

(Draft)

DEPARTMENT OF BOTANY
University of Malakand



WORKING PAPER

For

**SECOND MEETING OF THE BOARD OF STUDIES
2014**


Assistant Registrar (Academics)
University of Malakand

DEPARTMENT OF BOTANY
UIVERSITY OF MALAKAND
2014

CONTENTS

S.NO.	Items	Annexure	Pages
1	Working paper for the 2 nd Meeting Board of Studies	Nil	03
2	Constitution and function of the Board of Studies	Annexure -A	04-05
3	Members of the Board of Studies of Botany Department	Annexure -B	06
4	Proposed courses of study for BS (four years)	Annexure -C	07-66
5	Proposed courses of study for M.Sc (two years)	Annexure -D	67-100
7	Proposed panel of examiners for evaluation and viva voice examination of B.S (Four years) and M.Sc (Two years)	Annexure -E	101-102
8	Proposed Courses for M.Phil & Ph.D Program	Annexure-F	103-104
9	Proposed Format of Question Paper for BS (4-years) Program	Annexure-G	105



Assistant Registrar (Academics)
 University of Malakand

DEPARTMENT OF BOTANY

University of Malakand, Chakdara, NWFP, Pakistan

Second Meeting of the Board of Studies

WORKING PAPER

Item 1 Proposed courses of study for BS (4-years) program

Course outlines and detailed contents for BS (Hons) Program are placed for consideration and approval of the Board (Annexure- C, Pages 7-65).

Item 2 Proposed courses of study for M.Sc (Two years) program

Course outlines and detailed contents for M.Sc (Two years) program are placed for consideration and approval of the Board (Annexure- D, Pages 66-98).

Item 3 Suggested Panel of Examiners

List of the Examiners for paper setting, evaluation and examination of students of B.S (Hons) & M.Sc Two Year Programs is presented as (Annexure- E, Page 99).

Item 4 Proposed courses for M.Phil & Ph.D Program

List of Proposed courses for M.Phil & Ph.D Program is placed for consideration and approval of the Board (Annexure-F, page 100).

Item 5 Proposed format of Question Paper for BS (4-years) program

Proposed format of Question Paper for BS (4-years) program is placed for consideration and approval of the Board (Annexure-G, page 101)



Assistant Registrar (Academics)
University of Malakand

Assistant Registrar (Academics)
University of Malakand

Annexure – A

CONSTITUTION AND FUNCTIONS OF THE BOARD OF STUDIES

(According to the University of Malakand Statutes)

The Board of Studies:

1. There shall be a separate board of studies for each subject or group of subject, as may be prescribed by Bye-Laws
2. Each board of studies shall consist of –
 - a) The chairperson or Director of the registered institute;
 - b) All professors and Associate Professor in the University teaching Departments or institutes;
 - c) Two experts to be appointed by the Vice Chancellor;
 - d) Three teachers, other than University teachers to be appointed by the Vice Chancellor from affiliated colleges; and
 - e) One Assistant Professor and one Lecturer to be appointed by rotation in order of Seniority from the Department concerned, provided that in the case of professional subjects which are taught in the affiliated institutes/colleges only and not in the University, such as medicine, dentistry and education etc. the board of study shall consist of-
 - f) The principal of the colleges, Directors of Institute, Head of the Institute concerned;
 - g) Two teachers of the colleges, to be appointed by the Syndicate; and
 - h) Two experts to be appointed by the vice-Chancellor
3. The term of office of members of the Board of Studies, other than ex-officio members, shall be two years.
4. The quorum for meeting of the Board of Studies shall be one-half of members, a fraction being counted as one.
5. The Chairperson of the University Teaching Department concerned shall be the Chairperson and Convener of the Board of Studies. Where in respect of a subject there is no University Teaching Department, Chairperson shall be appointed by the Vice Chancellor.
6. The function of Board of Studies shall be-



Assistant Registrar (Academics)
University of Malakand

- To advise the authorities on all academic matters concerning instructions, publication, research and examination in the subject concerned;
- To propose the curricula and syllabi for all degree, diploma and certificate courses in the subject concerned;
- To suggest a panel of names of papers setters and examiners in the subjects concerned; and
- To perform such other function as may be prescribed by Bye-Laws

A handwritten signature in blue ink, appearing to read 'N. J. M.' followed by a stylized flourish.

Assistant Registrar (Academics)
University of Malakand

Annexure – B

MEMBERS FOR THE BOARD OF STUDIES, BOTANY DEPARTMENT.

S.No	Name / Designation	Address	Status
1.	Prof. Dr. Mir Azam Khan, Dean, Faculty of Biological Sciences,	University of Malakand	Convener (Ex-Officio)
2.	Dr. Mohammad Nisar / Chairman Under Section 4(2)(a)	Department of Botany, UOM	Member
3.	Prof. Dr. Abdur Rashid, Under Section 4(2)(c)	Chairman, Department of Botany, University of Peshawar	Member
4.	Dr. Wahab, Assistant Professor	University of Swat	Member
5.	Mr. Inamullah, Lecturer	GDC Timergara	Member
6.	Mr. Jalandar Shah, Associate Professor	GDC Wari, Dir Upper	Member
7.	Mr. Khursheed, Assistant Professor	GDC Thana, Malakand Agency	Member
8.	Ms. Sahar Nasim, Lecturer	Department of Botany, University of Malakand	Co-opted Member
9.	Mr. Shariatullah, Lecturer	Department of Botany, University of Malakand	Member



Assistant Registrar (Academics)
University of Malakand

Annexure - C

FOUR YEARS B.S (4-years) PROGRAMME SCHEME OF STUDIES FROM 2010 AND ONWARD

(The courses are proposed by the Higher Education Commission in B.S (4-years) Botany Program and are duly adopted by the Department of Botany University of Malakand for the Semester system from 2010 and onward.)

1st Year

SEMESTER-1

Course #	Title	Credit Hours
Bot-111	English-1	3(3+0)
Bot-112	Pakistan Studies	2(2+0)
Bot-113	Mathematics-I	3(3+0)
Bot-114	Physical Chemistry	3(2+1)
Bot-115	Principles in Animal Life-I	3(2+1)
Bot-116	Diversity of Plants	4(3+1)
		18

SEMESTER-2

Course #	Title	Credit Hours
Bot-121	English-II	3(3+0)
Bot-122	Islamic Studies	2(2+0)
Bot-123	Environmental Science	3(2+1)
Bot-124	Principles in Animal Life-II	3(2+1)
Bot-125	Inorganic Chemistry	3(2+1)
Bot-126	Systematics, Anatomy and Development	4(3+1)
		18

2nd Year

SEMESTER-3

Course #	Title	Credit Hours
Bot-231	English-III	3(3+0)
Bot-232	Introduction to Computer	3(1+2)
Bot-233	Animal Diversity-I	3(2+1)
Bot-234	Organic Chemistry	4(3+1)
Bot-235	Cell Biology, Genetics and Evolution	4(3+1)
		17

[Signature]
Assistant Registrar (Academics)
University of Malakand

SEMESTER-4

Course #	Title	Credit Hours
Bot-241	Biostatistics	3(3+0)
Bot-242	Animal Diversity-II	3(2+1)
Bot-243	Special Topics in Chemistry	3(2+1)
Bot-244	Plant Physiology and Ecology	4(3+1)
Bot-245	Biodiversity and Conservation	4(3+1)
		17

Note: In addition to Botany students are desired to study 2 other science subjects of equal credit hours as desired by the university.

3rd Year

SEMESTER-5

Course #	Title	Credit Hours
Bot-351	Bacteriology and Virology	3(2+1)
Bot-352	Diversity of Vascular Plants	3(2+1)
Bot-353	Phycology and Bryology	3(2+1)
Bot-354	Mycology and Plant Pathology	3(2+1)
Bot-355	Plant Systematics	3(2+1)
Bot-356	Plant Anatomy	3(2+1)
		18

SEMESTER-6

Course #	Title	Credit Hours
Bot-361	Plant Ecology-I	3(2+1)
Bot-362	Genetics-I	3(2+1)
Bot-363	Plant Biochemistry-I	3(2+1)
Bot-364	Plant Physiology-I	3(2+1)
Bot-365	Molecular Biology	3(2+1)
		15

4TH YEAR**SEMESTER-7**

Course #	Title	Credit Hours
Bot-471	Plant Bio-chemistry-II	3(2+1)
Bot-472	Plant Ecology-II	3(2+1)
Bot-473	Advances in Plant Breeding	3(2+1)
Bot-474	Genetics-II	3(2+1)
Bot-475	Plant Physiology-II	3(2+1)
		15

Assistant Registrar (Academics)
University of Malakand

SEMESTER-8

Course #	Title	Credit Hours
Bot-481	Tissue Culture	4(2+1)
Bot-482	Environmental Biology	3(2+1)
Bot-483	Elective-III/Research Project/Internship/Optional Paper	4(3+1) or 4(0+4)
Bot-486 /487	Advances in Plant Taxonomy	4(2+1)
		15

Detail of special papers

Survey of I code of Botanical nomenclature (ICBN)	4
Medicinal Plants	4
Introductory Horticulture	4
Plant conservation	4
Dendrochronology	4
Population structure in dynamics	4

Special papers will be according to the expertise available in the university

Total credit hours: 133

Diversity of Plants Zoology 1st Semester
Diversity of Plants Biotechnology 1st Semester

Assistant Registrar (Academics)
University of Malakand

DETAIL OF COURSES

1st Year

SEMESTER-1

Course #	Title	Credit Hours
Bot-111	English-1	3(3+0)
Bot-112	Pakistan Studies	2(2+0)
Bot-113	Mathematics-I	3(3+0)
Bot-114	Physical Chemistry	3(2+1)
Bot-115	Principles in Animal Life-I	3(2+1)
Bot-116	Diversity of Plants	4(3+1)
		18

SEMESTER-1

Bot-111

English-1

3(3+0)

Objectives: Enhance language skills and develop critical thinking.

Course Contents:

Basics of Grammar, Parts of speech and use of articles, Sentence structure, active and passive voice, Practice in unified sentence, Analysis of phrase, clause and sentence structure, Transitive and intransitive verbs, Punctuation and spelling

Comprehension: Answers to questions on a given text

Discussion: General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Listening: To be improved by showing documentaries/films carefully selected by subject teachers

Translation Skills, Urdu to English

Paragraph Writing: Topics to be chosen at the discretion of the teacher

Presentation Skills: Introduction, Extensive reading is required for vocabulary building



 Assistant Registrar (Academics)
 University of Malakand

RECOMMENDED BOOKS:

1. Functional English

a) Grammar:

1. Practical English Grammar by A.J. Thomson and A.V., Martinet. Exercises 1. Third edition. Oxford University, Press. 1997. ISBN 0194313492.
2. Practical English Grammar by A.J. Thomson and A.V., Martinet. Exercises 2. Third edition. Oxford University, Press. 1997. ISBN 0194313506

b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford, Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension

1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression, 1992. ISBN 0 19 453402 2.

Bot-112 PAKISTAN STUDIES 2(2+0)

Introduction/Objectives

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline

1. Historical Perspective

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and geo-physical features.

2. Government and Politics in Pakistan

Political and constitutional phases:

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward



3. Contemporary Pakistan

- a. Economic institutions and issues
- b. Society and social structure
- c. Ethnicity
- d. Foreign policy of Pakistan and challenges
- e. Futuristic outlook of Pakistan

Books Recommended

1. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
4. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
5. Burki, Shahid Javed. *State & Society in Pakistan*, The Macmillan Press Ltd 1980.
6. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.
7. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
8. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
9. Muhammad Waseem, Pakistan Under Martial Law, Lahore: Vanguard, 1987.
10. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.
12. Wilcox, Wayne. *The Emergence of Banglades*., Washington: American Enterprise, Institute of Public Policy Research, 1972.
13. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
- Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.

Assistant Registrar (Academics)
University of Malakand

Bot-113

MATHEMATICS-I (ALGEBRA)

3(3+0)

Specific Objectives of the Course: To prepare the students, not majoring in mathematics, with the essential tools of algebra to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions.

Matrices: Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.

Quadratic Equations: Solution of quadratic equations, qualitative analysis of roots of a quadratic equations, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations.

Sequences and Series: Arithmetic progression, geometric progression, harmonic progression.

Binomial Theorem: Introduction to mathematical induction, binomial theorem with rational and irrational indices.

Trigonometry: Fundamentals of trigonometry, trigonometric identities.

Recommended Books:

1. Boston (suggested text)
2. Dolciani MP, Wootton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin,
3. Kaufmann JE, College *Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
4. Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston.



Aims and Objectives

The course aims to impart knowledge and understanding of:

- The concept and status of Zoology in life sciences.
- The common processes of life through its chemistry, biochemical and molecular processes.
- 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.
- Animals and their relationship with their environment.

Course Contents

1. Place of Zoology in Science: A one-world view: genetic unity, the fundamental unit of life, evolutionary oneness and the diversity of life, environment and world resources; what is zoology? The classification of animals; the scientific method.

2. 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.

3. 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.

4. 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.

5. 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.

6. Ecology I: Individuals and Populations; Animals and their abiotic environment; populations; interspecific interactions.

7. Ecology II: Communities and Ecosystems; Community structure and diversity; ecosystems; ecosystems of the earth; ecological problems; human population growth, pollution, resource depletion and biodiversity.

Practicals

- 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.

- Study of the prepared slides of epithelial tissue (squamous, cuboidal, columnar), connective tissue (adipose, cartilage, bone, blood), nervous tissue and muscle tissue (skeletal, smooth and cardiac).

Note: Prepared microscopic and/or projection slides and/or CD ROM computer projections must be used.

- Plasmolysis and deplasmolysis in blood.

Assistant Registrar (Academics)
University of Malakand

4. Protein digestion by pepsin.
5. Ecological notes on animals of a few model habitats.
6. Field observation and report writing on animals in their ecosystem (a terrestrial and an aquatic ecosystem study).

