



UNIVERSITY OF THE POONCH RAWALAKOT
AZAD JAMMU AND KASHMIR
Department of Botany

SCHEME OF STUDY FOR SEMESTER FALL 2023 (1ST, 3RD, 5TH, AND 7TH)

COURSE CONTENTS OF COMPULSORY/GENERAL COURSES FOR BS-4 YEAR PROGRAM IN BOTANY

Semester-I (Cr. 15)

Year	Semester	Course Code	Course Title	Credit Hrs.	Category
First Year	1 st	GEN-3101	Functional English	3(3-0)	General
		GEN-3102	Environmental Science	3(2-1)	General
		GEN-3103	Quantitative Reasoning –I	3(3-0)	General
		BOT-3104	Introduction to Plant Sciences	3(2-1)	Major
		ZOO-3105	Principles of Animal Life-I	3(2-1)	Interdisciplinary
Semester Total Credit Hours				15	

GEN-3101 **Functional English** **3(3-0)**

Course Objectives: The course is developed to enhance the language skills and critical thinking of students by

- Enabling them to correct use of grammar and language structures
- Enabling them to communicate effectively

Course Contents:

Grammar:

- Basics of grammar
- Parts of speech and their use in communication
- Sentence structure
- Correct use of Tenses
- Active and passive voice
- Practice in unified sentences (unity and coherence)
- Analysis of Phrase, Clause and sentence structures
- Transitive and Intransitive Verbs
- Punctuation and Spellings

Reading skills:

- Comprehension skills
- Literal understanding of text, reading between lines (interpret text), reading beyond lines (to assimilate, integrate knowledge)
- Answers to the questions on a given text

Discussion:

- General topics and everyday conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of the students)
- Introducing ourselves, describing things, recounting past events, agreeing and disagreeing, compare and contrast

Listening:

- To be improved by showing documentaries/ films carefully selected by subject teacher
- Listening and note taking

Translation Skills:

- Urdu to English

Writing Skills:

- Paragraph Writing
Basic structure of paragraph and guidelines for writing an effective paragraph

Speaking Skills:

- Presentation Skills
- Introduction (types of presentation, structure of presentation)
- Prepared and unprepared talks

Note: Extensive reading is required for vocabulary building

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 Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension

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

d) Speaking

- 1) Ellen, K. 2002. Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top

- 2) Hargie, O. (ed.) Hand book of Communications Skills
- 3) Mandel, S. 2000. Effective Presentation Skills: A Practical Guide Better Speaking
- 4) Mark, P. 1996. Presenting in English. Language Teaching Publications

GEN-3102

Environmental Science

3(2-1)

Objectives:

- ❖ To understand and provide updated knowledge of environmental problems
- ❖ To provide a basic introduction sustainable environmental management.

Course Contents

Unit I. The human environment, the litho, bio and hydrosphere, the nature and composition of natural waters,

Unit II. Pollution: definition, classification and impact on habitats

- i. Air pollution: Sources and effect of various pollutants (inorganic, organic), control, remediation. Photochemical smog. Smog. Acid rain: 1. Theory of acid rain, 2. Adverse effects of acid rains. Chlorofluorocarbons and its effects.
- ii. Water pollution: Major sources of water pollution its impact. Prevention, control remediation, Heavy metal pollution. Tanneries. Hospital waste. Treatments of sewage, sludge, and polluted waters.
- iii. Soil pollution: major sources of soil pollution and its impact. Prevention, control remediation.
- iv. Noise pollution.

Unit III. Ozone layer:

- i. Formation
- ii. Mechanism of depletion
- iii. Effects of ozone depletion

Unit VI. Greenhouse effect: causes, impacts.

Practical:

Examination of water for

- i. Total dissolved solids.
- ii. pH and Conductance.
- iii. Alkalinity.
- iv. Hardness of water
- v. Determination of phosphates and sulphates

Recommended Books:

1. Newman, E.I. 2001. Applied Ecology. Blackwell Science. UK
2. Mooney, H.A. and Saugier, B. 2000. Terrestrial Global Productivity. Academic Press, UK.
3. Eugene, E.D. and Smith, B.F. 2000. Environmental Science: A study of interrelationships. McGraw Hill. USA.
4. French, 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. Bazzaz, F.A. 2004. Plants in changing environments: Linking physiological, population, and community ecology. Cambridge Univ. Press.
7. Bush, M.B. 1997. Ecology of a changing planet. Prentice Hall, UK.
8. Marsh, M.W. and Grossa Jr., J.M. 1996 Environmental geography: Science, land use, and earth systems. John Wiley and Sons.
9. Lambers, H., T. L. Pons and F. Stuart. 2008. Plant Physiological Ecology

Objectives: Students will get familiarized with the importance of quantitative reasoning skills in the modern age.

Course Contents:

1. Numerical Literacy

- Number system and basic arithmetic operations;
- Units and their conversions, dimensions, area, perimeter and volume;
- Rates, ratios, proportions and percentages;
- Types and sources of data;
- Measurement scales;
- Tabular and graphical presentation of data;
- Quantitative reasoning exercises using number knowledge.

2. Fundamental Mathematical Concepts

- Basics of geometry (lines, angles, circles, polygons etc.);
- Sets and their operations;
- Relations, functions, and their graphs;
- Exponents, factoring and simplifying algebraic expressions;
- Algebraic and graphical solutions of linear and quadratic equations and inequalities;
- Quantitative reasoning exercises using fundamental mathematical concepts.

