin and management); water (sources, domestic and industrial pollution, heavy metals, water purification, waste water treatment); air (sulphur dioxide, nitrogen oxide, carbon monoxide, ozone, smog and PAN, MTBE & CFCs); land pollution (pesticides, bacterial toxins, synthetic hormones); noise pollution. Radiation. Space biology. Contemporary environmental themes: (ozone depletion, acid rain, green house effect and global warming, desertification, deforestation, exotic and invasive species, radioactivity leakage, environmental laws).

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

Chapman, J. L. & Reiss, M. J. (1997). *Ecology: principles and applications*. Cambridge Univ. Press, UK.

- Cox, C. B. & Morre, D. (2000). *Biogeography: an Ecological and Evolutionary Approach*, (6<sup>th</sup>ed.), Life Sciences King's College, London, UK.
- Dondson, S.I., Allen, T.F.N., Carpenter, S.R., Ives, A., Jeanne, R.L., Kitchell, J.F., Langston, N.E. & Turner, M.G., (1998). *Ecology*. UK: Oxford Univ. Press.
- Molles, M.C. (2005). *Ecology: Concepts and Applications*. (6<sup>th</sup>ed.), New York, USA: McGraw Hill.
- Newman, I. (1993). *Applied Ecology*. UK: Black Well Scientific Publications Oxford.
- Odum, E. P. (1994). *Fundamentals of Ecology*. (3<sup>rd</sup>ed.), Philadelphia: W.B. Saunders.
- Slingsby, D. & Cook, C., (1986). *Practical Ecology*. UK: McMillan Education Ltd.
- Smith, R.L. (1980). *Ecology And Field Biology*, Harper and Row.



## ADVANCE ZOOLOGY VI (ENVIRONMENTAL BIOLOGY) PRACTICALS

1. Measurement of environmental factors on land, water and air.
2. Study of different ecosystems: pond, agricultural or grassland, forest.
3. Community analysis through different sampling techniques (quadrat, Transect).  
Population dynamics of grasshoppers.
4. Adaptive features of animals in relation to food and environment.
5. Food chain studies through analysis of gut contents.
6. Analysis of polluted and fresh water for biotic and abiotic variations.
7. Field visits for study of selected terrestrial habitat and writing notes.
8. Development of an ecological management plan of some selected area.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

Chapman, J. L. & Reiss, M. J. (1997). *Ecology: principles and applications*. Cambridge Univ. Press, UK.

Cox, C. B. & Morre, D. (2000). *Biogeography: an Ecological and Evolutionary Approach*, (6<sup>th</sup> ed.), Life Sciences King's College, London, UK.

Dondson, S.I., Allen, T.F.N., Carpenter, S.R., Ives, A., Jeanne, R.L., Kitchell, J.F., Langston, N.E. & Turner, M.G., (1998). *Ecology*. UK: Oxford Univ. Press.

Molles, M.C. (2005). *Ecology: Concepts and Applications*. (6<sup>th</sup> ed.), New York, USA: McGraw Hill.

Newman, I. (1993). *Applied Ecology*. UK: Black Well Scientific Publications Oxford.

Odum, E. P. (1994). *Fundamentals of Ecology*. (3<sup>rd</sup> ed.), Philadelphia: W.B. Saunders.

Slingsby, D. & Cook, C., (1986). *Practical Ecology*. UK: McMillan Education Ltd.

Smith, R.L. (1980). *Ecology And Field Biology*, Harper and Row.

## **SEMESTER-VIII**

### **Course: Comparative Science Education**

**Credit Hours: 3**

**Introduction:** Educators improve their practice by adopting and adapting educational systems and practices that were developed elsewhere. Comparisons of educational systems also provide a basis for assessing the suitability of current practices. This course focuses on training student teachers to compare and contrast educational systems and exposes students to the comparative approaches in education. Furthermore, the course aims at providing prospective teachers a basis for educational comparisons aimed at creating an understanding of issues influencing the focus, structure, organization and practice of education at international level, regional level and local level. With a major focus on Science Education, the course will equip the prospective science teachers with necessary acquaintance regarding issues and trends in the field of Science Education around the world so that they can learn the lessons for improvement and quality enhancement of Science Education in Pakistan.

#### **Course Content**

Unit 1: Introduction to Comparative Education

Topic: The Meaning of Comparative Education

Topic: The Purpose and Uses of Comparative Education

Topic: Concept of Globalization

Topic: Comparative Education: Historical Development and Evolution

Topic: Introduction to The WCCES: A Global Body in Comparative Education

Unit 2: Comparative Approaches in Education

Topic: Bereday's Four-Stage Method

Topic: Holmes' Problem Solving Approach

Topic: Eckstein and Noah's Scientific Method

Unit 3: Comparative Study of International Systems of Education

Topic: Western Europe

Topic: USA

Topic: East Asia

Topic: Latin America

Topic: Africa

Topic: South East Asia

Unit 4: Comparative Study of Regional Systems of Education

Topic: Anglophone

Topic: Francophone

Topic: Lusophone

Unit 5: Comparative Studies in Science Education

Topic: Globalization of Science Education

Topic: Factors affecting globalization of Science Education

Topic: Nuffield Science Foundation report

Topic: Analysis of TIMSS reports

Topic: Analysis of PISA reports

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **REFERENCES**

- Beech J. (2006). The Theme of Educational Transfer in Comparative Education: A View over time I (pp. 2-13) in Research in Comparative and International Education Vol. 1. No. 1
- Bereday, G. F. Z. (1964). Comparative Method in Education. New York: Holt, Rhinehart & Winston
- Bereday G. F. Z. (1975) The Contribution of Comparative Education to Comparative Studies of Adult Education in Bennett, C., Kidd, J. R., and J. Kulich Comparative Studies in Adult Education: An Anthology Syracuse, USA: Syracuse University Publications in Continuing Education. pp. 114-118
- Ndoye M. (2008) Education in Africa: Knowledge Makes the Difference in Fredriksen B. and J. P. Tan (editors) An African Exploration of the East Asian Education Experience. Washington: World Bank pp. 61-79
- Noah H. J. (1984) The Use and Abuse of Comparative Education in Comparative Education Review. 28 pp. 550-562
- Phillips D. (2006) Comparative Education: Method in Research in Comparative and International Education, Vol. 1 No. 4 pp. 304-319.

World Bank, (2008) Governance, Management and Accountability in secondary Education in Sub-Saharan Africa World. World Bank Working Paper No. 127 African Human Development Series. Washington: World Bank

## **Course: Arabic Language**

**Credit Hours: 3**

**Introduction:** the main objective of this course is to give students an introduction to the basic syntax and morphology of the Arabic language so that they can study the language at an advanced level of their own. Although the main focus of the course will remain on sentence structure, the limited use of situational language teaching (SLT) is also expected.