Books Recommended

1. Campbell, N.A. Biology, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
2. Hickman, C.P. and Kats, H.L., Laboratory Studies in Integrated Principles of Zoology. 2000. Singapore: McGraw Hill.
3. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles of Zoology, 12th Edition (International), 2004. Singapore: McGraw Hill.
4. Kent, G.C. and Miller, S. Comparative Anatomy of Vertebrates, 2001. New York: McGraw Hill.
5. Miller, S.A. and Harley, J.B. Zoology, 6th Edition (International), 2005. Singapore: McGraw Hill.
6. Miller, S.A. General Zoology Laboratory Manual. 5th Edition (International), 2002. Singapore: McGraw Hill.
7. Molles, M. C. Ecology: concepts and Applications. 6th Edition. 2005. McGraw Hill, New York, USA.
8. Odum, E. P. Fundamentals of Ecology. 3rd Edition. 1994. W.B. Saunders. Philadelphia.
9. Pechenik, J.A. Biology of Invertebrates, 5th Edition (International), 2000. Singapore: McGraw Hill.
10. Slingby, D. and Cook, C., Practical Ecology. 1986. McMillan Education Ltd. UK.

Assistant Registrar (Academics)
University of Malakand

Bot-115

PHYSICAL CHEMISTRY (G)

3(2+1)

Course Contents:

Physical States of Matter

Ideal and real gases; equations of state, critical phenomenon and critical constants. Molecules in motion: collision diameter and mean free path. Physical properties of liquids: surface tension, viscosity, refractive index etc. and their applications. Brief account of interactions among the molecules in liquids. Packing of atoms in solids. Unit cells and crystal systems. Method of crystal structure analysis. Brief account of polymers and composite materials with special emphasis on superconductors, semi-conductors etc. Introduction to plasma.

Chemical Thermodynamics

Laws of thermodynamics and their applications. Thermodynamic functions: internal energy, enthalpy, entropy and free energy. Relation between thermodynamic functions. van't Hoff's equation. Heat capacities, concept of entropy and probability.

Chemical Kinetics

Rate of reaction. Rate law, order and molecularity of the reactions. Zero, first and second order reactions. Determination of reaction order and its rate constant. Effect of temperature on the reaction rate. Concepts of chemical equilibrium. Le-Chatelier's principle and its applications. Elementary concepts underlying complex and fast reactions.

Solution Chemistry

Ideal and non-ideal solutions. Raoult's and Henry's laws and their applications. Molecular interactions in solutions. Colligative properties. Distillation and concept of azeotropic mixture.

Surface Chemistry

Concept of interfaces. Adsorption and adsorption isotherms: Freundlich and Langmuir adsorption isotherms. Catalysis, colloids emulsion and their industrial applications.

Electrochemistry

Basic concepts of electrochemistry. Ions in solution. Measurement of conductance and Kohlrausch's law. Debye-Hückel theory and activity coefficient. Application of conductance measurement. Electrode potential. Electrochemical cell. Application of electrode potential

Practical:

Determination of viscosity and parachor values of liquids.

2. Determination of percent composition of liquid solutions viscometrically.

Assistant Registrar (Academics)
University of Malakand

3. Determination of refractive index and molar refractivity.
4. Determination of percent composition of liquid solutions by refractive index measurements.
5. Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).
6. Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).
7. Determination of heat of solution by solubility method.
8. Determination of heat of neutralization of an acid with a base.
9. Kinetic study of acid catalyzed hydrolysis of ethyl acetate.
10. Determination of partition coefficient of a substance between two immiscible liquids.

RECOMMENDED BOOKS:

1. Albert R. "Physical Chemistry" 17th ed., John Wiley and Sons (1987).
2. Atkins, P.W. "Physical Chemistry" 6th ed., W.H. Freeman and Co. New York (1998).
3. Barrow G.M. "Physical Chemistry" 5th ed., McGraw Hill (1992).
4. Brain S.E. "Basic Chemical Thermodynamics" 4th ed., E.L.B.S. Publishers (1990).
5. Jaffar M. "Experimental Physical Chemistry" University Grants Commission (1989).
6. Laidler K.J. "The World of Physical Chemistry" 1st ed., Oxford University Press (1993).
7. Laidler K.J., John H.M. and Bryan C.S. "Physical Chemistry" 4th ed., Houghton Mifflin Publishing Company Inc. (2003).
8. Levitt B.P. "Findlay's Practical Physical Chemistry" 9th ed., Longman Group Limited (1978).
9. Peter P.A. "Chemical Thermodynamics" Oxford University Press (1983).
10. Shoemaker D. "Experiments in Physical Chemistry" 5th ed., McGraw Hill Publishing Company Limited (1989).



Bot-116

DIVERSITY OF PLANTS

4(3+1)

Theory

- Comparative study of life form, structure, reproduction and economic significance of:
- a) Viruses (RNA and DNA types) with special reference to TMV;
 - b) Bacteria and Cyanobacteria (*Nostoc*, *Anabaena*, *Oscillatoria*) with specific reference to biofertilizers, pathogenicity and industrial importance;
 - c) Algae (*Chlamydomonas*, *Spirogyra*, *Chara*, *Vaucheria*, *Pinnularia*, *Ectocarpus*, *Polysiphonia*)
 - d) Fungi (*Mucor*, *Penicillium*, *Phyllactinia*, *Ustilago*, *Puccinia*, *Agaricus*), their implication on crop production and industrial applications.
 - e) Lichens (*Physcia*)
 - f) Bryophytes
 - i. *Riccia*
 - ii. *Anthoceros*
 - iii. *Funaria*
 - f). Pteridophytes.
 - i. Fossils and fossilization
 - ii. *Psilopsida* (*Psilotum*)
 - iii. *Lycopsida* (*Selaginella*)
 - iv. *Sphenopsida* (*Equisetum*)
 - v. *Pteropsida* (*Marsilea*)
 - vi. Seed Habit
 - g). Gymnosperms Cycas, Pinus, Ephedra.

Practical

Culturing, maintenance, preservation and staining of microorganisms. Study of morphology and reproductive structures of the types of each subject mentioned in theory. Identification of various types mentioned from prepared slides and fresh collections.

Books recommended:

1. Agrios, G.N. 2004. Plant pathology. 8th ed. Academic press London.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. 4th ed. John Wiley and Sons Publishers.
3. Andrew, H. N. 1961. Studies in Paleobotany. John Willey and Sons.
4. Ingrouille , M. 1992. Diversity and Evolution of Land Plants. Chapman & Hall .
5. Lee, R.E. 1999. Phycology. Cambridge University Press, UK
6. Mauseth, J.D. 2003. Botany: An Introduction to Plant Biology 3rd ed., Jones and Bartlett Pub. UK
7. Prescott, L.M., Harley, J.P. and Klein, A.D. 2004. Microbiology, 3rd ed. WM. C. Brown Publishers.
8. Vashishta, B.R. 1991. Botany for degree students (all volumes). S. Chand and Company. Ltd. New Delhi.

Assistant Registrar (Academics)
University of Malakand

SEMESTER-2

Course #	Title	Credit Hours
Bot-121	English-II	3(3+0)
Bot-122	Islamic Studies	2(2+0)
Bot-123	Environmental Science	3(2+1)
Bot-124	Principles in Animal Life-II	3(2+1)
Bot-125	Inorganic Chemistry	3(2+1)
Bot-126	Systematics, Anatomy and Development	4(3+1)
		18

SEMESTER-2

Bot-121 **ENGLISH-II** **3(3+0)**

Objectives: Enable the students to meet their real life communication needs.

Course Contents

Paragraph Writing: Practice in writing a good, unified and coherent paragraph

Essay Writing: Introduction

CV and Job Application

Translation Skills: Urdu to English

Study Skills: Skimming and scanning, intensive and extensive, and speed-reading, summary and précis writing and comprehension

Academic Skills: Letter/memo writing, minutes of meetings, use of library and internet

Presentation Skills: Personality development (emphasis on content, style and pronunciation)

RECOMMENDED BOOKS:

a) Grammar

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

b) Writing

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

c) Reading

Reading and Study Skills by John Langan

Assistant Registrar (Academics)
University of Management

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
Study Skills by Riachard Yorky.

Bot-122 ISLAMIC STUDIES 2(2+0)

Objectives:

This course is aimed at:

- 1 To provide Basic information about Islamic Studies
- 2 To enhance understanding of the students regarding Islamic Civilization
- 3 To improve Students skill to perform prayers and other worships
- 4 To enhance the skill of the students for understanding of issues related to faith and religious life.

Detail of Courses

Introduction to Quranic Studies

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

Study of Selected Text of Holly Quran

- 1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi
(Verse No-1-18)
- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

Study of Selected Text of Holly Quran

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

Seerat of Holy Prophet (S.A.W) I

- 1) Life of Muhammad Bin Abdullah (Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

*Assistant Registrar (Academics)
University of Malakand*

Seerat of Holy Prophet (S.A.W) II

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life of Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction To Sunnah

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

Selected Study from Text of Hadith

Introduction To Islamic Law & Jurisprudence

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

Islamic Culture & Civilization

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

Islam & Science

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

Islamic Economic System

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

Political System of Islam

Assistant Registrar (Academics)
University of Malakand

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

Islamic History

- 1) Period of Khlaft-E-Rashida
- 2) Period of Ummayyads
- 3) Period of Abbasids

Social System of Islam

- 1) Basic Concepts Of Social System Of Islam
- 2) Elements Of Family
- 3) Ethical Values Of Islam

Reference Books:

1. Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research
2. Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama
3. H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep
4. Hameed ullah Muhammad, 'Introduction to Islam'
5. Hameed ullah Muhammad, "Emergence of Islam", IRI, Islamabad
6. Hameed ullah Muhammad, "Muslim Conduct of State"
7. Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf
Publication Islamabad, Pakistan.
8. Institute, International Islamic University, Islamabad (1993)
9. Iqbal Open University, Islamabad (2001)
10. Islamic Book Service (1982)
11. Mir Waliullah, "Muslim Jurisprudence and the Quranic Law of Crimes"
12. Mulana Muhammad Yousaf Islahi,"Publications New Delhi (1989)



Assistant Registrar (Academics)

Bot-123

ENVIRONMENTAL SCIENCE

3(2+1)

Course Contents:

Theory

The Environmental Challenges We Face; Environmental Sustainability and Human Values; Environmental History, Politics and Economics; Risk analysis and Environmental Health Hazards; How Ecosystems Work; Ecosystems and Evolution; Human Population Change and the Environment; Air and air Pollution; Global Atmospheric Changes; Freshwater Resources and Water Pollution; The Ocean and Fisheries; Mineral and Soil Resources; Land Resources; Agriculture and Food Resources; Biological Resources; Solid and Hazardous Waste; Nonrenewable Energy Resources; Renewable Energy Resources.

Practical:

13. Testing Water for Coliform Bacteria
14. Effects of Environmental Pollutants on Daphnia
15. Density of Invasive species
16. Do Plants Grows As well in Gray water As in tape water?
17. Build and Use a Turbidity Tube
18. What do People Throw Away?
19. Solar Energy
20. The Safety of Resting Water Bottles
21. Wind Energy
22. Test for Ozone
23. Biodegradation of Oil
24. The Taste Test
25. Solar Water Heater
26. Population Growth in Yeast
27. How Does acid Precipitation Affect Coleus
28. Effects of Nitrates Nitrates on Duckweed Populations
29. Seeds of The Future
30. Design a Reusable Envelope
31. Algae As Biofuel
32. Energy in Ecosystems

HO ~ Q
Assistant Registrar (Academics)
University of Malakand

Assistant Registrar (Academics)
University of Malakand

Course Contents**33. Cell Division**

Mitosis, cytokinesis, and the cell cycle: an overview; control of the cell cycle; meiosis: the basis of sexual reproduction; gamete formation.

1. Inheritance Patterns

The birth of modern genetics; mendelian inheritance patterns; other inheritance patterns; environmental effects and gene expression.

2. Chromosomes and Gene Linkage

Eukaryotic chromosomes; linkage relationships; changes in chromosome number and structure.

3. Molecular Genetics: Ultimate Cellular Control

DNA: the genetic material; DNA replication in eukaryotes; genes in action; control of gene expression in eukaryotes; mutations; applications of genetic technologies; recombinant DNA.

5. 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.

6. Evolution and Gene Frequencies

The modern synthesis: a closer look; the Hardy-Weinberg theorem;

BOOKS RECOMMENDED

1. Campbell, N.A. 2002. BIOLOGY Sixth Edition. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
2. Hickman, C.P. Roberts, L.S. and Larson, A. 20044. INTEGRATED PRINCIPLES OF ZOOLOGY, 11th Edition (International). Singapore: McGraw Hill.
3. Kent, G.C. and Miller, S. 2001. COMPARATIVE ANATOMY OF VERTEBRATES. New York: McGraw Hill.
4. Miller; S.A. and Harley, J.B. 1999 & 2002. Zoology, 4th & 5th Edition (International). Singapore: McGraw Hill.
5. Pechenik, J.A. 2000. BIOLOGY OF INTERVEBRATES, 4TH Edition (International). Singapore: McGraw Hill.

Ron
Assistant Registrar (Academics)
University of Malakand

Course Contents**Objective of the Program**

After completing this program students will be able to learn the following:

1. The historical development of transition element chemistry
2. The importance and applications of the transition elements
3. To learn about coordination chemistry and various theories developed to explain the structure and properties of these complexes
4. Reactions in non-aqueous solvents.

Coordination Compounds

Historical back ground of coordination compounds, geometry of complexes having coordination number 2 to 9, nomenclature, theories of coordination compounds; Werner's theory, valence bond theory, crystal field and; molecular orbital theory; Jahn-Teller theorem; magnetic properties; spectrochemical series, isomerism and stereochemistry, stability constants, techniques for studying complexes, applications of coordination compounds.

Non Aqueous Solvents

Classification of solvents, types of reactions in solvents, effect of physical and chemical properties of solvent, detailed study of liq. NH₃, liq. H₂SO₄, liq HF, and liq. SO₂, BrF₃ and reaction in molten salts system.

Practicals:

1. Semi-micro analysis and Separation of anions in a mixture by paper chromatography
2. Preparation of at least four coordination compounds in a pure state
3. Complexometric titrations

RECOMMENDED BOOKS:

1. A. K. Holliday, and A. G. Massey, "Inorganic Chemistry in Non- Aqueous Solvents", Pergamon Press, New York, 1990.
2. Atkins, P. and Jones, L., "Chemical Principles" Freeman & Company, 2002.
3. Bassette, J., Denney, G. H. and Mendham, J., "Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis" English Language Book Society, 4th Edition, 1981.
4. Cotton, F. A., Wilkinson, G. and Gaus, P. L., "Basic Inorganic Chemistry", 3rd Ed., Wiley, New York, 1995.

Assistant Registrar (Academics)
University of Malakand

5. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, "Advanced Inorganic Chemistry", 6th Ed., Wiley-Interscience, New York, 1999.
6. Huheey, J. E., Keiter, E. A. and Keiter, R. L., "Inorganic Chemistry: Principles of Structure and Reactivity", 4th Ed., Harper and Row, New York, 2001
7. Larsen, E. M., "Transition Elements", W. A. Benjamin Inc., 1995
Vogel, A. I., "A Textbook of Micro and Semi-micro Qualitative Inorganic Analysis" Longman Green & Co. 1995.



Assistant Registrar (Academics)
University of Malakand

a) Plant Systematics

1. Introduction to Plant Systematics: aims, objectives and importance.
2. Classification: brief history of various systems of classification with emphasis on Takhtajan.
3. Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to International Code of Botanical Nomenclature (ICBN). St. Luis code.
4. Morphology: a detailed account of various, morphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.
5. Diagnostic characters, economic importance and distribution pattern of the following families:
 - i) Ranunculaceae
 - ii) Brassicaceae (Cruciferae)
 - iii) Fabaceae (Leguminosae)
 - iv) Rosaceae
 - v) Euphorbiaceae
 - vi) Cucurbitaceae
 - vii) Solanaceae
 - viii) Lamiaceae (Labiatae)
 - ix) Apiaceae (Umbelliferae)
 - x) Asteraceae (Compositae)
 - xi) Liliaceae (Sen. Lato)
 - xii) Poaceae (Graminae)

b) Anatomy

1. Cell wall: structure and chemical composition
2. Concept, structure and function of various tissues like:
 - i. Parenchyma
 - ii. Collenchyma
 - iii. Sclerenchyma
 - iv. Epidermis (including stomata and trichomes)
 - v. Xylem
 - vi. Phloem
3. Meristem: types, stem and root apices
4. Vascular cambium
5. Structure and development of root, stem and leaf. Primary and secondary growth of dicot stem, periderm
6. Characteristics of wood: diffuse porous and ring –porous, sap and heart wood, soft and hard wood, annual rings.

c) Development / Embryology.

1. Early development of plant body: *Capsella bursa-pastoris*
2. Structure and development of Anther
 - Microsporogenesis
 - Microgametophyte
3. Structure of Ovule
 - Megasporogenesis
 - Megagametophyte
4. Endosperm formation

Assistant Registrar (Academic)
University of Malakand

5. Parthenocarpy
6. Polyembryony

Practical Anatomy

1. Study of stomata, epidermis,
2. Tissues of primary body of plant
3. Study of xylem 3-dimensional plane of wood.,
4. T.S of angiosperm stem and leaf .

Taxonomy

1. Identification of families given in syllabus with the help of keys.
2. Technical description of common flowering plants belonging to families mentioned in theory syllabus.
3. Field trips shall be undertaken to study and collect local plants. Students shall submit 40 fully identified herbarium specimens.

Books Recommended

1. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.
2. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
3. Lawrence, G.H.M. 1951 Taxonomy of Vascular Plants. MacMillan & Co. New York.
4. Maheshwari, P.1971. Embryology of Angiosperms, McGraw Hill.New York.
5. Mauseth, J.D. 1998. An Introduction to Plant Biology: Multimedia Enhanced. Jones and Bartlett Pub. UK.
6. Moore, R.C., W.D. Clarke and Vodopich, D.S. 1998. Botany. McGraw Hill Company, U.S.A.
7. Panday, B.P. 2004. A textbook of Botany (Angiosperms). S. Chand and Co. New Delhi.
8. Raven, P.H., Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants. W.H. Freeman and Company Worth Publishers.
9. Raymond E, S. E. Eichhorn. 2005. Esau's Plant Anatomy. Meristems cells and tissues of the plant body, 3rd ed. John Wiley & Sons. Inc.
10. Stuessy, T.F. 1990. Plant Taxonomy. Columbia University Press, USA.

Assistant Registrar (Academics)
University of Malakand

2nd Year

SEMESTER-3

Course #	Title	Credit Hours
Bot-231	English-III	3(3+0)
Bot-232	Introduction to Computer	3(1+2)
Bot-233	Animal Diversity-I	3(2+1)
Bot-234	Organic Chemistry	4(3+1)
Bot-235	Cell Biology, Genetics and Evolution	4(3+1)
		17

Bot-231 ENGLISH-III 3(2+1)

English III (Technical Writing and Presentation Skills)

Objectives: Enhance language skills and develop critical thinking

Course Contents

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Assistant Registrar (Academics)
University of Malakand

Recommended books:

Technical Writing and Presentation Skills

a) Essay Writing and Academic Writing

1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
2. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004.
3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.

b) Presentation Skills

c) Reading

The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editiors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

Assistant Registrar (Academics)
University of Malakand

Bot-232

INTRODUCTION TO COMPUTER

3(1+2)

Introduction to Computers Science; Introduction to Data-Base; Introduction to Windows; Windows Application (Word, Excel, PowerPoint and Multimedia); introduction to INTERNET & use of Electronic Mail; Introduction to Medical Informatics & use of Statistical Package; Introduction to UNIX & C; Computer Aided Teaching & testing

Practicals:

Medline, Meddler Search; Usage of statistics for data analysis; Creation of Data Base; Slide Presentation; Computer Aided Learning.



A handwritten signature in blue ink, appearing to read "H. S. R.", is written over a blue oval. Below the oval, the text "Assistant Registrar (Academics)" and "University of Malakand" is printed in a smaller, slanted font.

Bot-233

ANIMAL DIVERSITY-I

3(2+1)

(Same course as for other bachelor degree)

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.

Course Contents

1. Introduction

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

2. 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.

3. Multicellular and Tissue Levels of Organization

Evolutionary perspective: origins of multicellularity; animal origins. Phylum porifera: cell types, body wall, and skeletons; water currents and 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 ctenophora; further phylogenetic considerations.

4. Triploblastics and 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.

5. Pseudocoelomate Body Plan: Aschelminths

Evolutionary perspective; general characteristics; classification up to phyla with external features; feeding and the digestive system; other organ systems; reproduction and development of phylum rotifera and phylum nematoda; phylum kinorhyncha. Some important nematode parasites of humans; further phylogenetic considerations.

6. 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.

7. 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.

8. Arthropods: Blueprint for Success

Assistant Registrar (Academics)
University of Malakand

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

9. 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.

Books Recommended

1. Campbell, N.A. Biology, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
2. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles of Zoology, 11th Edition (International), 2004. Singapore: McGraw Hill.
3. Kent, G.C. and Miller, S. Comparative Anatomy of Vertebrates. 2001. New York: McGraw Hill.
4. Miller, S.A. and Harley, J.B. Zoology, 5th Edition (International), 2002. Singapore: McGraw Hill.
5. Pechenik, J.A. Biology of Invertebrates, 4th Edition (International), 2000. Singapore: McGraw Hill.

Practicals

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*.



Isomerism

Introduction; classification of isomerism; optical isomerism: optical activity, chirality and optical activity, symmetry elements and optical inactivity, relative and absolute configuration, R, S notation, method of determining configuration, racemic mixtures and their resolution, asymmetric synthesis, optical activity in biphenyls, allenes and spiro compounds, stereospecific and stereoselective reactions; geometrical isomerism: determination of configuration of geometrical isomers, Z,E convention and *cis trans* isomerism in cyclic systems; conformational isomerism: conformational analysis of mono-substituted cyclohexanes, di-substituted cyclohexanes and decalin systems.

Introductory Organic Spectroscopy

Introduction to IR, UV, 1H-NMR and Mass spectrometric methods, and their usage for structure elucidation of some simple organic compounds.

Aliphatic Substitution Reactions

Aliphatic Nucleophilic Substitution Reactions: Mechanisms—study of SN₂, SN₁, SNi, SN_{2'}, SN_{1'}, SNi' mechanisms; neighbouring group participation—intramolecular displacement by neighbouring oxygen, nitrogen, sulphur and halogen; structure and reactivity—effects of the substrate structure, entering group, leaving group and reaction medium on the mechanisms and rates of substitution reactions.

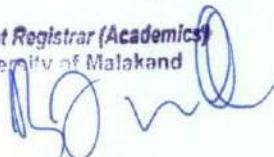
Aliphatic Electrophilic Substitution Reactions: Mechanisms—study of SE₁, SE₂ (front), SE₂ (back) and SE_i mechanisms; structure and reactivity—effects of substrate, leaving group and medium on the rates of these reactions.

Elimination Reactions

Eliminations Proceeding by Polar Mechanisms: Study of E₁, E_{1cB} and E₂ mechanisms; orientation: Saytzeff and Hofmann rules; structure and reactivity—the effects of substrate structure, attacking base, leaving group and the reaction medium on the rates and mechanisms of elimination reactions; competition between elimination and substitution reactions.

Eliminations Proceeding by Non-polar Mechanisms: Pyrolytic eliminations—study of E_i and free-radical mechanisms; orientation in pyrolytic eliminations.

Assistant Registrar (Academics)
University of Malakand



Practicals:

Laboratory work illustrating topics covered in the lecture of Chem-261

RECOMMENDED BOOKS:

1. Carey, F. A., "Organic Chemistry", McGraw-Hill, New York
2. Eliel, E. L., Wilen, S. H. and Doyle, M. P., "Basic Organic Stereochemistry", Wiley-Interscience, New York.
3. Kalsi, P.S. "Spectroscopy of Organic Compounds", Wiley Eastern Ltd., New Delhi.
4. Loudon, G. M., "Organic Chemistry", Oxford University Press, New York.
5. March, J., "Advanced Organic Chemistry", John Wiley & Sons, New York.
6. McMurry,J., "Organic Chemistry", Brooks/Cole Publishing Company, California.
7. Morrison, R. T. and Boyd, R. N., "Organic Chemistry", Prentice-Hall of India, New Delhi.
8. Norman, R. O.C. and Coxon, J. M., "Principles of Organic Synthesis", Nelson Thornes, Cheltenham.
9. Pavia, D. L., Lampman, G. M. and Kriz, G. S., "Introduction to Spectroscopy: A Guide for Students of Organic Chemistry", Saunders Golden Sunburst Series, London.
10. Solomons, T. W. G. and Fryhle, C. B., "Organic Chemistry", John Wiley & Sons, New York.
11. Sykes, P., "A Guide Book to Mechanism in Organic Chemistry", Longman, London.



Theory**a) Cell Biology**

1. Structures and Functions of Bio-molecules
 - i. Carbohydrates
 - ii. Lipids
 - iii. Proteins
 - iv. Nucleic Acids
2. Cell: Physico-chemical nature of plasma membrane and cytoplasm.
3. Ultrastructure of plant cell with a brief description and functions of the following organelles
 - 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 embryogenic cell, mitosis and meiosis, cell cycle
6. Chromosomal aberrations; Changes in the number of chromosomes. Aneuploidy and euploidy. Changes in the structure of chromosomes, deficiency, duplication, inversion and translocation.

b) Genetics

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

Assistant Registrar (Academics)
University of Malakand



Practical

Cell Biology

1. Study of cell structure using compound microscope and elucidation of ultrastructure 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 carbohydrate, protein, RNA and DNA from plant sources.

Genetics

1. Genetical problems related to transmission and distribution of genetic material.
2. Identification of DNA in plant material. Carmine/orcein staining.
3. Study of salivary gland chromosomes of Drosophila.

Books Recommended

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

Assistant Registrar (Academics)
University of Malakand

SEMESTER-4

Course #	Title	Credit Hours
Bot-241	Biostatistics	3(3+0)
Bot-242	Animal Diversity-II	3(2+1)
Bot-243	Special Topics in Chemistry	3(2+1)
Bot-244	Plant Physiology and Ecology	4(3+1)
Bot-245	Biodiversity and Conservation	4(3+1)
		17

SEMESTER-4

Bot-241 **Biostatistics** **3(3+0)**

Theory

1. Introduction and scope: definition; characteristics, importance and limitations, population and samples.
2. Frequency distribution and probabilities: Formation of frequency table from raw data, histograms. Applications of probabilities to simple events.
3. Measures of central tendencies and dispersion: Arithmetic mean, median, mode, range, variance, standard deviation, standard error of the mean, mean deviation, semi interquartile range.
4. Standard distributions: Binomial, Poisson and normal distributions, properties and applications. Normality.
5. Tests of significance: Introduction:
 - i) t-test: Basic idea, confidence limits of means, significant difference of means.
 - ii) Chi square test: Basic idea, testing goodness of fit to a ratio, testing association (contingency table).
 - iii) F-test: Introduction and application in analysis of variance.
 - iv) LSD test, Duncan's New Multiple Range test (for comparison of individual means). Bonferroni test.
6. Design of experiment: Concept of design, principles of experiment, planning of an experiment, replication and randomization, field plot technique, layout and analysis of completely randomized design, randomized complete block design, Latin square, factorial design, treatment comparison.
7. Brief account of correlation and linear regression.