### **Objectives:**

At the end of course students will be able to:

Understand simple Arabic sentence

Decipher the meanings of complex sentences with the help of dictionary

Explain the meaning of sentence structure

Communicate in the Arabic language

### **Course Content**

#### **Grammar, Morphology & Syntax**

##### **Arabic Letters and Their Pronunciation**

- Arabic alphabets
- Pronunciations
- The consonants
- The vowels
- The definite and the indefinite article
- The Moon letters and the Sun letters

##### **The Kinds of Arabic word**

- Nouns
- Verbs

##### **Particles plus Functional Words**

- Separate Pronouns
- Attached pronouns

##### **The Demonstrative And The Relative Nouns**

- The Demonstrative Nouns
- The Relative Nouns

##### **The Singular, The Dual & The Plural**

- The Dual & The Sound Plural
- The Broken Plural

### **The Masculine and the Feminine Gender**

### **The Possessive Compound**

- References from Noble Quran
- Examples

### **Adjective Compounds**

- Some references from the Qur'an for Adjectives

### **The Kinds of Verbs**

- The past tense
- The present and the future tense
- The imperative and the prohibitive word

### **Morphological Groups/ Gates Verb with Consonants and Vowels and Double Sound of A Letter**

- Verb with Consonants and Vowels
- Verb with Double Sound of A Letter

### **The Active Principle, The Passive Principle And The Five Nouns**

- The Active Principle, The Passive Principle
- The Five Nouns

### **The Numbers**

- Numbers from 1 to 10 in Arabic
- Examples from Numbers from 1 to 10 from Holy Quran

### **The Functional Words**

- The interrogative practices
- Prepositions
- References from the Holy Qur'an

### **The kinds of Arabic Sentences**

- Nominal Sentences
- Verbal sentences

### **Selected Text from the Religious Literature**

- Parts of human body
- The colors
- Days of the week
- Seasons of the year

- Timings
- Food and drink
- Greetings and introduction
- Shopping

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**Course: Students Teaching and Observation (PRACTICAL)**  
**Credit Hours: 6 (Long Term: 8-10 Weeks)**

**Introduction:**

This course provides the experience secondary school, science teachers with carefully sequenced and supervised field experiences in all subject areas related to science disciplines. Opportunities to work with secondary level students are provided. As a student teacher it is required that they will work with students of various backgrounds and of different capabilities. The developmental

**Objectives:**

Student teachers will be able to:

1. Reflect on and learn from connecting theory to their teaching practice.
2. Collaborate with peers, cooperating teachers, other school staff and university supervisor, establishing professional relationships.
3. Invite, accept and utilize formative feedback from the cooperating teaching, peers, and the university supervisor in a non-defensive manner
4. Produce plans for teaching and learning that reflects the use of appropriate instructional methods and strategies to meet the needs of all students.
5. Utilize appropriate instruments or techniques informally and formal accessing students' learning needs
6. Recognize cognitive and affective need of students and establish learning environment and use activities appropriate to meet those needs,
7. Maintain their lesson plan and use it effectively.

**Course Activities.**

<b>Week No</b>	<b>Activities</b>
<b>1</b>	<b>Introduction to the school and Classroom context</b> <ul style="list-style-type: none"><li>• Complete school based assignments</li><li>• Complete classroom observations</li><li>• The classroom environment, placement of materials, arrangement of workspaces and traffic patterns</li><li>• Classroom interactions</li><li>• Assist the cooperating teacher as requested</li><li>• Small administrative tasks</li><li>• Helping individuals or small groups of children</li><li>• Preparation of lesson planner</li><li>• Reflection on learning of this week</li></ul>
<b>2</b>	<b>Becoming more involved in the classroom</b> <ul style="list-style-type: none"><li>• Complete school based assignments</li><li>• Complete classroom observations</li><li>• Assist the cooperating teacher as requested</li><li>• Reflection on learning of this week</li></ul>
<b>3</b>	<b>Taking an active role in co planning and co teaching section of a lesson alongside your cooperating teacher</b> <ul style="list-style-type: none"><li>• Complete school based assignments</li><li>• Complete classroom observations</li></ul>



	<ul style="list-style-type: none"> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>
<b>4</b>	<b>Assuming responsibility for co planning and co teaching as many classes as a student can</b> <ul style="list-style-type: none"> <li>• Complete school based assignments</li> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>
<b>5</b>	<b>Assuming responsibility for planning, teaching and assessing in at least one subject</b> <ul style="list-style-type: none"> <li>• Complete school based assignments</li> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>
<b>6</b>	<b>Assuming responsibility for planning, teaching and any additional responsibilities as negotiated with the cooperating teacher and university supervisor</b> <ul style="list-style-type: none"> <li>• Complete school based assignments</li> <li>• Complete classroom observations</li> <li>• Assist the cooperating teacher as requested</li> <li>• Reflection on learning of this week</li> </ul>

#### Evaluation Criteria (For Practical Activity in Schools)

Examination	Type	Marks
Internal Examination	College Supervision in Schools	40%
External Examination	Examination of Model Lessons Delivered by each student in Schools and Evaluation by University Panel of Examiners	60%

## **COURSE TITLE: ADVANCE BOTANY-VII (PLANT BREEDING & HORTOCULTURE)**

**CREDIT HOURS: 3**

**Syllabus Outline:** An introduction to Plant Breeding and Horticulture. Different strategies used in breeding for plant selection with desired characteristics. Application of horticulture techniques used in Green house and in landscaping.

### **Course Outline:**

**Plant Breeding:** Basic Principles and Aims of Plant Breeding, General Outlines of Breeding Methods, Selection in Inbreeders (Single Plant Selection, Mass Selection, Pedigree Selection, Bulk Population Selection, Backcross Breeding), Selection in Outbreeders (Single Plant Selection, Mass Selection, Recurrent Selection, Backcross Breeding).

**Horticulture:** An Introduction, Plant Science, Plant Propagation, Greenhouse Management and Crops, Integrated Pest Management (IPM), Container-Grown Plants, Using Plants in the Landscape, Lawn and Turf Grass Establishment and Maintenance, The Vegetable Garden, The Small Fruit Garden.

**Module Aims:** This course enables the students to learn basic knowledge about Plant Breeding Strategies and Implementation to Horticultural Studies. The aim of this module is to give general Information to enter into Applied Breeding and Horticultural Practices.

### **Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory Work
4. Seminar/ Workshop

**Learning Outcome:** The successful completion of this course shall enable the students to apply basic knowledge into Applied Plant Breeding Practices.

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Books Recommended:**

1. Peter, K.V. (2009). Basics of Horticulture. New India Publishers.
2. Brown, J. and Caligare, P. (2008). An Introduction to Plant Breeding. Blackwell Synergy Publishers.
3. Acquaaach, G. (2006). Principles of Plant Genetics and Breeding. Blackwell and Synergy Publishers.
4. Kumar, N. (2006). Breeding of Horticulture Crops: Principles and Practices. New Indian Publishers.