Assistant Registrar (Academics)
University of Malakand

Practical

1. Probability of simple events.
2. Data collection, arrangement of data in frequency table.
3. Calculation of mean from grouped and ungrouped data.
4. Calculation of variance and standard deviation from grouped and ungrouped data.
5. Binomial distribution.
6. T-test.
7. Poisson distribution,
8. Chi square test.
9. Analysis of variance - one factor design

10. Analysis of variance - two way analysis
11. Analysis of variance - for latin square
12. Analysis of variance - for factorial design.
13. Correlation.
14. Linear Regression.

Books Recommended

1. Bailey, N.T.J. 1994. Statistical Methods in Biology, Cambridge University Press.
2. Fernholz L.T, Morgenhaler, S., Stahel, W. 2000. Statistics in Genetics and in Environmental Sciences, Birkhauser Verlag;
3. Kuzma J.W. and Bohnenblust, S.E. 2001, Basis Statistics for the Health Sciences, McGraw-Hill International Education.
4. Quinn, G. 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press.
5. Wonnacott, T.H, and Wonnacott. R.J. 1990, Introductory Statistics, John Wiley and Sons.
6. Zar J.H. 1999. Biostatistical Analysis., Pearson Education,



Assistant Registrar (Academics)
University of Malakand

SEMESTER-4

Bot-242

Animal Diversity-II

3(2+1)

Aims and Objectives

The course provides knowledge and understanding about the different animal groups, emphasizing their phylogenetic relationships.

Course Contents

1. 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, cyclophores, and chaetognaths.

2. Hemichordates and Invertebrate Chordates:

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

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

Assistant Registrar (Academic)
University of Malakand
[Signature]

Books Recommended

1. Campbell, N.A. Biology, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
2. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles of Zoology, 11th Edition (International), 2004. Singapore: McGraw Hill.
3. Kent, G.C. and Miller, S. Comparative Anatomy of Vertebrates. 2001. New York: McGraw Hill.
4. Miller, S.A. and Harley, J.B. Zoology, 5th Edition (International) 2002. Singapore: McGraw Hill.
5. Pechenik, J.A. Biology of Invertebrates, 4th Edition (International), 2000. Singapore: McGraw Hill.

Practicals

1. Study of a representative of Hemichordate and Invertebrate Chordate.
2. Study of representative groups of class Fishes.
3. Study of representative groups of class Amphibia.
4. Study of representative groups of class Reptilia.
5. Study of representative groups of class Aves.
6. Study of representative groups of class Mammalia.
7. Field trips to study animal diversity in an ecosystem.

Note: Preserved specimen and/or colored projection slide and/or CD ROM projection of computer must be used.

Assistant Registrar (Academics)
University of Malakand

Bot-243

Science Subject other than Major-IV

3(2+1)

Or

Special Topics in Chemistry

Special Topics in Chemistry

Electrochemistry

Electrolysis

Electrolytic Conductance (Specific Conductance, Equivalent and Molar Conductance, Measurement of Electrolytic Conductance)

Variation of Conductance with Concentration

Kohlrausch's Law

Debye-Hückel Theory

Activity of Electrolytes

Electrochemical Cells

Electrode Potential

Quantum Theory

Quantum Mechanics

The de-Broglie Equation

Heisenberg's Uncertainty Principle

Schrödinger's Wave Equation

Chemistry of d-Block Elements

Transition Elements

Electronic Configuration of d-Block Elements

General Characteristics of d-Block Elements

Important Terms in Coordination Chemistry (Complex Ion, Ligands, Coordination Sphere, Coordination Number)

Transition Metal Complexes-Nature of Coordinate Bond

Structure of Coordination or Complex Compounds

Werner's Theory (Postulates of Werner's Theory, Applications of Werner's Theory)

Valence Bond Theory (VBT as Applied to Octahedral Complexes e.g., $[Co(NH_3)_6]^{3+}$ Complex Ion and $[CoF_6]^{3-}$ Complex Ion, VBT as Applied to Tetrahedral Complexes e.g., $[Ni(CO)_4]$, VBT as Applied to Square Planar Complexes e.g., $[Ni(CN)_4]^{2-}$)

Crystal Field Theory (CFT as Applied to Octahedral Complexes, Explanation of Magnetic Properties of $[CoF_6]^{3-}$ Complex Ion and $[Co(NH_3)_6]^{3+}$ Complex Ion, Explanation of Color of Complexes)

Molecular Orbital Theory (MOT as Applied to Octahedral Complexes e.g., $[CoF_6]^{3-}$ and $[Co(NH_3)_6]^{3+}$)

Nomenclature of Coordination Compounds

Chelates

Importance of Chelates and Coordination Compounds

Assistant Registrar (Academics)
University of Malakand

Introduction to Nuclear Chemistry

Radioactivity (Natural and Artificial)

Nuclear Reactions (Nuclear Fission and Nuclear Fusion)

Medical, Research and Industrial Applications of Radioactive Isotopes and Radioactive Dating

Chromatography

Introduction to Column, Thin Layer and Paper Chromatography

Heterocyclic Compounds

Introduction

Structure, Preparation and Chemical Reactions of Pyrrole, Furan, Thiophene and Pyridine

Introduction to Spectroscopy

Electromagnetic Radiation

Principle of Spectroscopy

Spectrophotometer

Introduction to UV-Visible and IR Spectroscopy

Carbohydrates

Introduction

Classification of Carbohydrates

D and L Designations

Introductory Study of Monosaccharides (Glucose, Fructose), Disaccharides (Sucrose, Lactose, Maltose) and Polysaccharides (Starch, Glycogen, Cellulose)



SEMESTER-4**Bot-244****Plant Physiology and Ecology****4(3+1)****A. Plant Physiology**

1. Water relations (water potential, osmotic potential, pressure potential, matric potential).
Absorption and translocation of water.
1. Stomatal regulation.
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 C₃ and C₄ plants. Factors affecting this process, Products of photosynthesis.
4. Respiration: Definition and respiratory substrates. Mechanism-Glycolysis, Krebs cycle. Electron transport and oxidative phosphorylation. Anaerobic respiration. Energy balance in aerobic and anaerobic respiration, Respiratory quotients.
5. Growth: Definition; role of auxins, gibberellins, cytokinins, abscisic acid and ethylene in controlling growth. Introduction to plant tissue culture.
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. 12. Plant Movements: Classification. Tropic movements-phototropism, gravitropism and their mechanisms. Nastic movements.

b) Ecology

1. Introduction, aims and applications of ecology.
2. Soil: Physical and Chemical properties of soil (soil formation, texture, pH, EC, organism and organic matter etc)and their relationships 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. Effect of precipitation on distribution of plants.
5. Wind: Wind as an ecological factor and its importance.
6. Population Ecology: Introduction. A brief description of seed dispersal, seed bank, demography, density effects and reproductive strategy.
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, types and components of ecosystem.
 - II. Food chain and Food web.
 - III. Biogeochemical cycles, definition, types with emphasis on
1. Nitrogen and Hydrological cycles.
9. Applied Ecology

Assistant Registrar (Academics)
University of Malakand

- I. Causes, effects and control of water logging and salinity with respect to Pakistan
- II. Soil erosion: types, causes and effects (wind and water)
- III. Brief concept of pollution types and effects (air, sediments and water pollution)
- IV. Brief introduction to biodiversity and conservation with emphasis on Pakistan.

Practical

a) Plant Physiology

1. Preparation of solutions of specific normality of acids/bases, salts, sugars, molal and molar solutions and their standardization.
2. Determination of uptake of water by swelling seeds when placed in sodium chloride solution of different concentrations.
3. Measurement of leaf water potential by the dye method.
4. Determination of the temperature at which beet root cells lose their permeability.
5. Determination of the effects of environmental factors on the rate of transpiration of a leafy shoot by means of a porometer/by cobalt chloride paper method.
6. Chemical tests for the following cell constituents:
 - i. Starch
 - ii. Cellulose
 - iii. Lignin
 - iv. Proteins
7. Extraction of chlorophyll from the leaves and separation of component pigments on a paper chromatogram. Study of absorption spectra using spectrophotometer.
8. Estimation of oxygen utilized by a respiring plant by Winkler's method.
9. Extraction of amylase from germinating wheat seeds and study of its effect on starch breakdown.
10. Measurement of carbon dioxide evolution during respiration of germinating seeds by the titration method.
11. Measurement of light and temperature.
12. Effect of light and temperature on seed germination.

b) Ecology

13. Determination of physical and Chemical characteristics of soil.
14. Measurements of various population variables
15. Measurement of vegetation by Quadrat and line intercept methods.
16. Field trips to ecologically diverse habitats.
17. Measurements of wind velocity.



 Assistant Registrar (Academics)
 University of Malakand

Books Recommended

1. Barbour, M. G., J. H. Burke and W.D. Pitts. 1999. Terrestrial Plant Ecology, The Benjamin, Cumming Publishing Co. Palo Alto, California, USA.
2. Chapman, J.L. and Reiss, M.J. 1995. Ecology: Principles and Applications. Cambridge University Press.
3. Hopkins, W.B. 1999. Introduction to Plant Physiology. 2nd Ed. John Wiley and Sons. New York
4. Hussain F. 1989. Field and Laboratory Manual of Plan Ecology. National Academy of Higher Education, Islamabad.
5. Ihsan Illahi (1995). Plant Physiology, Biochemical Processes in Plants, UGC Press.

6. Krebs, C. J. 1997. Ecology. Harper and Row Publishers.
7. Odum, E.P. 1985. Basic Ecology. W.B. Saunders.
8. Ricklefs, R.E. 2000. Ecology. W.H. Freeman and Co., UK.
9. Ricklefs, R.E. 2001. The Economy of Nature. W.H. Freeman and Co., UK.
10. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
11. Schultz et al. (2005). Plant Ecology. Springer-Verlag, Berlin.
12. Smith, R. L. 1996. Ecology and Field Biology. Addison Wesley Longman, Inc., New York.
13. Smith, R. L. 1998. Elements of Ecology. Harper and Row Publishers, New York.
14. Subrahmanyam, N.S. and Sambamurthy, A.V.S.S. 2000. Ecology. Narosa Publishing House, New Delhi.
15. Taiz, L. and Zeiger, E. 2002. Plant Physiology. 3rd. Sinauer Publ. Co. Inc. Calif.
16. Townsend, C.R., Harper, J.L. and Begon, M.E. 2000. Essentials of Ecology. Blackwell Scientific Publications, UK.
17. Witham and Devlin. 1986 Exercises in Plant Physiology, AWS Publishers, Boston.

40 ~ 0
Assistant Registrar (Academics)
University of Malakand

SEMESTER 4**Bot-245****Biodiversity and Conservation****3(2+1)****Theory**

1. Introduction and importance of biodiversity: Species diversity, Ecological diversity, Genetic diversity, Social diversity
- 2.

- i Causes and depletion of biodiversity: Habitat loss, Habitat fragmentation, Over-exploitation, Climatic changes, Invasive species, Seawater intrusion
- ii The value of species
- iii How species become endangered?
- iv Extinction of species, present rate. Theory of mass extinction
- v Inventory and monitoring of biodiversity
- vi Importance of red data book
- vii *In situ* and *ex situ* conservation of plants
- viii Implementation of laws (protection and conservation of various taxa).
- ix Sustainable use of biodiversity (plant wealth)
- x Protected areas of Pakistan
- xi Criteria for determining different categories of protected areas
- xii Baseline study
- xiii Impact assessment
- xiv Management plan for protected area
- xv IUCN categories for threatened species
- xvi Criteria for recognizing different categories of threatened species
- xv Gene bank management and operation
- xvi Public awareness strategies.
- xvii Population explosion
- xviii Biodiversity action plan for Pakistan
- xix Role of herbaria and botanical gardens in conservation.

Practical

1. Causes of local species extinction.
2. To study the hilly and plane area of pakistan.
3. Data collection.
4. Preparation of an inventory of the flora of a given region.
5. To carry on base line study of any designated category.

Assistant Registrar (Academics)
University of Malakand

Book Recommended 48

1. Bush, M.B. 1997. Ecology of a Changing Planet. Prentice Hall.
2. Cotton, C.M. (1996). Ethnobotany Principle Application. John Wiley & Sons Chichester, UK.
3. Cunningham, A.B. 2001. Applied ethnobotany: People, wild plant use and conservation. Earthspan Publications.
4. De Klemm, C. (1990) Wild plant conservation, IUCN, Gland.
5. Dyke, F.V. (2003). Conservation Biology. Mc Graw Hill, New York.
6. Grombridge, B. & Jenkins, M. D. (2002). World Atlas of Biodiversity: Earths Living Resources in the 21st. Century. University California Press, Berkeley.

7. Heywood, V.H. 1995. Global Biodiversity Assessment. Cambridge University Press and UNEP.
8. Krishnamurthy, K.V. 2003. A Textbook of biodiversity Science publishers Inc. Enfield, NH, USA.
9. Levine, D.A. 2000. The origin, expansion and demise of plant species. Oxford University Press.
10. Ministry of Environment, IUCN, WWF. 1998. Biodiversity Action Plan for Pakistan.
11. Primack, R.B. 1998. Essentials of conservation Biology. Sinaur Association Pub. Mass. USA.
12. Virchow, D. (1998). Conservation of Genetic Resources. Springer-Verlag, Berlin



Assistant Registrar (Academics)
University of Malakand

3rd Year

SEMESTER-5

Course #	Title	Credit Hours
Bot-351	Bacteriology and Virology	3(2+1)
Bot-352	Diversity of Vascular Plants	3(2+1)
Bot-353	Phycology and Bryology	3(2+1)*
Bot-354	Mycology and Plant Pathology	3(2+1)
Bot-355	Plant Systematics	3(2+1)
Bot-356	Plant Anatomy	3(2+1)
		18

SEMESTER-5

Bot-351 Bacteriology and Virology 3(2+1)

Theory

a) Viruses

1. General features of viruses, viral architecture, classification, dissemination and replication of single and double – stranded DNA/RNA viruses.
2. Plant viral taxonomy
3. Virus biology and virus transmission
4. Molecular biology of plant virus transmission
5. Symptomatology of virus-infected plants: (External and Internal symptoms).
6. Metabolism of virus-infected plants
7. Resistance to viral infection
8. Methods in molecular virology

b) Bacteria

1. History, characteristics and classification.
2. Evolutionary tendencies in Monera (Bacteria, actinomycetes and cyanobacteria)
3. Morphology, genetic recombination, locomotion and reproduction in bacteria
4. Bacterial metabolism (respiration, fermentation, photosynthesis and nitrogen fixation)
5. Importance of bacteria with special reference to application in various modern sciences specially agriculture, biotechnology and genetic engineering.