5. Carpenter, P.L. and Walker, I. (2004). Plants in Landscape. (2<sup>nd</sup> Ed.), New York Freeman.
6. Acquaach, G. (2002). Horticulture Principles and Practices. (2<sup>nd</sup> Ed.), Prentice Hall of India Private Limited, New Delhi.
7. Crockett, J.V. (1999). Landscape Gardening. New York Time — Life.

# **TITLE: ADVANCEBOTANY-LAB-VII (PLANT BREEDING & HORTICULTURE)**

**CREDIT HOURS: 1**

**Syllabus Outline:** Different techniques used in Plant Breeding and Horticulture

## **Course Outline:**

1. Techniques of Plant Breeding
2. Pollination and fertilization in self and out Breeding Plants, their Implications and Consequences

**Module Aims:** The aim of this subject is to give practical knowledge and in-hand experience to the students in various Plant Breeding and Horticulture Methods.

## **Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory Work
4. Seminar/Workshop

**Learning Outcome:** The outcome of this course is same as Theory paper. The successful completion of this course will enable the students to apply their Practical Experience under full conditions.

## **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## **Books Recommended:**

1. Peter, K.V. (2009). Basics of Horticulture. New India Publishers.
2. Brown, J. and Caligore, P. (2008). An Introduction to Plant Breeding. Blackwell Synergy Publishers.
3. Acquaach, G. (2006). Principles of Plant Genetics and Breeding. Blackwell and Synergy Publishers.
4. Kumar, N. (2006). Breeding of Horticulture Crops: Principles and Practices. New Indian Publishers.
5. Carpenter, P.L. and Walker, I. (2004). Plants in Landscape. (2<sup>nd</sup> Ed.), New York Freeman.
6. Acquaach, G. (2002). Horticulture Principles and Practices. (2<sup>nd</sup> Ed.), Prentice Hall of India Private Limited, New Delhi.
7. Cleaveland, D.A. (2002). Farmers, Scientists and Plant Breeding Integrating Knowledge and Practice.
8. Kang, M.S. (2002). Quantitative Genetics. Genomics and Plant Breeding.
9. Crockett, J.V. (1999). Landscape Gardening. New York Time - Life.

10. Gupta, S.K. (2000). Plant Breeding Theory and Techniques. Narosa Publishers.

## **COURSE TITLE: ADVANCE BOTANY-VIII (SALINITY & WATER LOGGING)**

**CREDIT HOURS: 3**

**Syllabus Outline:** Importance and Assessment of Salinity and Water Logging, their Impacts on Environment and Ecosystem and Adaptations exhibited by plants.

### **Course Outline:**

**SALINITY:** Origin of Saline and Sodic Soils; Measurement of Salinity and Sodicty; Classification of Saline and Sodic Soils; Inter-Relations of Water Logging and Salinity, Effects of Soil Salinity and Alkalinity on Plant Growth (a) Osmotic Effect, (b) Specific Ion Effect, (c) Nutritional Imbalance. Quality of Irrigation Water;

Classification of Irrigation Water from view point of its Quality, Management and Reclamation of Saline and Sodic Soils, Mechanism of Salt Tolerance, Methods of Increasing Salt Tolerance in Plants, Biotic Approach and Genetic Engineering for Improvement of Salt Tolerance in Crops, Extent of Salinity in Pakistan.

**WATER LOGGING:** Origin of Water Logging, Physical and Chemical changes in Soil as a result of Water Logging, Measurement of Soil Redox Potential, Iron and Manganese Relations in Water Logged Soils, Higher Plants and the Water Logged Soils, Adaptations of Plants to Water Logging, Mechanism of Water Logging Tolerance in Plants, Extent of Water Logging in Pakistan.

**Module Aims:** To make the students well aware of this National Menace and the Ways to Control it.

### **Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory Work
4. Seminar/ Workshop

**Learning Outcome:** The student should be able to determine when the Soil becomes Water Logged and ultimately Saline and to ways to Manage these National Problems.

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Books Recommended:**

1. Horneck, D.A., Ellsworth, J.W., Hopkins, E.G., Sullivan, D.M. and Stevens, R.G. (2007). **Managing Salt affected Soils for Crop Production. Oregon State University.**
2. Hoorn, W.V. and Alpen J.G. (2006). Salinity Control in Retzema. (Ed.) Drainage Principle and Applications. Pub. No. 16. International Institute for Land Reclamation and improvement (LRRI). Wageningen, Netherland.

3. Warsi, I. (2005).. Master Plan of Pakistan, Main Report Volume II. IWRPO.
4. World Bank, (2005). Pakistan Water Resources Assessment Strategy, Report No. 34081PK. Agricultural & Rural Development Unit South Asia Region Washington D.C.
5. Shah, A.H., Anwar-ul-Haq and Bhutta, M.N. (2003). Success of Biosaline Approach for Land Rehabilitation. Pakistan Community Project for Rehabilitation of Saline and Water Logged land, WARSI Report No. 2003/22.
6. Qurashi, R.U. and Lennard, E.G.B. (1999). A Hand Book of Saline Agriculture of Irrigated lands in Pakistan. Australian Centre for International Agriculture Research.
7. Warsi, I. (UNDP) (1992). Manual of Salinity Research Methods. Warsi Publication No. 147, Lahore.
8. Alien, S.E. (1976). Chemical Analysis of Ecological Material. Blackwell Scientific Publications.
9. Mayber, P. and Gale, G. (1975). Plants in Saline Environment. Springer Verlag, Berlin, Washington.

## **TITLE: ADVANCEBOTANY-LAB-VIII (SALINITY AND WATER LOGGING)**

**CREDIT HOURS: 1**

**Syllabus Outline:** Various .Physical and Chemical Parameters to Assess Salinity, observations of hazardous Impacts of Water Logging and Salinity of Plants. Course Outline:

1. Measurement of Electrical Conductivity of Soil Saturation Extract.
2. Measurement of Cation Exchange Capacity of Soil.
3. Determination of the Amounts of Soluble Calcium.
4. Calculation of Exchangeable Sodium Percentage of Soil from its Sodium Adsorption Ratio.
5. Determination of the Amounts of Chlorides and Sulphates in a Soil Saturation Extract.
6. Analysis of Irrigation Water for the following: Electrical Conductivity, Sodium Adsorption Ratio, Chlorides, Sulphates, Carbonates, Bicarbonates, Total Dissolved Salts, Nitrates, Fluorides, Iron and Silica.
7. Classification of Irrigation Water from the view point of its Salinity and Sodium Hazard.
8. Effects of Salinized Media on Germination of Seeds of Different Crop Plants.
9. Experimental Investigation to test the Salt Tolerance of Different Crop Plants.
10. Quantitative studies of Halophytes in the Field.
11. Measurement of pH and EC of a Water Logged Soil.
12. Measurement of the amount of Iron and Manganese in Water Logged Soils.
13. Field observations on Water Logging of Soil and its Effects on Plant Distribution through Quantitative Studies of Vegetation.
14. Visit to WASID Laboratories of WAPDA and Laboratories of Land Reclamation Directorate, Lahore.
15. Field Tours to Saline and Water Logged Areas of Punjab.