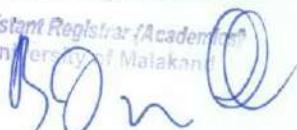
Practical

a) Viruses

Observation of symptoms of some viral infected plant specimens.

a) Bacteria, Actinomycetes and Cyanobacteria

1. Methods of sterilization of glassware and media etc.
2. Preparation of nutrient medium and inoculation.
3. Preparation of slides for the study of various forms, capsule/slime layer, spores, flagella and Gram-staining.
4. Growth of bacteria, subculturing and identification of bacteria on morphological and biochemical basis (using available techniques).
5. Microscopic study of representative genera of Actinomycetes and Cyanobacteria from fresh collections and prepared slides.

Assistant Registrar/Academic
University of Malakand


Books Recommended

1. Arora, D.R. 2004. Textbook of Microbiology, CBS Publishers and Distributors, New Delhi.
2. Black, J.G. 2005 Microbiology - Principles and Exploration, John Wiley and Sons, Inc.
3. Hull R. Matthews, 2004, Plant Virology, Academic Press.
4. Khan, J. A. and Dijkstra J. Plant Viruses as Molecular Pathogens, The Haworth Press, Inc.
5. Prescott, L.M., Harley, J.P. and Klein, D.A. 2005. Microbiology McGraw Hill Companies, Inc.
6. Ross F.C. 1995. Fundamentals of Microbiology. John Wiley Co. New York.
7. Tortora, G.J.; Funke, B.R. and Case C.L., 2004, Microbiology. Pearson Education.



Assistant Registrar (Academics)
University of Malakand

SEMESTER-5**Bot-352****Diversity of Vascular Plants****3(2+1)****Theory****a). Pteridophytes**

Introduction, origin, history, features and a generalized life cycle.

Methods of fossilization, types of fossils, geological time scale and importance of paleobotany. First vascular plant - Rhyniophyta e.g. *Rhynia*.

General characters, classification, affinities and comparative account of evolutionary trends of the following phyla: Psilophyta (*Psilotum*), Lycophyta (*Lycopodium*, *Selaginella*), Sphenophyta (*Equisetum*), Pterophyta (*Ophioglossum*, *Dryopteris* and *Azolla/Marsilea*).

b). Gymnosperms:

Geological history, origin, distribution, morphology, classification affinities and anatomy of Cycadofilicales, Bennettitales, Ginkgoales, Cycadales and Gnetales. Origin and Evolution of seed habit. Distribution of gymnosperms in Pakistan. Economic importance of gymnosperms. An introduction to the Gondwana flora of world.

c). Palynology:

1. An introduction to Neopalynology and Paleopalynology, its applications in botany, geology, archaeology, criminology, medicines, honey and oil and gas exploration.
2. Basic information about the nomenclature, morphology and classification of living and fossil pollen and spores.

d). Angiosperms:

1. Origin of angiosperms
2. Evolution of fruit habit.

Practical

1. Morphological and reproductive features of available genera.
2. Study trips to different parts of Pakistan for the collection and identification of important pteridophytes and gymnosperms.

Assistant Registrar (Academics)
University of Malakand

Books Recommended:

1. Beck, C.B. 1988. Origin and Evolution of Gymnosperms, Columbia University Press, New York,
2. Erdtman, G. 1954. An Introduction to Pollen analysis. 2nd. Ed. Ronald Press, New York.
3. Foster, A.S. and Gifford, E. M. Jr. 1998. Comparative Morphology of Vascular Plants. W. H. Freeman and Co.
4. Jones, D. 1983. Cycadales of the World, Washington, DC.
5. Mauseth, J.D. 1998. An Introduction to Plant Biology, Multimedia Enhanced, Jones and Bartlett Pub. UK.
6. Moore, R.c., W.d. Clarke and Vodopich, D.S. 1998. Botany McGraw Hill Company, USA
7. Raven, P.H. Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants, W.H. Freeman and Company Worth Publishers.
8. Ray, P.M. Steeves, T.A. and Fultz, T.A. 1998. Botany Saunders College Publishing, USA.
9. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson Univ. Library.
10. Stewart, W. N. and Rothwell, G.W. 1993. Paleobotany and the Evolution of Plants, University Press, Cambridge.
11. Taylor, T.N. and Taylor, E.D. 1987. The Biology and Evolution of Fossil Plants, Prentice Hall.

H. N. S.
Assistant Registrar (Academics)
University of Malakand

SEMESTER-5

Bot-353

Phycology and Bryology**3(2+1)****Theory****a) Phycology**

Introduction, general account, evolution, classification, biochemistry, ecology and economic importance of the following divisions of algae: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta.

b) Bryology:

Introduction and general account of bryophytes, classification, theories of origin and evolution. Brief study of the classes: Hepaticopsida, Anthoceropsida and Bryopsida.

Practical**a) Phycology:**

- i. Collection of fresh water and marine algae.
- ii. Identification of benthic and planktonic algae
- iii. Section cutting of thalloid algae
- iv. Preparation of temporary slides
- v. Use of camera lucida/micrographs.

b) Bryology

Study of the following genera: *Pellia*, *Porella*, *Anthoceros* and *Polytrichum*.

Books Recommended:

1. Bold, H. C. and M.J. Wynne 1985. Introduction to Algae: structure and reproduction. Prentice Hall Inc. Engle Wood Cliffs
2. Chapman, V.J. and D.J. Chapman. 1983. Seaweed and their uses. McMillan and Co. Ltd. London.
3. Dawson, E.Y., Halt. 1966. Marine Botany. Reinhart and Winstan, New York.
4. Hussain, F. and I. Ilahi. 2004. A textbook of Botany. Department of Botany, University of Peshawar.
5. Lee. R.E. 1999. Phycology. Cambridge University Press, U.K.
6. Schofield, W.B. 1985. Introduction to Bryology. Macmillan Publishing Co. London.
7. Vashishta. B. R. 1991. Botany for degree students. Bryophytes 8th ed. S. Chand and Co. Ltd. Delhi.



Assistant Registrar (Academics)
University of Malakand

SEMESTER-5

Bot-354

Mycology and Plant Pathology

3(2+1)

Theory**a) Mycology**

1. Introduction: General characters of fungi, Thallus, cell structure and ultrastructure of fungi
2. Reproduction: Asexual and sexual reproduction and reproduction structures, life cycle, haploid, heterokaryotic and diploid states.
3. Fungal Systematics: Classification of fungi into phyla with suitable examples to illustrate somatic structures, life cycle and reproduction of Myxomycota, Chytridiomycota, Zygomycota (Mucrales) Oomycota (Peronosporales), Ascomycota (Erysiphales, Pezizales), Basidiomycota (Agaricales, Polyporales, Uredinales, Ustilaginales) and Deuteromycetes.
4. Symbiotic relationships of fungi with other organisms (lichens and mycorrhiza) and their significance.
5. Importance of fungi in human affairs with special reference to Industry and Agriculture

b) Pathology

1. Introduction and classification of plant diseases.
2. Symptoms, causes and development of plant diseases
3. Loss assessment and disease control
4. Epidemiology and disease forecast
5. Important diseases of crop plants and fruit trees in Pakistan caused by fungi, e.g. damping off, mildews, rusts, smuts, shisham dieback etc.

Practical**a) Mycology**

General characters and morphology of fungi. Study of unicellular and mycelial forms with septate and aseptate hyphae. Distinguishing characters of different phyla: study of suitable examples. Study of asexual and sexual reproductive structures in different groups of fungi. Study of some common examples of saprophytic, parasitic and air-borne fungi belonging to different phyla.

b) Pathology

Identification of major plant pathogens under lab and field conditions, cultural studies of some important plant pathogenic fungi, application of Koch's postulates for confirmation of pathogenicity. Demonstration of control measures through chemotherapeuticants.

Books Recommended

1. Agrios, G.N., 2002. Plant Pathology, 5th ed. Academic Press, London.
2. Ahmad, I. and Bhutta, A.R., 2004. Textbook of Introductory Plant Pathology. Book Foundation, Pakistan.
3. Alexopoulos, C.J., Mims, C.W. and Blackwell, M., 1996. Introductory Mycology, 4th ed. John Wiley & Sons.
4. Khan, A.G. and Usman, R., 2005. Laboratory Manual in Mycology and Plant Pathology. Botany Department Arid Agriculture University, Rawalpindi.
5. Mehrotra, R.S. and Aneja, K.R., 1990. An Introduction to Mycology. Wiley and Eastern Ltd., New Delhi, India.

ASSISTANT Registrar (Academics)
University of Malakand
[Signature]

6. Moore-Landecker, E., 1996. Fundamentals of Fungi. 4th edn. Prentice Hall Inc., New Jersey, USA.
7. Trigiano, R.N., Windham, M.T. and Windham, A.S., 2004. Plant Pathology: Concepts and Laboratory Exercises. CRC Press, LLC, N.Y.

SEMESTER-5

Bot-355

Plant Systematics

3(2+1)

Theory

1. Introduction: Importance and relationship with other sciences, Phases of plant taxonomy. Origin and radiation of angiosperm, their probable ancestors, when, where and how did the angiosperms evolve; the earliest fossil records of angiosperms.
2. Concept of Species: What is a species? Taxonomic species, Biological species, Micro and macro species, Species aggregate., Infra specific categories
3. Speciation: Mechanism of speciation, Mutation and hybridization Geographical isolation, Reproductive isolation, Gradual and abrupt
4. Variation : Types of variation, Continuous and discontinuous variation, Clinal variation
5. Systematics and Genecology / Biosystematics: Introduction and importance, Methodology of conducting biosystematics studies, Various biosystematics categories such as ecophene, ecotype, ecospecies, coenospecies and comparium.
6. Taxonomic Evidence: Importance and types of taxonomic evidences: anatomical, cytological, chemical, molecular, palynological, geographical and embryological.
7. Nomenclature : Important rules of botanical nomenclature including effective and valid publication, typification, principles of priority and its limitations, author citation, rank of main taxonomic categories, conditions for rejecting names.
8. Classification: Why classification is necessary? Importance of predictive value. Brief history, Different systems of classification with at least one example of each (Linnaeus, Bentham and Hooker, Engler and Prantl, Bessey, Cronquist, Takhtajan, and Dahlgren.
9. Brief introduction of Numerical taxonomy.
10. General characteristics, distribution, evolutionary trends, phyletic relationships and economic importance of the following families of angiosperm:
 1. Apiaceae (Umbelliferae)
 2. **Arecaceae (Palmae)**
 3. Asclepiadaceae
 4. Asteraceae (Compositae)
 5. Boraginaceae
 6. Brassicaceae (Cruciferae)
 7. Cannaceae
 8. Capparidaceae
 9. Caryophyllaceae
 10. Casuarinaceae
 11. Chenopodiaceae
 12. Convolvulaceae
 13. Cucurbitaceae
 14. Cyperaceae
 15. Euphorbiaceae
 16. Fabaceae (Leguminosae)



- 17. Juncaceae**
 18. Lamiaceae (Labiatae)
 19. Liliaceae
 20. Magnoliaceae
 21. Malvaceae
 22. Myrtaceae
 23. Orchidaceae
 24. Papaveraceae
 25. Poaceae (Graminae)
 26. Ranunculaceae
27. 31
 28. Rosaceae
29. Salicaceae
30. Scrophulariaceae
 31. Solanaceae
32. Trochodendraceae
33. Winteraceae

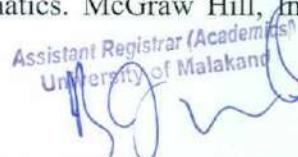
Practical

1. Technical description of plants of the local flora and their identification up to species level with the help of a regional/Flora of Pakistan
2. Preparation of indented and bracketed types of keys
3. Preparation of permanent slides of pollen grains by acetolysis method and study of different pollen characters.
4. Study of variation pattern in different taxa.
5. Submission of properly mounted and fully identified hundred herbarium specimens at the time of examination
6. Field trips shall be undertaken to study and collect plants from different ecological zones of Pakistan.

Books Recommended

1. Ali, S.I. and Nasir, Y. 1995. Flora of Pakistan. Karachi Univ. Press, Karachi
2. Ali, S.I. and Qaiser, M. 1995 -todore. Flora of Pakistan. Karachi Univ. Press, Karachi.
3. Davis, P.H. & Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd, London
4. Greuter,W., McNeill, J., Barrie, F.R., Burdet, H. M., Demoulin, V., Filgueiras, T.S., Niclson, D.H. Silva, P.C., Skog, J.E., Trehane, P.,Turland, N.J. & Hawksworth, D.L.,(eds.) 2000. International code of botanical nomenclature (Saint Louis Code) adopted by the Sixteenth International botanical congress St. Louis Missouri, July –August 1999. Koeltz, Konigstein. (Regnum Veg.138.)
5. Ingrouille, M. 1992. Diversity and Evolution of Land Plants, Chapman & Hall. London
6. Jeffrey C. 1980. An Introduction to Plant Taxonomy. Cambridge University Press.UK
7. Jones, S. B. and Luchsinger, A.E. 1987. Plant Systematics. McGraw Hill, Inc. New York.

Assistant Registrar (Academics)
University of Malakand



8. Levine, D.A. 2000. The Origin, Expansion and Demise of Plant Species. Oxford University Press.
9. Naik, V.N. 1988. Taxonomy of Angiosperms. Tata McGraw Hill Publishing Company, New Delhi.
10. Nasir, E. & Ali, S.I. 1994. Flora of Pakistan. Karachi Univ. Press, Karachi.
11. Stace, C. (1992). Plant Taxonomy and Biosystematics, Edward Arnold..
12. Stussy, T.F. 1990. Plant Taxonomy, Columbia University Press, USA.
13. Takhtajan, A. (1986). Flowering Plant: Origin and Dispersal, Oliver and Boyd, Edinburgh



Assistant Registrar (Academic)
University of Malakand

SEMESTER 5**Bot-356****Plant Anatomy****3(2+1)****Theory**

1. The plant body and its development: fundamental parts of the plant body, internal organization, and different tissue systems of primary and secondary body.
2. Meristematic tissues: classification, cytohistological characteristics, initials and their derivatives.
3. Apical meristem: Delimitation, different growth zones, and evolution of the concept of apical organization. Shoot and root apices.
4. Leaf: types, origin, internal organization, development of different tissues with special reference to mesophyll, venation, bundle sheaths and bundle sheath extensions. Enlargement of epidermal cells.
5. Vascular cambium: Origin, structure, storied and non-storied cell types, types of divisions: additive and multiplicative; cytoplasmic characteristics, seasonal activity and its role in the secondary growth of root and stem. Abnormal secondary growth.
6. Origin, structure, development, and functional and evolutionary specialization of the following tissues: Epidermis and epidermal emergences, Parenchyma, Collenchyma, Sclerenchyma, Xylem, Phloem with special emphasis on different types of woods, Periderm.
7. Secretory tissues: Laticifers (classification, distribution, development, structural characteristics, functions) and Resin Canals.
8. Anatomy of reproductive parts:
 - a. Flower
 - b. Seed
 - c. Fruit
9. Economic aspects of applied plant anatomy
10. Anatomical adaptations
11. Molecular markers in tree species used for wood.

Assistant Registrar (Academics)
University of Malakand

Practical:

1. Study of organization of shoot and root meristem, different primary and secondary tissues from the living and preserved material in macerates and sections, hairs, glands and other secondary structures.
2. Study of abnormal/unusual secondary growth.
3. Peel and ground sectioning and maceration of fossil material.
4. Comparative study of wood structure of Gymnosperms and Angiosperms with the help of prepared slides.

Books Recommended:

1. Anon. Manual of Microscopic Analysis of Feeding Stuffs. The American Association of feed Microscopists.
2. Cutler, D.F. 1969. Anatomy of the Monocotyledons. IV. Juncales. Clarendon Press, Oxford.
3. Cutler, D.F. 1978. Applied Plant Anatomy. Longman Group Ltd. England
4. Dickison, W.C. 2000. Integrative plant anatomy. Academic Press, U.K.
5. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.

6. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
7. Metcalf, C.R. and Chalk, L. 1950. Anatomy of the Dicotyledons. Clarendon Press, Oxford.
8. Metcalfe, C.R. 1960. Anatomy of the Monocotyledons. Gramineae. Clarendon Press, Oxford.
9. Metcalfe, C.R. 1971. Anatomy of the Monocotyledons'. Cyperaceae. Clarendon Press, Oxford.
10. Vaughan, J.G. 1990. The Structure and Utilization of Oil Seeds. Chapman and Hall Ltd. London.

SEMESTER-6

Course #	Title	Credit Hours
Bot-361	Plant Ecology-I	3(2+1)
Bot-362	Genetics-I	3(2+1)
Bot-363	Plant Biochemistry-I	3(2+1)
Bot-364	Plant Physiology-I	3(2+1)
Bot-365	Molecular Biology	3(2+1)
		15

SEMESTER-6

Bot-361

Plant Ecology-I

3(2+1)

Theory

1. Introduction: history and recent developments in ecology
2. Soil: Nature and properties of soil (Physical and Chemical). Water in the soil-plant-atmosphere continuum. The ionic environment and plant ionic relations, Nutrient cycling. Physiology and ecology of N, S, P and K nutrition. Heavy metals (brief description), Salt and drought stress and osmoregulation. Soil erosion
3. Light and temperature: Nature of light, Factors affecting the variation in light and temperature, Responses of plants to light and temperature, Adaptation to temperature extremes,
4. Carbon dioxide: Stomatal responses, water loss and CO₂-assimilation rates of plants in contrasting environments. Ecophysiological effects of changing atmospheric CO₂ concentration. Functional significance of different pathways of CO₂ fixation. Productivity: response of photosynthesis to environmental factors, C and N balance
5. Water: Water as an environmental factor, Role of water in the growth, adaptation and distribution of plants, Water status in soil., Water and stomatal regulation, Transpiration of leaves and canopies.
6. Oxygen deficiency: Energy metabolism of plants under oxygen deficiency, Morpho-anatomical changes during oxygen deficiency, Post-anoxic stress
7. Wind as an ecological factor.
8. Fire as an ecological factor.

Assistant Registrar (Academics)
University of Malakand

Practical:

1. Determination of physico-chemical properties of soil and water.
2. Measurements of light and temperature under different ecological conditions.
3. Measurements of wind velocity.
4. Measurement of CO₂ and O₂ concentration of air and water.
5. Effect of light, temperature, moisture, salinity and soil type on germination and growth of plants.
6. Measurement of ions, stomatal conductance, osmotic potential, water potential, xylem pressure potential, leaf area and rate of CO₂ exchange in plants in relation to various environmental conditions.

Books recommended:

1. Bazzaz, F.A. 2004. Plants in Changing Environments: Linking Physiological, Population, and Community Ecology, Cambridge University Press
2. Chapin, F.S. et al. 2002. Principle of Terrestrial Plant Ecology, Springer-Verlag
3. Lambers, H. et al. 2002. Plant Physiological Ecology, Springer-Verlag
4. Larcher, W. 2003., Physiological Plant Ecology: Ecophysiology and Stress Physiology of Function Groups - Springer-Verlag
5. Nobel, P.S 1999, Physico-chemical and Environmental Plant Physiology, Academic Press
6. Schultz et al. 2005. Plant Ecology, Springer-Verlag

Assistant Registrar (Academics)
University of Malakand

SEMESTER-6**Bot-362****Genetics-I****3(2+1)****Theory**

1. Extensions of Mendelian Analysis: Variations on dominance, multiple alleles, lethal alleles, several genes affecting the same character, penetrance and expressivity.
2. Linkage I: Basic Eukaryotic Chromosome Mapping : The discovery of linkage, recombination, linkage symbolism, linkage of genes on the X chromosome, linkage maps, three-point testcross, interference, linkage mapping by recombination in humans,
3. Linkage II: Special Eukaryotic Chromosome Mapping Techniques: Accurate calculation of large map distances, analysis of single meioses, mitotic segregation and recombination, mapping human chromosomes.
4. Gene Mutation: Somatic versus germinal mutation, mutant types, the occurrence of mutations, mutation and cancer, mutagens in genetic disorder, mutation breeding. Evolutionary significance of mutation.
5. Recombination in Bacteria and their Viruses : Bacterial chromosome, bacterial conjugation, bacterial recombination and mapping the *E. coli* 34
6. Chromosome, bacterial transformation, Bacteriophages genetics, transduction, mapping of bacterial chromosomes, bacterial gene transfer.
7. The Structure of DNA: DNA: The genetic material, DNA replication in eukaryotes, DNA and the gene.
8. DNA Function: Transcription, translation, the genetic code, protein synthesis, universality of genetic information transfer, eukaryotic RNA.
9. The Extranuclear Genome: Variegation in leaves of higher plants, cytoplasmic inheritance in fungi, extra-nuclear genes in chlamydomonas, mitochondrial genes in yeast, extra-genomic plasmids in eukaryotes.
10. Developmental Genetics: Gene Regulation and Differentiation, Crown gall disease in plants, cancer as a developmental genetic disease.
11. Population Genetics: Gene frequencies, conservation of gene frequencies, equilibrium, Hardy-Weinberg law, factors affecting gene equilibrium.

Assistant Registrar (Academic)
University of Malakand

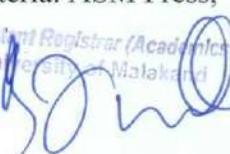
Practical

A. Numerical problems

- i. Arrangement of genetic material:
 - a. Linkage and recombination.
 - b. Gene mapping in diploid.
 - c. Recombination in Fungi.
 - d. Recombination in bacteria.
 - e. Recombination in viruses.
- ii. Population Genetics:
 - a. Gene frequencies and equilibrium.
 - b. Changes in gene frequencies,
2. **Blood group and Rh-factor.**
3. **Drosophila**
 - a. Culture technique
 - b. Salivary gland chromosome
4. **Fungal genetics**
Sacchromyces culture techniques and study.
5. **Studies on variation in maize ear size and colour variation.**
6. **Bacterial Genetics.**
 - a. Bacterial cultural techniques, Gram staining (*E. coli, B. subtilis*) .
 - b. Transformation.
 - c. Conjugation.

BOOKS RECOMMENDED

1. Gardner, E.J., 2004. Principles of Genetics, John Willey and Sons, New York.
2. Gelvin, S.B. 2000. Plant Molecular Biology Manual. Kluwer Academic Publishers.
3. Griffiths A.J.F; Wessler, S.R; Lewontin, R.C, Gelbart, W.M; Suzuki, D.T. and Miller, J.H., 2005, Introduction to Genetic Analysis, W.H. Freeman and Company.
4. Hartl, D.L. and Jones, E.W. 2005, Genetics - Analysis of Genes and Genomes, Jones and Bartlett Publishers. Sudbury, USA.
5. Hedrick, P.W. 2005. Genetics of Population. Jones and Bartlett Publisher, Sudbury, USA.
6. Klug, W.S. and Cummings, M.R. 1997. Concepts of Genetics, Prentice Hall International Inc.
7. Pierce, B.A. 2005. Genetics. A conceptual approach, W. H. Freeman and Company, New York.
8. Ringo J, 2004. Fundamental Genetics, Cambridge University Press.
9. Roth Well, N.V. 1997. Understanding Genetics, second edition, Oxford University Press Inc.
10. Snyder, L and Champness W, 2003, Molecular Genetics of Bacteria, ASM Press.
11. Synder, L, and Champness, W. 2004. Molecular Genetics of Bacteria. ASM Press, Washington D.C.

Assistant Registrar (Academic)
University of Malakand


SEMESTER-6

Bot-363

Plant Bio-chemistry-I

3(2+1)

Theory**Carbohydrates:**

Occurrence and classification. A general account of ribose, deoxyribose, xylulose, xylose, D-glucose, D-galactose, D-mannose, cellobiose, sucrose, maltose, trehalose, pentosans, fructosans, starch, cellulose, hemicellulose, amino sugars, derived acids and alcohols, glycosides, mucilages, pectins and lignins.

Lipids:

Occurrence, classification, Structure and chemical properties of fatty acids, triglycerides, phospholipids, glycolipids, sulpholipids, waxes and sterols.

Proteins:

Amino acids and their structure. Electro chemical properties and reactions of amino acids. Classification of proteins. Primary, secondary, tertiary and quaternary structure of proteins. Protein targeting. Protein folding and unfolding. Transport, storage, regulatory and receptor proteins. Protein purification. Protein sequencing. Biological role.

Nucleic Acids:

General introduction. Purine and pyrimidine bases, nucleosides, nucleotides. Structure and properties of DNA and RNA. Types and functions of RNA. Chemical synthesis of oligonucleotides and DNA sequencing. DNA restriction enzymes. Properties of DNA polymerase I, II and III.

Enzymes:

Nature and functions, I.U.E. classification with examples of typical groups. Isozymes, ribozymes, abzymes. Enzyme specificity. Enzyme kinetics. Nature of active site and mode of action. Allosteric enzymes and feedback mechanism.

Practical

1. Solutions, acids and bases. Electrolytes, non-electrolytes, buffers, pH. Chemical bonds.
2. To determine the Rf value of monosaccharides on a paper Chromatogram.
3. To estimate the amount of reducing and non-reducing sugars in plant material titrimetrically/spectrophotometrically.
4. To determine the saponification number of fats.
5. To extract and estimate oil from plant material using soxhlet apparatus.
6. Analysis of various lipids by TLC methods.
7. To estimate soluble proteins by Biuret or Lowry or Dye-binding method.
8. To estimate the amount of total Nitrogen in plant material by Kjeldahl's method.
9. To determine the Rf value of amino acids on a paper chromatogram.
10. Extraction of Nucleic acids from plant material and their estimation by UV absorption or colour reactions.
11. To estimate the catalytic property of enzyme catalase or peroxidase extracted from a plant source.
12. To determine the PKa and isoelectric point of an amino acid.

Assistant Registrar (Academics)
University of Malabar

Books Recommended

1. Abdes, R.H. Frey, P.A. and Jencks W.P. 2004, Biochemistry, Jones and Bartlet, London.
2. Chesworth., J.M., Strichbury T. and Scaife, J. R. 1998. An introduction to agricultural biochemistry. Chapman and Hall, London.
3. Conn E E. and Stumpf P.K., 2002. Outlines of Biochemistry, John Wiley and Sons Inc. New York.
4. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
5. Goodwin T.W. and Mercer, E.I. 1997. Introduction to Plant Biochemistry. Pergamon Press, Oxford.
6. Heldt, H-W. 2004. Plant Biochemistry. 3rd Edition, Academic Press, U.K.
7. Lea, P.J... and Leegood, R.C. 1993. Plant Biochemistry and Molecular Biology. Wiley and Sons, New York.
8. Lehninger, A L. 1998. Principles of Biochemistry. Worth Publishers Inc.
9. McKee, T. and McKee, J.R. 1999. Biochemistry – An Introduction. WCB/McGraw-Hill, New York, Boston, USA.
10. Smith, E. L., Hill, R L, Lehman, R I., Lefkowitz, R J. Handler and Abraham. 2003, Principles of Biochemistry, (General Aspects). White. International Student Edition. McGraw Hill International Book Company.
11. Voet, D., Voet J.G. and Pratt, C.W. 1998. Fundamentals of Biochemistry, John Wiley and Sons, New York.
12. Zubay G., 2003, Biochemistry, MacMillan Publishing Co., New York.