**Module Aims:** The student is expected to make a complete Analysis of Saline Sodic and Water Logging and suggest Ways of Reclamation and Remediation.

### **Learning Strategies:**

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

**Learning Outcome:** The students should be able to assess Salinity and Water Logging in the Field and their Hazardous Impacts on Plants. i



## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## Books Recommended:

1. F.A.O. (1994). The Literature of Soil Science. Bulletin No. 59, Irrigation and Drainage Series.
2. Horneek, D.A., EUsworth, J.W., Hopkins, B.G., Sullivan, D.M. and Stevens, R.G. (2007). Managing Salt Affected Soils for Crop Production. Oregon Star University.
3. Hoorn, W.V. and Alpen J.G. (2006). Salinity Control. In; Retzema (ed.) Drainage Principle and Applications. Pub. No. 16. International Institute for Land Reclamation and improvement (LRRI). Wageningen, Netherland.
4. IWARSI, I (2005). Master Plan of Pakistan. Main Report, Volume II. IWRPO.
5. Armstrong, W. (2005). Water Logged Soils. In; Environment and Plant Ecology (Etherington, J.R.) John Wiley and Sons, Inc. New York.
6. World Bank, (2005). Pakistan Water Resources Assessment Strategy, Report No. 34081PK. Agricultural and Rural Development Unit South Asia Region Washington D.C.
7. Shah, A.H., Anwar-ul-Haq and Bhutta, M.N. (2003). Success of Biosaline approach for land Rehabilitation. Pakistan Community Project for Rehabilitation of Saline and Water Logged Land, Warsi, Report No. 2003/22.
8. Chapman, V.J. (2001). Salt Marshes and Salt Deserts of the world. (Net Prescribed).
9. Qurashi, R.U. and Lennard, E.G.B. (1999). A Hand Book of Saline Agriculture of Irrigated Lands in Pakistan. Australian Centre for International Agriculture Research.
10. Warsi I. (UNDP) (1992). Manual of Salinity Research Methods. Warsi Publication No. 147, Lahore.
11. Alien, S.E. (1976). Chemical Analysis of Ecological Material. Blackwell Scientific Publications.
12. Mayber, P. and Gale, G. (1975). Plants in Saline Environment. Springer VerSiag, Berlin, Washington.
13. UNESCO (1973). Irrigation, Drainage and Salinity.
14. Waisel Y. (1972). Biology of Halophytes. Tel Aviv University Press.

## ADVANCE CHEMISTRY- VII (BIO-CHEMISTRY)

### CREDIT HOURS: 3

**Course Objectives:** Students will gain knowledge about fundamental concepts of biochemistry as well as be able to learn about the structures, properties and functions of amino acids, proteins, carbohydrates, lipids and nucleic acids.

**1. Introductory Biochemistry:**

Scope of Biochemistry. The molecular logic of life. Structure and Functions of Cells. Cell wall Composition. A brief description on the isolation of cellular components.

**2. Water:**

Weak interactions in aqueous system. Ionization of water. Weak acids and weak bases. pH and buffer systems. Different buffering agents. Importance of buffers in biological systems.

**3. Carbohydrates:**

Nature, Structure and Classification of Carbohydrates. Aldoses and Ketoses Cyclic structure of monosaccharides, Haworth configurations D and L configuration of monosaccharides, Optical isomerism and Mutarotation in glucose. Formation of Glycosidic bonds. Reducing and non reducing sugars. Important monosaccharide and their derivatives. Invert sugars. Biological significance of Glucose. Structures and functions of common Disaccharides and Polysaccharides: Sucrose, Lactose, Maltose Amylose and Amylopectins. , Cellulose, Chitin Glycogen, Starch and Dextran. Derived carbohydrates and hexose derivatives present in microorganisms. Sensory properties of monosaccharides. Proteoglycan and glycoproteins: their Structure and function.

**4. Nucleic acids:**

Purines, Pyrimidines and nucleotides. Structure and functions of DNA, different type of RNA. Nucleic acid hydrolysis. Determination of Primary structure of Nucleic acids. Chemical synthesis of oligonucleotides.

**5. LIPIDS:**

Lipid Classification, Structures and functions. Chemical Properties of triglycerides. Phospholipids. Sterol/steroids. Lipid with specific biological activities. Prostaglandins: Structure and function. Properties of lipid aggregates: Micelles and Bilayers. Biological membranes. Membrane proteins, Membrane structure and Assembly. Fluid Mosaic model. The erythrocyte membrane. .

**6. PROTEINS:**

Amino acids: their Structure, Chiral Center, and stereoisomerism. Classification of amino acids. Acid base properties, their titration curve and its importance. . Amino acid sequence. Peptides and their biological importance. Proteins: classification, Covalent structure and biological significance including Primary. Secondary, Tertiary and Quaternary structure of proteins, as Keratins, Collagens and elastin. Conformation and function of globular proteins with special reference to structure and function of Hemoglobin and Myoglobin. Biological significance of Proteins.

**7. ENZYMES:**

Chemical nature, nomenclature and classification of enzymes. Cofactors and Coenzymes. Concepts of Active site. Substrate specificity. Affect of different factors on enzyme activity. Kinetics of single substrate reactions. Quantitative assay of enzymatic activity. Enzyme inhibition: Competitive, non-competitive and irreversible inhibition. Regulatory enzymes, allosteric enzymes, Multienzyme system, Zymogens, isoenzyme. Immobilized enzymes.

**8. NUTRITION:**

Introduction to the science of nutrition: Nutrients and their functions Biological evaluation of proteins, carbohydrates and lipids. Sources and forms of Energy. Energy value of foods. Energy requirements under different living and physiological conditions. Direct and indirect Calorimetry. Basal metabolic Rate, Respiratory quotient and their measurements. Assessment of nutritional status in Pakistan. Thermogenic effects of food.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**RECOMMENDED BOOKS:**

1. Principles of Biochemistry by Lehninger AL, Nelson DL and Cox MN, 2000 Pub: worth Publishers
2. Biochemistry by Lubert Stryer 2006 Pub: Freeman and Company
3. Biochemistry by Voet, and Pratt, 2004, John wiley and sons Inc.
4. Lippincott's Biochemistry by Champe.P C; Harvey. R. A and Ferrier. D. R. 3rd ed., 2004 Pub: J. b. Lippincott Company
5. Harpers Biochemistry, 27th ed. 2006 Pub: McGraw Hill Inc.

## ADVANCE CHEMISTRY LAB- VII (BIO-CHEMISTRY)

CREDIT HOURS: 1

**1. Carbohydrates:**

Qualitative tests for Carbohydrates. Distinction between pentoses and hexoses, aldoses and Ketoses, reducing and non reducing sugars mono and polysaccharides. Chromatography of sugars. Preparation of glycogen from liver. Acid and enzymic hydrolysis of glycogen.