Assistant Registrar (Academics)
University of Malakand

SEMESTER-6

Bot-364

Plant Physiology-I

3(2+1)

Theory

1. **Photosynthesis:** History of photosynthesis. Nature and units of light. Determination of oxygenic and anoxygenic photosynthesis. Ultrastructure of thylakoid vesicle. Various pigments and photosynthetic activity. Ultrastructure and composition of photosystem-I and II. Absorption and action spectra of different pigments. Mechanism of photosynthesis - light absorption, charge separation or oxidation of water (water oxidizing clock), electron and proton transport through thylakoid protein-pigment complexes. Photophosphorylation and its mechanism. CO₂ reduction (dark reactions) - C₃ pathway and Photorespiration, Regulation of C₃ pathway, C₄ pathway and its different forms, C₃-C₄ intermediates, CAM pathway. Methods of measurement of photosynthesis.
2. **Respiration:** Synthesis of hexose sugars from reserve carbohydrates. Mechanism of respiration- Glycolysis, Differences between cytosolic and chloroplastidic glycolysis, Oxidative decarboxylation, Krebs cycle, Regulation of glycolysis and Krebs cycle, Electron transport and oxidative phosphorylation. Aerobic and anaerobic respiration. Energetics of respiration. Pentose phosphate pathway. Glyoxylate cycle. Cyanide resistant respiration.
3. **Translocation of Food:** Pathway of translocation, source and sink interaction, materials translocated, mechanism of phloem transport, loading and unloading.
4. **Leaves and Atmosphere:** Gaseous exchange, mechanism of stomatal movement (photoactive opening; scotoactive closing and opening). Factors affecting stomatal movement.
5. **Assimilation of Nitrogen, Sulphur and Phosphorus:** The nitrogen cycle. Nitrogen fixation. Pathways of assimilation of nitrate and ammonium ions. Assimilation of sulphur and phosphorus.

Practicals

1. To determine the volume of CO₂ evolved during respiration by plant material.
2. To determine the amount of O₂ used by respiring water plant by Winkler Method.
3. Separation of chloroplast pigments on column chromatogram and their quantification by spectrophotometer.
4. To extract and separate anthocyanins and other phenolic pigments from plant material and study their light absorption properties.
5. To categorize C₃ and C₄ plants through their anatomical and physiological characters.
6. To regulate stomatal opening by light of different colours and pH.

Books Recommended

1. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
2. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
3. Epstein, E. and Bloom, A.J. 2004. Mineral Nutrition of Plants: Principles and Perspectives. 2nd Edition. Sinauer Associates, California, USA.

Assistant Registrar (Academics)
University of Malakand

4. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
5. Heldt, H-W. 2004. Plant Biochemistry. 3rd Edition, Academic Press, U.K.
6. Ihsan Illahi, 1991. Plant Growth, UGC Press, Islamabad.
7. Ihsan Illahi, 1995. Plant Physiology, Biochemical Processes in Plants, UGC Press.
8. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
9. Nobel, P.S. 1999. Physicochemical and Environmental Plant Physiology. Academic Press, UK.
10. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
11. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5th Edition.. Wadsworth Publishing Co. Belmont CA.
12. Taiz, L. and Zeiger, E. 2002. Plant Physiology. 3rd Edition. Sinnauers Publ. Co. Inc. Calif.
13. W.B. Hopkins. 1999. Introduction to Plant Physiology. 2nd Ed. John Wiley and Sons. New York.



Assistant Registrar (Academics)
University of Malakand

Theory

1. Nucleic Acids: DNA-circular and super helical DNA. Renaturation, hybridization, sequencing of nucleic acids, synthesis of DNA
2. Proteins: Basic features of protein molecules. Folding of polypeptide chain, α -helical and β -secondary structures. Protein purification and sequencing.
3. Transcription: Enzymatic synthesis of RNA, transcriptional signals
4. Translation: The genetic code. The Wobbling, polycistronic and monocistronic RNA. Overlapping genes.
5. Gene regulation in Eukaryotes: Differences in genetic organization and prokaryotes and eukaryotes. Regulation of transcription, initiation, regulation of RNA processing, regulation of nucleocytoplasmic mRNA transport, regulation of mRNA stability, regulation of translation, regulation of protein activity.
6. Plant Omics: Transcriptomics; DNA libraries, their construction, screening and application. Microarray of gene technology and its application in functional genomics.
7. Proteomics; structural and functional proteomics. Methods to study proteomics Metabolomics; methods to study metabolomics; importance and application of metabolomics.
8. Bioinformatics and computational biology. Levels, scope, potential and industrial application of bioinformatics and computational biology.

Books recommended

1. Cullis, C.A. 2004. Plant Genomics and Proteomics. Wiley-Liss, New York.
2. Gibson, G. and S.V. Muse, 2002. A Premier of Genome Science, Sinauer Associates Inc. Massachusetts.
3. Gilmartin, P.M. and C. Bowler. 2002. Molecular Plant Biology. Vol. 1 & 2. Oxford University Press, UK.
4. Ignacimuthu, S. 2005. Basic bioinformatics. Narosa Publishing House, India.
5. Lodish, H. et al., 2004. Molecular Cell Biology. 5th Edition. W.H. Freeman & Co., New York.
6. Malacinski, G. M. 2003. Essentials of Molecular Biology, 4th edition. Jones and Bartlett Publishers, Massachusetts.
7. Watson, J.D. et al. 2004. Molecular Biology of the Gene. Pearson Education, Singapore.
8. Weaver, R.F. 2005. Molecular Biology. McGraw Hill, St. Louis.



4th YEAR

SEMESTER-7

Course #	Title	Credit Hours
Bot-471	Plant Bio-chemistry-II	3(2+1)
Bot-472	Plant Ecology-II	3(2+1)
Bot-473	Advances in Plant Breeding	3(2+1)
Bot-474	Genetics-II	3(2+1)
Bot-475	Plant Physiology-II	3(2+1)
		15

SEMESTER-7

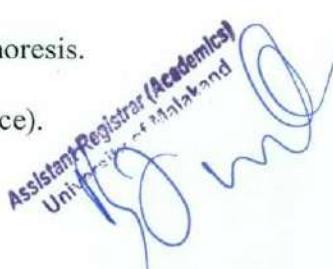
Bot-471 Plant Bio-chemistry-II 3(2+1)

Theory

1. Bioenergetics: Energy, laws about energy changes. Oxidation and reduction in living systems.
2. Metabolism:
 - i. Biosynthesis, degradation and regulation of sucrose and starch. Breakdown of fats with special reference to beta-oxidation and its energy balance. Biosynthesis of fats.
 - ii. Replication of DNA. Reverse transcription. Biosynthesis of DNA and RNA.
 - iii. Components of protein synthesis. Genetic code, protein synthesis: initiation, elongation and termination.
3. Alkaloids: Occurrence, physiological effects, chemical nature with special reference to solanine, nicotine, morphine, theine and caffeine. Aflatoxins, their nature and role.
4. Terpenoids: Classification: monoterpenes, sesquiterpenes, diterpenes, triterpenes, tetraterpenes, polyterpenes and their chemical constitution and biosynthesis.
5. Vitamins: General properties and role in metabolism.

Practical

1. Separation of soluble proteins by polyacrylamide gel (PAGE) electrophoresis.
2. Separation of nucleic acids by gel electrophoresis.
3. To estimate the amount of vitamin C in a plant organ (orange, apple juice).
4. To determine potential alkaloids in plants.
5. To estimate terpenoids in plants.



Books Recommended

1. Abides, R.H., Frey P.A. and Jencks, W.P. 1992. Biochemistry, Jones and Bartlet, London.
2. Albert L. Lehninger, 1998. Principles of Biochemistry. Worth Publishers Inc.
3. Cheshworth, J.M., Strichbury T. and Scaife, J. R. 1998. An introduction to agricultural biochemistry. Chapman and Hall, London.
4. Conn E. E. and Stumpf, P.K. 2002. Outlines of Biochemistry, John Wiley and Sons Inc. New York.
5. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.

6. Goodwin T.W. and Mercer, E.I. 1997. Introduction to Plant Biochemistry. Pergamon Press, Oxford.
7. Heldt, H-W. 2004. Plant Biochemistry. 3rd Edition, Academic Press, U.K.
8. Lea, P.J.. and Leegood, R.C. 1993. Plant Biochemistry and Molecular Biology. Wiley and Sons, New York.
9. McKee, T. and McKee, J.R. 1999. Biochemistry – An Introduction. WCB / McGraw-Hill, New York, Boston, USA.
10. Smith; E L., Hill; R. L., Lehman; R. I., Lefkowitz, R. J. and Abraham. H. Principles of Biochemistry, (General Aspects). White. International Student Edition. McGraw Hill International Book Company.
11. Voet, D. Voet J.G. and Pratt, C.W. 1998. Fundamentals of Biochemistry, John Wiley and Sons, New York.
12. Zubay. G. 2003, Biochemistry, MacMillan Publishing Co., New York.



R. J. Nair
Assistant Registrar (Academics)
University of Mysore

SEMESTER-7**Bot-472****Plant Ecology-II****3(2+1)****Theory****A Population Ecology**

1. Population structure and plant demography.: Seed dispersal, Dormancy, Seed Bank, Seed dormancy, Recruitment, Demography
2. Life history pattern and resource allocation : Density dependent and density independent factors, Resource allocation, Reproductive effort, Seed size vs seed weight, Population genetics, Evolution

B Community Ecology : Historical development of community ecology, Community concepts and attributes, Methods of sampling of plant communities, Ecological succession, Community soil-relationship, Local Vegetation, Vegetation of Pakistan, Major formation types of the world**C Ecosystem Ecology**: Ecological concepts of ecosystem, Boundaries of ecosystem? Compartmentalization and system concepts, Energy flow in ecosystem, Biogeochemical cycles: water carbon and nitrogen Case studies: any example**Practical**

Determination of seed bank in various populations. Seed dispersal pattern of local populations. Demography and life history of local annual population. Study of community attributes. Sampling of vegetation including Quadrat, plotless, transect and Braun-Blanquet. Correlate soil properties with vegetation type. Field trip to study different communities located in different ecological regions of Pakistan. Slide show of the vegetation of Pakistan. Slide show of the major formations of the world. Soil physical and chemical properties

Books Recommended

1. Barbour M. G. et al., 1999, Terrestrial Plant Ecology, The Benjamin-Cumming Publishing Co.
2. Chapin, F.S. et al. 2002. Principle of Terrestrial Plant Ecology, Springer-Verlag
3. Gurevitch, et al., 2002. The Ecology of Plants, Sinauer Associates, Inc.
4. Hussain, F. 1989. Field and Laboratory Manual of Plant Ecology, National Academy of Higher Education. Islamabad
5. Hussain, S. Pakistan Manual of Plant Ecology,
6. Lambers, H. et al., 2002. Plant Physiological Ecology, Springer-Verlag
7. Moore P.D. and Chapman S. B. 1986. Methods in Plant Ecology, Blackwell Scientific Publication, Oxford.
8. Schultz et al. 2005. Plant Ecology, Springer-Verlag .
9. Smith, R. L. 1998. Elements of Ecology by Harper & Row Publishers,
10. Townsend et al. (2003). Essentials of Ecology, Blackwell Publishing,

Assistant Registrar (Academic)

SEMESTER-7

Bot-473	Advance in Plant Breeding	3(2+1)
<hr/>		
1. Plant Breeding and its scope. Definition, concept, Goals of plant breeding, contribution of plant breeding.		
2. Genetic Basis for plant Breeding. Genetic consequences of hybridization, Quantitative inheritance, Population structure, Hardy-Weinberg Law, combining ability, Habitability, Genetic advance, Genetic base, choice of breeding methods.		
3. Nature of crops and Method of Breeding. Mode of reproduction, Incompatibility, Male sterility, Methods of breeding and mode of reproduction.		
4. Origin, Domestication and Introduction of Crop Plants. Centers of origin, centers of origin, centers of Diversity and origin, Domestication, Domestication of some crop plants, Introduction, procedure of introduction, Achievements and uses of introduction, Disadvantages.		
5. Breeding for Disease and insect Resistance. Definition and history, loss of resistance, Race and its identification, classification, classification of resistance, Genetics of host-parasite interaction, Breeding for disease resistance, introduction, selection and hybridization, Back cross method, Mutation Breeding, Breeding for insect resistance, Breeding for Multiple resistance, Exploitation of resistance genes, advantages & Limitations of resistance breeding.		
6. Organization and Achievements of plant breeding in some crops, Rice, Maize, wheat, Bajra, Sorghum, Potato, cotton, sugar cane, tea.		