**2. Nucleic Acids:**

Isolation of RNA from beef liver. Isolation of DNA from Calf Spleen. UV absorption of nucleic acids.

**3. Lipids:**

Qualitative tests for lipids including fatty acids, sterols and phospholipids. Lipids separation from Calf brain tissue. Acid value, Saponification Value and Iodine Value of fats. Extraction and TLC of Wheat Lipids.

**4. Amino Acids and Proteins:**

Qualitative tests of amino acids, determination of isoelectric Point. Isolation and solubilization of proteins from plant and animal origin. Hydrolysis of proteins. Estimation of proteins by Kjeldahl method. Isolation of enzyme amylase, a study on its properties and catalytic activity.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### RECOMMENDED BOOKS:

- 1 Practical Clinical Biochemistry by Varley. Pub: CBS publishersAn
- 2 Introduction to Practical Biochemistry By D. T. Plummer Pub: McGraw Hill

# ADVANCE CHEMISTRY- VIII (AGRICULTURAL CHEMISTRY)

**CREDIT HOURS: 3**

## Objectives

The students will learn about:

- Discipline of Agricultural Chemistry and its applications
- Upgrade and update the knowledge regarding the progress in Agricultural Chemistry and related disciplines
- Bring uniformity in curricula taught in different universities offering Agricultural Chemistry as major
- Provide recent trends and skills to help in an agricultural system which can meet the need of our country and contribute to global requirement as well
- Achieve the highest possible standards in teaching and research in Agricultural Chemistry and related disciplines.
- The physical aspects of bio-macromolecules
- Functions in living organisms
- Food security in relation to food production in Pakistan
- Taxonomy of medicinal plants
- Essential chemical components of medicinal herbs, including appropriate extraction and quantization methods, and strategies for structure elucidation
- Biosyntheses and synthetic methodologies, involved in deriving the active components of medicinal herbs.

## COURSE CONTENT

**Agricultural chemistry:** Introduction, history, contribution and scope.

**Bio-Organic Chemistry :** General concepts, Chemistry of natural products (alkaloids, flavonoids and terpenes), organic matter , Stereochemistry, Chemistry and application.

**Bio-Physical chemistry :**Introduction and scope, modern concepts of acids and bases, pH measurement, buffers and their role in biological system. Biophysical phenomena.

**Food chemistry:** Introduction: Color, flavor and taste of foods, sensory evaluation of foods. Composition of Foods, Methods of improving protein quality of food, Enzymes and vitamins, Mineral elements, Food additives and value addition, Toxicity of food, Water activity.Principles Of Food Security, Introduction: Food security, international commitment to end hunger and malnutrition. Food security and human rights, Factors affecting food security, Food safety and food quality.

**Protein Chemistry :**Introduction: Structural and functional proteins, importance of proteins. Amino Acids: Structure, classification and properties, essential and non essential, occurrence in animals and plants.

**Plant Biochemistry :** Cell: Structure, functions, origin and nature of bio-molecules, chemical composition of cell membrane, cell wall and transport processes. Plant Enzyme and co-enzymes, Nucleic acids ,Secondary Metabolites, Growth Hormones ,Photosynthesis.

**Clinical Biochemistry:** Role of clinical Biochemistry in health and diseases, factors causing diseases. Biochemistry of blood, Chemistry of gastrointestinal tract, Immunology.

**Agrochemical pollution:** Impact of fertilizer and pesticide industry, residual effect of pesticide, plant response to metals in soil and water, biosorption of metals, bioremediation. Anthropogenic activities.

**Agricultural Microbiology :**Introduction, Definition and history. Microbiological techniques: Pure and sterilize culture media, selective media, and light microscopy, antimicrobial activity. Viruses, Bacteria, Rhizobacteria, Fungi, Toxicity, Microbial transformations.

**Applied Biochemistry :** Fermentation: Aerobic and anaerobic fermentation, production of bio-fuels. Pulp and Paper Industry: Sulfite, sulfate pulp, types of paper and production processes. Oils and Ghee Industry, Soap Industr, Sugar and Starch industry, Starch, Fertilizer Industry.

**Pesticide Chemistry :**Introduction: History, importance, current application status, international concern about pesticide usage, role of pesticides in agriculture. Formulation of Pesticides, Groups of Pesticides, Herbicides, Fungicides, Pheromones, Environmental Hazards of Pesticides.

**Fundamentals Of Phytochemistry:** Introduction: History, scope and development of phytochemistry. Plant taxonomy, Record keeping (Herbarium),The classification and nomenclature of important medicinal herbs, Factors influencing cultivation of medicinal plants, Study of important chemical classes found in medicinal herbs (including their role and ecological function).**Soil Chemistry :** Soil, Definition, type and composition. Nature of soil elements, Properties of soil.

## ADVANCE CHEMISTRY- VIII LAB (AGRICULTURAL CHEMISTRY)

**CREDIT HOURS: 1**

- Microscopic examination of cell
- Determination of phytic acid in cereal and legume
- Laboratory equipment and apparatus, name and use, general lab instructions
- Preparation and standardization of solutions
- Qualitative tests of carbohydrates and protein
- Use of food composition tables
- Determination of dietary intake through questionnaire
- Use of questionnaire to measure household food security
- Designing home gardens for food security
- Determination of food insecurity in terms of malnutrition
- Determination of molecular weight by osmometry
- Determination of viscosity
- Determination of surface tension
- Determination of pH
- Staining Techniques: Simple, Microbial tests for drinking water quality.
- Fermentation of milk
- Identification of sugars
- Extraction of crude oil from oil seeds
- Macroscopic Examination of Natural Products.
- Collection and preparation of soil sample, Determination of soil pH
- Determination of electrical conductivity (EC) of saturated soil extract

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended:

1. David, H. 2000. Modern Analytical Chemistry. International ed. McGraw Hill Co. Inc. New York.
2. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.
3. Khalil, I. A. and H. Shah. 2003. Basic Biochemistry. National Book Foundation Islamabad, Pakistan.
4. Lehninger, A.L. 2000. Principles of Biochemistry. 3<sup>rd</sup> ed. Worth Publisher, New York. USA.
5. Rupm, H. and H. Krist, 1992. Laboratory Manual for the Examination of Water, Wastewater and Soil. 2<sup>nd</sup> ed. Weinheim, Fed. Rep. Germany.
6. Stryer, L. 1994. Biochemistry. 5<sup>th</sup> ed. W. H. Freeman and Co. London UK.

7. Vogel, A. I. 1995. A Text Book of Macro and Micro Quantitative Inorganic Analysis. 1<sup>st</sup> ed. Longman Green and Co. Inc, New York
8. Bansel, R.K. 1998. Synthetic Approaches in Organic Chemistry. 2<sup>nd</sup> ed. Jones and Bartlett Publishers Inc., New York, USA.
9. Bansel, R.K. 2001. Heterocyclic Chemistry. Weig Eastern Ltd. New Delhi, India.
10. Clayden, J., N. Greeves, S. Warren, P. Wothers, 2001. Organic Chemistry. Oxford, Uk.
11. Finar, I.L. 2000. Organic chemistry. 6<sup>th</sup> ed. John Wiley and Sons Inc., New York, USA.
12. Morrison, R.T., and Boyd, R.N., 2001. Organic Chemistry. 6<sup>th</sup> Ed. Prentice Hall. NY.
13. Blei, I. and G. Odian, 2006, Organic Biochemistry 2<sup>nd</sup> Ed. Freeman, USA
14. Adamson, A.W. and P.G. Alice. 1997. Physical Chemistry of Surfaces. 6<sup>th</sup> ed. John Wiley and Sons Inc., New York, USA.
15. Alberty, R.A. and R.J. Silbey. 1992, Physical Chemistry. 5<sup>th</sup> ed. John Wiley and sons Inc., New York, USA.
16. Atkins, P. and J. de Paula, 2005, Physical Chemistry for the Life Sciences. Freeman, USA.
17. Dykstra, C.E. 1997. Physical Chemistry, A modern Introduction. International ed. Prentice Hall International Inc., USA.
18. Hammes, G.G. 2007, Physical Chemistry for the Biological Sciences, John Wiley, USA.
19. Sheehan, D., 2009, Physical Biochemistry: Principles and Applications. 2<sup>nd</sup> Ed. John Wiley, USA.
20. Van Holde, K. E., Johnson, C. and P.S. Ho, 2005. Principles of Biochemistry. 2<sup>nd</sup> Ed. Printice Hall, USA
21. Campbell, M.K. 1991. Biochemistry. Saunders College Pub. Philadelphia USA.



## **Course Title: Advance Mathematics- VII (Methods of Mathematical Physics)**

**Course Rating: 4 Cr. Hours**

### **Sturm Liouville Systems**

- Some properties of Sturm-Liouville equations
- Regular, Periodic and singular Sturm-Liouville systems and its applications

### **Series Solutions of Second Order Linear Differential Equations**

- Series solution near an ordinary point
- Series solution near regular singular points

### **Series Solution of Some Special Differential Equations**

- Hypergeometric function  $F(a, b, c; x)$  and its evaluation
- Series solution of Bessel equation
- Expression for  $J_n(X)$  when  $n$  is half odd integer, Recurrence formulas for  $J_n(X)$
- Orthogonality of Bessel functions
- Series solution of Legendre equation

### **Introduction to PDEs**

- Review of ordinary differential equation in more than one variables
- Linear partial differential equations (PDEs) of the first order
- Cauchy's problem for quasi-linear first order PDEs

### **PDEs of Second Order**

- PDEs of second order in two independent variables with variable coefficients
- Cauchy's problem for second order PDEs in two independent variables

### **Boundary Value Problems**

- Laplace equation and its solution in Cartesian, Cylindrical and spherical polar coordinates
- Dirichlet problem for a circle
- Poisson's integral for a circle
- Wave equation
- Heat equation

### **Fourier Methods**

- The Fourier transform
- Fourier analysis of generalized functions
- The Laplace transform

### **Green's Functions and Transform Methods**

- Expansion for Green's functions
- Transform methods
- Closed form of Green's functions

### **Variational Methods**

- Euler-Lagrange equations
- Integrand involving one, two, three and  $n$  variables
- Necessary conditions for existence of an extremum of a functional
- Constrained maxima and minima

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## Recommended Books

1. D.G. Zill and M.R. Cullen, *Advanced Engineering Mathematics*, (Jones and Bartlett Publishers, 2006)
2. W.E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, (John Wiley & Sons, 2005)
3. E.T. Whittaker, and G. N. Watson, *A Course of Modern Analysis*, (Cambridge University Press, 1962)
4. I.N. Sneddon, *Elements of Partial Differential Equations*, (Dover Publishing, Inc., 2006)
5. R. Dennemyer, *Introduction to Partial Differential Equations and Boundary Value Problems*, (McGraw Hill Book Company, 1968)
6. D.L. Powers, *Boundary Value Problems and Partial Differential Equations*, (Academic Press, 2005)
7. W.E. Boyce, *Elementary Differential Equations*, (John Wiley & Sons, 2008)
8. M.L. Krasnov, G.I. Makarenko and A.I. Kiselev, *Problems and Exercises in the Calculus of Variations*, (Imported Publications, Inc., 1985)
9. J. Brown and R. Churchill, *Fourier Series and Boundary Value Problems*, (McGraw Hill, 2006)

## **Course Title: Advance Mathematics- VIII (Numerical Analysis)**

**Course Rating: 4 Cr. Hours**

### **Error Analysis**

- Errors, Absolute errors, Rounding errors, Truncation errors
- Inherent Errors, Major and Minor approximations in numbers

### **The Solution of Linear Systems**

- Gaussian elimination method with pivoting, LU Decomposition methods,
- Algorithm and convergence of Jacobi iterative Method, Algorithm and convergence of Gauss Seidel Method
- Eigenvalue and eigenvector, Power method

### **The Solution of Non-Linear Equation**

- Bisection Method, Fixed point iterative method, Newton Raphson method, Secant method, Method of false position, Algorithms and convergence of these methods

### **Difference Operators**

- Shift operators
- Forward difference operators
- Backward difference operators
- Average and central difference operators

### **Ordinary Differential Equations**

- Euler's, Improved Euler's, Modified Euler's methods with error analysis
- Runge-Kutta methods with error analysis
- Predictor-corrector methods for solving initial value problems
- Finite Difference, Collocation and variational methods for boundary value problems

### **Interpolation**

- Lagrange's interpolation
- Newton's divided difference interpolation
- Newton's forward and backward difference interpolation, Central difference interpolation
- Hermit interpolation
- Spline interpolation
- Errors and algorithms of these interpolations

### **Numerical Differentiation**

- Newton's Forward, Backward and central formulae for numerical differentiation

### **Numerical Integration**

- Rectangular rule
- Trapezoidal rule
- Simpson rule
- Boole's rule
- Weddle's rule
- Gaussian quadrature formulae
- Errors in quadrature formulae

- Newton-Cotes formulae

### **Difference Equations**

- Linear homogeneous and non-homogeneous difference equations with constant coefficients

### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### **Recommended Books**

1. Curtis F. Gerald and Patrick O. Wheatley, *Applied Numerical Analysis*, (Addison- Wesley Publishing Co. Pearson Education, 2003)
2. Richard L. Burden and J. Douglas Faires, *Numerical Analysis*, (Brooks/Cole Publishing Company, 1997)
3. John H. Mathews, *Numerical Methods for Mathematics, Science and Engineering*, (Prentice Hall International, 2003)
4. Steven C. Chapra and Raymond P. Canale, *Numerical Methods for Engineers*, (McGraw Hill International Edition, 1998)

## **ADVANCE PHYSICS 7 (NUCLEAR PHYSICS)**

**PRE-REQUISITE: Modern Physics**

**CREDITE HOURS: 3+1**

### **INTRODUCTION:**

This class covers basic concepts of nuclear physics with emphasis on nuclear structure and interactions of radiation with matter. Topics include elementary quantum theory; nuclear forces; shell structure of the nucleus; alpha, beta and gamma radioactive decays; interactions of nuclear radiations (charged particles, gammas, and neutrons) with matter; nuclear reactions; fission and fusion.