Assistant Registrar (Academics)
University of Malakand

SEMESTER-7**Bot-474****Genetics-II****3(2+1)****Theory**

1. Recombinant DNA :Recombinant DNA Technology – Introduction, Basic Techniques, PCR and Rt PCR, Restriction enzymes, Plasmids, Bacteriophages as tools, the formation of recombinant DNA, recombinant DNA methodology, recombinant DNA and social responsibility, Site directed Mutagenesis, DNA sequencing.
2. Application of Recombinant DNA: Applications of recombinant DNA technology using prokaryotes, recombinant DNA technology in eukaryotes: An overview, transgenic yeast, transgenic plants, transgenic animals, screening for genetic diseases, identifying disease genes, DNA typing, gene therapy, genetically modified organisms and apprehensions.
3. Control of Gene Expression: Discovery of the *lac* system: negative control, catabolite repression of the *lac* operon: positive control, transcription: gene regulation in eukaryotes - an overview.
4. Mechanisms of Genetic Change I: Gene Mutation: The molecular basis of gene mutations, spontaneous mutations, induced mutations, reversion analysis mutagens and carcinogens, biological repair mechanisms.
5. Mechanisms of Genetic Change II: Recombination: General homologous recombination, the holiday model, enzymatic mechanism of recombination, site-specific recombination, recombination and chromosomal rearrangements.
6. Mechanisms of Genetic Change III: Transposable Genetic Elements:
7. Insertion sequences, transposons, rearrangements mediated by transposable elements, review of transposable elements in prokaryotes, controlling elements in maize.
8. Plant Genome Projects: Arabidopsis, achievement and future prospects. Other plant genome projects
9. Bioinformatics : Application of computational tests to the analysis of genome and their gene products
10. Bioethics : Moral, Religious and ethical concerns

Practical

1. Problems relating to the theory
2. Isolation and separation of DNA and protein on Gel electrophoresis.
 - i) Bacterial chromosome
 - ii) Plasmid DNA (minipreps)
 - iii) Plant DNA
 - iv) Protein
3. DNA Amplification by PCR

Books Recommended

1. Beaycamp T.L. and Walters L., Contemporary Issues in Bioethics, Wadsworth Publishing Company.
2. Brown, T.A., 2002 Genomes, Bios Scientific Publishers Ltd.
3. Gelvin, S. B. 2000. Plant Molecular Biology Manual. Kluwer Academic Publishers.
4. Hartt, D. L, and Jones, E.W. 2005. Genetics, Analysis of Gene and Genomes. Jones and Bartlett Publishers, Sudbury, USA

5. Ignacimuthu, S. 2005, Basic Bioinformatics, Narosa Publishing House, India.
6. Lwein, B. 2004, Gene VIII, Pearson Education Int..
7. Miglani, 2003, Advanced Genetics, Narosa Publishing House, India.,
8. Primrose, S.B., Twyman, R. M. and Old R.W. 2004. Principles of Gene Manipulation, an Introduction to Genetic Engineering (6th edition), Blackwell Scientific Publications.
9. Snyder, L and Champness W, 2003, Molecular Genetics of Bacteria, ASM Press.
10. The Genome of Homo Sapiens, 2003, Cold Spring Harbor Laboratory Press.
11. Trun, N and Trempe J., 2004, Fundamental Bacterial Genetics, Blackwell Publishing House.
12. Wilson, J. and Hunt, T. 2004. Molecular Biology of the cell – the problems book, Garland publishing Inc.
13. Winnacker, E.L.2003, From Gene to Clones – Introduction to Gene Technology, Panima Publishing Corporation, New Delhi.



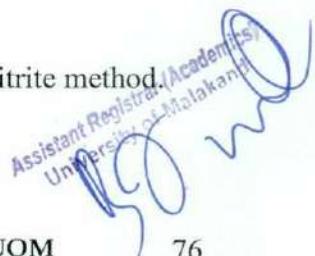
Assistant Registrar (Academics)
University of Malakand

SEMESTER-7**Bot-475****Plant Physiology-II****3(2+1)****Theory**

1. Plant Growth Regulators: Major natural hormones and their synthetic analogues. Bioassay, structure, biosynthesis, receptors, signal transduction and mode of action, transport, physiological effects of Auxins , Gibberellins, Cytokinins, Abscisic acid, Ethylene, Polyamines, Brassinosteroids, Jasmonates, and Salicylic acid.
2. Water Relations: The soil -plant -atmosphere continuum - an overview. Structure of water. Physico-chemical properties of water. Water in the soil and its potentials. Water in cell components. Absorption of water in plants (pathways and driving forces, Aquaporins,-their structure and types). Cell water relations terminology. Hofler diagram - analysis of change in turgor, water and osmotic potential with changes in cell volume. Modulus of elasticity coefficient; Hydraulic conductivity. Osmoregulation, Methods for measurement of water, osmotic and turgor potentials- Pressure chamber, psychrometry, pressure probe, pressure volume curve.
3. Plant Mineral Nutrition: Inorganic composition of plant and soil. Absorption of mineral nutrients - roots, mycorrhizae. Effect of soil pH on nutrient availability. Ion traffic into root. The nature of membrane carriers, channels and electrogenic pumps .Passive and active (primary and secondary) transports and their energetic. Essential and beneficial elements-their functions and deficiency symptoms in plants. Fertilizers and their significance in Agriculture.
4. Phytochromes: Discovery of Phytochromes and cryptochromes. Physical and chemical properties of Phytochromes. Distribution of Phytochromes among species, cells and tissues and their role in biological processes. Phytochromes and gene expression.
5. Control of Flowering: Autonomous versus environmental regulation. Circadian rhythms. Classification of plants according to photoperiodic reaction, photoperiodic induction, locus of photoperiodic reaction and dark periods in photoperiodism. Role of photoperiodism in flowering. Biochemical signaling involved in flowering. Vernalization and its effect on flowering. Floral meristem and floral organ development. Floral organ identity genes and the ABC model.
6. Gene Regulation and Signal Transduction: Genome size and organization. Gene regulation in prokaryotes and eukaryotes. Signal transduction in prokaryotes and eukaryotes.

Practical

1. To investigate the preferential absorption of ions by corn seedlings and potato slices.
2. To determine osmotic potential of massive tissue by freezing point depression method or by an Osmometer.
3. To investigate water potential of a plant tissue by dye method and water potential apparatus.
4. Determination of K uptake by excised roots.
5. Measurement of stomatal index and conductance.
6. Qualitative determination of K content in Guard cells by Sodium cobalt nitrite method.



Books Recommended

1. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
2. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
3. Epstein, E. and Bloom, A.J. 2004. Mineral Nutrition of Plants: Principles and Perspectives. 2nd Edition. Sinauer Associates, California, USA.
4. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
5. Heldt, H-W. 2004. Plant Biochemistry. 3rd Edition, Academic Press, U.K.
6. Ihsan Illahi, 1991. Plant Growth, UGC Press, Islamabad.
7. Ihsan Illahi, 1995. Plant Physiology, Biochemical Processes in Plants, UGC Press.
8. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
9. Nobel, P.S. 1999. Physicochemical and Environmental Plant Physiology. Academic Press, UK.
10. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
11. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
12. Taiz, L. and Zeiger, E. 2002. Plant Physiology. 3rd Edition. Sinnauers Publ. Co. Inc. Calif.
13. W.B. Hopkins. 1999. Introduction to Plant Physiology. 2nd Ed. John Wiley and Sons. New York.

RAO
Assistant Registrar (Academics)
University of Malakand

SEMESTER-8

Course #	Title	Credit Hours
Bot-481	Tissue Culture	4(3+1)
Bot-482	Environmental Biology	3(2+1)
Bot-483-484	Elective-I/Research Project/Internship/Optional Paper	4(3+1) or 4(0+4)
Bot-485	Advances in Plant Taxonomy	4(3+1)
		15

SEMESTER-8**Bot-481****4(3+1)****Tissue Culture****Introduction:**

Introduction to plant cell and tissue culture. Plant tissue culture, plant genetic engineering and crop improvement. Tissue culture in agriculture, forestry, Botany and industry.

Explant Preparation and Selection Strategies:

Type of explant, size, age, quality, location and season. Surface Sterilization of explant

Culture Facilities and Sterile Techniques:

The basic laboratory layout and equipment. Sterilization of glassware, equipments and working area.

Media Components and Preparation:

Inorganic nutrients, organic nutrients, vitamins, amino acids, carbohydrates, gelling agents, antibiotic, plant hormones, complex organic supplements. Preparation of MS media from commercial packages and from stock solution. Contamination and its disposing. Safety in the laboratory.

Initiation and Maintenance of Callus:

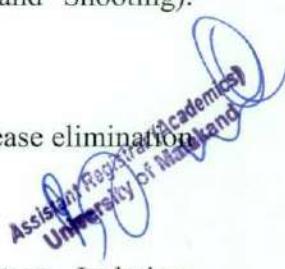
Origin and types of callus, Role of callus in embryogenesis, organogenesis and cell culture. Initiation and propagation of callus cultures. Monitoring the growth of callus. Genetic transformation of callus. Sub-culturing of callus. Organogenesis (Rooting and Shooting). Deflasking or Acclimatization.

Production of Virus Free Plants:

Disease elimination by tissue culture. Disease elimination by chemotherapy. Disease elimination by thermotherapy. Virus Eradication.

Types of Culture:

Initiation, maintenance, growth characters and uses of cell suspension culture. Isolation, purification, culturing and uses of protoplast culture. Introduction of anther and microspore culture. Pollen culture. Haploid for plant breeding and genetics. Factors affecting the success of



anther culture. Organ and embryo culture. Culturing of Hairy roots, Minitubers and Microtubers. Callus culture, Meristem culture, and fern spore culture.

Somaclonal Variation:

Origin, mechanism and uses of somaclonal variation. Somaclonal variations for salt, herbicide, drought, nematodes and disease tolerance. Somaclonal variations in major crops.

Somatic Hybridization and Germplasm Conservation:

Protoplast fusion and hybridization. Somatic hybrids plants and their regeneration. Germplasm conservation, methods for germplasm conservation. Cryopreservation. Artificial seeds.

Plant Hormones:

Uses of plant hormones in tissue cultures. Auxins, Cytokinins, Gibberellins, Florigen and Abscisic acid.

Recommended Books:

1. Attege, C.R and B. Kristiansen. 2001. Basic Biotechnology, Cambridge University, Press UK.
2. Chopra V. L., V. S. Malik and S.R. Bhat. Plant Biotechnology. Oxford IBH Publishers New Delhi.
3. Evans, D.E. J.O.D. Coleman and A. Kearns. Plant Cell Culture. BIOS Scientific Publishers London.
4. John, H.D. and L.W. Roberts. Plant tissue culture. Second edition. Cambridge University Press Cambridge. 1985.
5. Smith. R.H. Plant Tissue Culture Techniques and experiments. Second edition. Academic press 2000.

Assistant Registrar (Academics)
University of Malakand

SEMESTER-8**Bot-482****Environmental Biology****3(2+1)****Theory**

1. Environment: Introduction, scope, pressure
2. Pollution: definition, classification and impact on habitats
 - i. Air pollution: Sources and effect of various pollutants (inorganic, organic) on plants, prevention, control, and remediation. Photochemical Smog. Acid rain: 1. Theory of acid rain, 2. Adverse effect of acid rains Chlorofluorocarbons and its effects.
 - ii. Water pollution: Major sources of water pollution and its impact on vegetation. Prevention, control remediation, eutrophication, thermal pollution.
 - iii. Sediments pollution: fungicide, pesticides, herbicide, major sources of soil pollution and its impact. Prevention, control remediation and Heavy metal pollution. Tanneries and Hospital waste. Treatments of sewage, sludge, and polluted waters.
 - iv. Noise pollution
 - v. Radiation pollution (including nuclear): Measurement, classification and effects, Principle of radiation protection, waste disposal
3. Forest: importance, deforestation, desertification and conservation
4. Ozone layer:
 - i. Formation
 - ii. Mechanism of depletion
 - iii. Effects of ozone depletion
5. Greenhouse effect: causes, impacts.
6. Human population explosion: impact on environment.
7. Impact assessment: Industrial urban, civil developments.
8. National conservation strategy: Brief review of major problems of Pakistan and their solutions.
9. Sustainable Environmental management
10. Wetlands and sanctuaries protection: The pressures, problems and solutions.
11. Range management: Types of rangelands, potential threats, sustainable management.

Practical

1. Examination of industrial waste water and Municipal sewage and sludge for
 - i) Total dissolved solids.
 - ii) pH and EC.
 - iii) BOD/COD.
 - iv) Chlorides, Carbonate, and Nitrates.
2. Examination of water samples from different sites for the presence and diversity of organisms.
3. Effect of air pollutants on plants.
4. Visits to environmentally compromised sites and evolution of remediation methods.



Assistant Registrar (Academic)

Books Recommended

1. Bazzaz, F.A. 1996. Plants in changing environments: Linking physiological, population, and community ecology. Cambridge Univ. Press.
2. Bush, M.B. 1997. Ecology of a changing planet. Prentice Hall, UK.
3. Eugene, E.D. and Smith, B.F. 2000. Environmental Science: A study of interrelationships. McGraw Hill. USA.
4. France, H. 2000. Vanishing Borders: Protecting the planet in the age of globalization. W.W. Norton and Company, NY.
5. Hall, C.A.S. and Perez, C.L. 2000. Quantifying Sustainable Development. Academic Press, UK.
6. Marsh, M.W. and Grossa Jr., J.M. 1996 Environmental geography: Science, land use, and earth systems. John Wiley and Sons.
7. Mooney, H.A. and Saugier, B. 2000. Terrestrial Global Productivity. Academic Press, UK.
8. Newman, E.I. 2001. Applied Ecology. Blackwell Science. UK

Assistant Professor (Prestonite)
University of Thailand

SEMESTER-8

Bot-485

Advance in Plant Taxonomy

4(3+1)

Chapter-I An introduction to systematics and Taxonomy introduction, Taxonomy and its significance, Basic Terms used in taxonomy, the Taxonomic hierarchy.

Chapter-II P. Classification. History, Need, Various systems of classification.

Chapter-III Methods of describing a plant specimen. Technical recording of characters, Drawing of scientific illustration, Floral diagram, F. Formula.

Chapter-IV Plant Nomenclature, Introduction, purposes, Principles, Typification, Terminology of type materials, Authority citation, Rules for author citations, effective & valid publication, principle of priority, synonyms & its related terms, Names for plant hybrids.

Chapter-V Phytophytography. Introduction, plant duration, Habit, plant organs, vegetative morphology, Reproductive morphology, inflorescence, Fruit, ovules & seed.

Chapter-VI Terminology used for types of leaves, arrangement on stem and branches, margins, types of pubescence, inflorescence.

Chapter-VII Study of Dicot families (Selected).

Chapter-VIII Study of Dicot selected Monocot families.