### **COURSE OBJECTIVE:**

The objectives of this course are to introduce students to the fundamental principles and concepts governing nuclear and particle physics and have a working knowledge of their application to real-life problems; and provide students with opportunities to develop basic knowledge and understanding of scientific phenomena, facts, laws, definitions, concepts, theories, scientific vocabulary, terminology, conventions, scientific quantities and their determination, order-of magnitude estimates, scientific and technological applications as well as their social, economic and environmental implications.

### **TOPICS COVERED:**

Basic Properties of Nucleus:

Detectors:

Particle Accelerators:

Radio-Active Decay:

Nuclear Forces:

Nuclear Models:

Nuclear Reactions:

Neutron Physics:

Thermonuclear Reactions:

### **COURSE OUTLINE:**

#### **Basic Properties of Nucleus:**

Size and mass of the nucleus, nuclear spin, magnetic dipole moment, electric quadrupole moment, parity and statistics.

#### **Detectors:**

Passage of charged particles through matter, ionization chamber, proportional counter, scintillation counter, semi-conductor detector, emulsion technique, bubble chamber.

#### **Particle Accelerators:**

Linear accelerator, Van de Graff, betatron, synchrocyclotron, proton synchrotron.

#### **Radio-Active Decay:**

Theory of alpha decay, and explanation of observed phenomena-measurement of  $\gamma$ -ray energy, the

magnetic lense spectrometer, Fermi theory of  $\beta$ -decay, neutrino hypothesis, theory of gamma decay, multipolarity of gamma-rays, nuclear isomerism.

#### **Nuclear Forces:**

Yukawa theory, proton-proton and neutron-proton scattering, charge independence of nuclear force, isotopic spin.

#### **Nuclear Models:**

Liquid drop model, shell model, collective model.

#### **Nuclear Reactions:**

Conservation laws of nuclear reactions, Q-value of nuclear reaction, threshold energy, transmutation by photons, protons, deuterons and alpha particles, excited states of nucleus, energy levels, level width, Cross section from nuclear reactions, compound nucleus theory of nuclear reactions, limitations of compound nucleus theory, resonances, Breit-Wigner formula, direct reactions.

#### **Neutron Physics:**

Neutron sources, radioactive sources, photo neutron sources, charged particle sources, reactor as a neutron source, slow neutron detectors, fast neutron detectors, slowing down of neutron, nuclear fission, description of fission reaction, mass distribution of fission energy, average number of neutrons released, theory of fission and spontaneous fission.

#### **Thermonuclear Reactions:**

Fusion and thermonuclear process, energy released in nuclear fusion, carbon nitrogen & oxygen cycle, controlled nuclear fusion, D-D & D-T reactions.

#### **Practical:**

1. To determine the characteristic of G. M. tube and measure the range and maximum energy of particles.
2. Measurement of half-life of a radioactive source.
3. Characteristics of G.M. counter and study of fluctuations in random process.

#### **Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

#### **REFERENCE BOOKS:**

1. Nuclei and particles by E. Serge. W. A. Benjamin Inc (1965).
2. A Text Book of Nuclear Physics by C.M.H. Smith, Pergamon Press Oxford (1966).
3. Nuclear Physics by A.E.S. Green, McGraw Hill Book Co. (1966).
4. Nuclear Physics by I. Kaplan, Addison-Wesley (1963).
5. The Atomic Nucleus by Evens, McGraw Hill, (1965).

# **ADVANCE PHYSICS 8 (SOLID STATE PHYSICS)**

**PRE-REQUISITE: Undergraduate level Physics**

**CREDITE HOURS: 3+1**

## **INTRODUCTION:**

Bonding in solids, thermal and electrical properties of solids, energy bands, imperfections in solids, properties of semiconductors and insulators.

## **COURSE OBJECTIVE:**

This course deals with crystalline solids and is intended to provide students with the basic physical concept and mathematical tools used to describe solids. The course deals with groups of materials, as in the periodic table, in terms of their structure, electronic, optical, and thermal properties.

## **TOPICS COVERED:**

Crystal Structure:

Reciprocal Lattice:

Crystal Binding and Elastic Constants:

Crystal Vibrations: Phonons I:

Thermal Properties: Phonons II:

Noncrystalline Solids:

Point Defects:

Dislocations:

## **COURSE OUTLINE:**

### **Crystal Structure:**

Periodic arrays of atoms, fundamental types of lattices, index system for crystal planes, simple crystal structures, direct imaging of atomic structure, non-ideal crystal structures.

### **Reciprocal Lattice:**

Diffraction of waves by crystals, scattered wave amplitude, Brillouin zones, Fourier analysis of the basis, quasi crystals.

### **Crystal Binding and Elastic Constants:**

Crystals of inert gases, ionic crystals, covalent crystals, metals, hydrogen bonds, analysis of elastic strains, elastic compliance and stiffness constants, elastic waves in cubic crystals.

### **Crystal Vibrations: Phonons I:**

Vibrations of crystals with monatomic basis, two atoms per primitive basis, quantization of elastic waves, phonon momentum, inelastic scattering by phonons.

### **Thermal Properties: Phonons II:**

Phonon, heat capacity, anharmonic crystal interactions, thermal conductivity, electronic heat capacity.

### **Noncrystalline Solids:**

Diffraction pattern, glasses, amorphous ferromagnets and semiconductors, low energy excitations in

amorphous solids, fiber optics.

**Point Defects:**

Lattice vacancies, diffusion, color centers.

**Dislocations:**

Shear strength of single crystals, dislocations, strength of alloys, dislocations and crystal growth, hardness of materials.

**Practical Work:**

1. To study Zeeman Effect
2. To study Hall effect in an n-type/p-type semiconductor or a metal.
3. To measure work function of a metal and verification of Richardson's equation.
4. Determination of dielectric constant of liquid and solid.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

**REFERENCE BOOKS:**

1. Introduction to Solid State Physics by C. Kittel, 7th Edition, John Wiley & Sons, Inc. (1996)
2. Solid State Physics by Neil W. Ashcroft, N. David Mermin, CBS Publishing Asia Ltd. (1987).
3. Solid State Physics by J. S. Blakemore, Cambridge University Press, (1991).



## ADVANCE ZOOLOGY VII (GENETICS AND WILDLIFE)

**CREDIT HOURS: 3+1**

### Objectives

The continuity of the life from one generation to other generation is based on the mechanisms involving nucleus, chromosomes and genes etc. The process of continuity not only transfers the traits of the parents but also imparts variations that render the generations sustainable in changing environment. These concepts will be imparted to the students in this course.

### Course Contents (Wild Life)

Wildlife of Pakistan, identification, distribution, status, conservation and management (population estimate technology) of fishes, reptiles, birds and mammals of major importance in Pakistan. Wildlife rules and regulations in Pakistan. National and International agencies involved in conservation and management of wildlife. Sanctuaries, Game Reserves and National Parks in Pakistan. Ramsar convention, wetlands, endangered species of Pakistan.

*(Note: The teacher is suggested to provide blank maps of Pakistan in the theory class to the students to indicate the distribution of the animals. Similar blanks maps should be attached with the question paper, if distribution of animals is asked from the student in the theory paper).*

### Course Contents (Genetics)

**Classical genetics** –genetics of blood groups, chromosomal basis of inheritance, interaction of genes, linkage, recombination and chromosome mapping in eukaryotes, quantitative inheritance. gene concept (classical and modern), genetics of viruses, bacteria, transposons.

**Molecular genetics** – analysis and techniques of molecular genetics (elements of genetic engineering), genetic basis of cancer, genetic control of animal development, the genetic control of the vertebrate immune system, complex inheritance patterns.

**Population genetics** – Hardy-Wienberg equilibrium, systematic and dispersive pressures, inbreeding and heterosis.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## Books Recommended

- Bailey, J.A. (1986). *Principles of Wildlife Management*, John Wiley and Sons.
- Ali S. & Ripley S.D. (1973). *A Handbook of Birds of India & Pakistan*, London: Oxford University Press.
- Ali, S.S. (1999). *Paleontology, Zoogeography & Wild-Life Management*. Hyderabad, India: Nasim Book Depot.
- Boyd, C.E. & Tucker, C. S. (1998). *Pond aquaculture and water quality management*. Boston, Kluwer Publishers Alabama.
- Magon, C.F. (1988). *Biology of freshwater pollution*. Longman and Scientific Publication.
- Roberts, T. J. (1992). *The Birds of Pakistan*, (Vol.I). Oxford University Press.
- Roberts, T. J. (1998). *The birds of Pakistan*, (Vol. II), Oxford University Press.
- Roberts, T.J. (1977). *Mammals of Pakistan*. London: Ernest Benon Ltd.
- Robinson, W.L. & Bolen, E.G. (1984). *Wildlife ecology and management*. McMillan, Cambridge.

## ADVANCE ZOOLOGY VII (GENETICS AND WILDLIFE) PRACTICALS

1. Mitosis (Onion root tips.)
2. Meiosis (Grass hopper testes)
3. Blood groups.
4. Salivary gland Chromosomes of *Drosophila melanogaster*
5. General morphology of *Drosophila melanogaster*
6. Human Pedigree analysis problems
7. Human Genetics problems
8. Probability problems. Tossing of coins.  $X^2$  test
9. Study of transformed bacteria on the basis of antibiotic resistance.

### Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

### Books Recommended

Gardener, E.J., Simmons, M.J. & Snustad, D.P. (1991). *Principles of genetics*. New York, USA: John Wiley and Sons Ins.

Lewin, B. (2000). *Gene-VIII*. UK: Oxford University Press.

Snustad, D.P. & Simmons, M.J. (2003). *Principles of Genetics*. (3<sup>rd</sup> ed.), New York, USA: John Wiley and Sons Ins.

Strickberger, M.W. (1985). *Genetics*. New York. USA: McMillan,.

Tamarin, R.H. (2001). *Principles of genetics*. (7<sup>th</sup> ed.), USA: WCB publishers.

# ADVANCE ZOOLOGY VIII (ZOOGEOGRAPHY AND PALEONTOLOGY)

CREDIT HOURS: 3+1

## Objectives:

The course imparts knowledge and concepts of evolution mainly based on the past fossil records. The fossil records also provide the information regarding the distribution of animals in the past eras. This course provides information on the distribution of animals and their associations in the past; thus, to rationalize their relationship in the present time.

## Course Contents

**Zoogeography:** Branches of zoogeography (descriptive, chorology, faunistics, systematic, biocoenotic, causal, ecological, historical, experimental and applied zoogeography). Animal distribution (cosmopolitan distribution, discontinuous distribution, isolation distribution, bipolar distribution and endemic distribution) Barriers and dispersal. Zoogeographical regions (division, geographic ranges, physical features, climates, faunas and affinities of Holarctic (Palaeartic, Nearctic regions), Oriental, Ethiopian, Australian, and New tropical Regions. Palaeogeography (Theories of Continental drift and Plate tectonics).

**Principles of Paleontology:** Earth, Shells of earth; (atmosphere, hydrosphere, biosphere and lithosphere). Rock, types of rocks (Igneous rocks, sedimentary rocks and metamorphic rocks) Fossil, types and uses of fossils, nature of fossils. Processes of fossilization. Geological time scale. Pre-Cambrian life. Post Cambrian life (Palaeozoic life, Mesozoic life, Cenozoic life). Geochronometry (Uranium/Lead dating, radiocarbon dating, methods), evolutionary history of man, elephant, horse and camel, Paleoecology, Paleomagnetism.

## Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

## Books Recommended

### Zoogeography:

Ali, S.S. (1999). *Palaeontology, Zoogeography and Wild Management*. Hyderabad, India: Nasim Book Depot.

Darlington, P. J. Jr. (1963). *Zoogeography*, John Wiley and Sons.

De Beaufort, L. F. (1951). *Zoogeography of the Land and Inland Waters*. Sidgwick and Jackson.

**Paleontology:**

Ali, S.S. (1999). *Palaeontology, Zoogeography and Wild Management*. Hyderabad, India: Nasim Book Depot.

Brouwer, A. (1977). *General Palaeontology*, London: Oliver and Boyd.

Dunbar, C.O. (1969). *Historical Geology*, New York: John Wiley and Sons Inc.

Gilbert, L. I. & Colbert, E.H. (1980). *Evolution of Vertebrates*, New York: John Wiley and Sons Inc.

## **ADVANCE ZOOLOGY VIII (ZOOGEOGRAPHY AND PALEONTOLOGY) PRACTICALS**

1. Study Of fauna of various zoogeographical regions.
2. Study of mould, cast, pseudomorph, coprolite, petrified fossils of plants and animals.
3. Study of invertebrate fossils of coelenterates, trilobites, ammonite, brachiopods, molluscs and echinoderms.
4. Study of vertebrate fossils e.g. horse/elephant/camel/bovids.
5. Study and identification of Igneous, Sedimentary and Metamorphic rocks
6. Map work for identification of various zoogeographical regions of the World.

**Evaluation Criteria**

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%