3. Fundamental Statistical Concepts

- Population and sample;
- Measures of central tendency, dispersion and data interpretation;
- Rules of counting (multiplicative, permutation and combination);
- Basic probability theory;
- Introduction to random variables and their probability distributions;
- Quantitative reasoning exercises using fundamental statistical concepts.

Recommended Books:

1. "Quantitative Reasoning: Tools for Today's Informed Citizen" by Bernard L. Madison, Lynn and Arthur Steen.
2. "Quantitative Reasoning for the Information Age" by Bernard L. Madison and David M. Bressoud.
3. "Fundamentals of Mathematics" by Wade Ellis.
4. "Quantitative Reasoning: Thinking in Numbers" by Eric Zaslow.
5. "Thinking Clearly with Data: A Guide to Quantitative Reasoning and Analysis" by Ethan Bueno de Mesquita and Anthony Fowler.
6. "Using and Understanding Mathematics: A Quantitative Reasoning Approach" by Bennett, J. O., Briggs, W. L., & Badalamenti, A.
7. "Discrete Mathematics and its Applications" by Kenneth H. Rosen.
8. "Statistics for Technology: A Course in Applied Statistics" by Chatfield, C.
9. "Statistics: Unlocking the Power of Data" by Robin H. Lock, Patti Frazer Lock, Kari Lock Morgan, and Eric F. Lock.

BOT-3104

Introduction to Plant Sciences

3(2-1)

Aims and Objectives

To help participants understand basic plant science fundamentals through a variety of hands-on activities and resources. This course also provides an overview of the past, present and potential uses of plants. Particular emphasis is given to plants used directly, as in food, or indirectly, as products used by humans or those used to enhance the environment in line with sustainable development goals (SDGs).

Course Contents

1. **History and the importance of plant sciences.** Scope of plant sciences. Renewable and non-renewable resources. Traditional uses and potentials: sources of food (cereals, legumes, root and tuber crops, vegetable crops, fruits), drug discovery and medicinal plants.
2. **Plants and SDGs:** The need for a focus on plant, SDG 1 No poverty (Use of plant to end poverty), SDG 2 Zero hunger (Role of plants to end hunger, achieve food security and improved nutrition and promote sustainable agriculture, SDG 3 Good health and well-beings (use of plants to ensure healthy life and promote well-being), SDG 13 Climate action (Role of plants to combat climate change and its impacts), SDG 15 Life on land (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss).

Practical

1. Identify local ethnobotanically useful species.
2. Survey of medicinally important plants and their products
3. Medicinal plant description and processing
4. Preparation of decoctions, syrups, ointments, and dried plants for domestic medicinal use
5. Field exercises on medicinal plant specimen collection, documentation, storage and gardening

Recommended Readings

- Simpson B., Ogorzaly M. (2000). Economic Botany: Plants in our world. McGraw-Hill Education.
- Plant Science: Growth, Development, and Utilization of Cultivated Plants, 4th edition (McMahon et al., 2007).

- Sharrock, S., & Jackson, P. W. (2016). Plant Conservation and the Sustainable Development Goals. Global Partnership for Plant Conservation. Missouri: Botanical Gardens Conservation International.

ZOO-3105

Principles of Animal life-I

3(2-1)

Aims and Objectives

The course aims to impart knowledge and understanding of:

1. The concept and status of Zoology in life sciences.
2. The common processes of life through their chemistry, biochemical and molecular processes.
3. The structure and function of cell organelles and how common animal cells diversified in various tissues, organs and organ systems.
4. Biochemical mechanisms eventually generate energy for animal work.
5. Animals and their relationship with their environment.

Course Contents

1. Scope of Zoology:

- a) Introduction.
- b) Significance and applications of zoology
- c) Animal diversity.
- d) The scientific method.
- e) Environment and world resources.

2. Chemical Basis of Animal Life:

Brief introduction to bio molecules.

- a) Carbohydrates, b) lipids, proteins, c) nucleic acids.

3. Cellular Organization:

- a) Structure of animal cells,
- b) cell membrane,
- c) cytoplasm and its organelles:
ribosomes, endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, cytoskeleton, cilia and flagella, centrioles and microtubules, vacuoles; ribosomes, endoplasmic reticulum, the nucleus: nuclear envelope, chromosomes and nucleolus.

4. Animal tissues:

- a) Types: epithelial, connective, muscle and nervous tissue.
- b) organs and organ systems.

5. Enzymes:

- a) Structure, b) types; c) function and factors affecting their activity; d) cofactors and coenzymes.

6. Energy Harvesting:

- a) Aerobic and anaerobic respiration: glycolysis, citric acid Cycle and electron transport chain; fermentation, the major source of ATP.

7. Reproduction and Development:

- a) Types; asexual and sexual,
- b) gamete genesis, fertilization, metamorphosis, zygote and early development.

8. Ecological Concepts:

- a) Individuals and Populations: Animals and their abiotic environment; populations and limiting factors.
- b) Communities and Ecosystems: Community structure and diversity; interspecific interactions. Ecosystem, types, homeostasis, biomes, food chain, food web, energy flow and thermodynamics; biogeochemical cycles.
- c) Ecological problems; human population growth, pollution, resource depletion and biodiversity.

Practical

1. Tests for different carbohydrates, proteins and lipids.

Note: Emphasis on the concept that test materials have been ultimately obtained from living organisms and constituted their body.

2. 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.

3. Preparation of blood smears.
4. Plasmolysis and de plasmolysis in blood.
5. Protein digestion by pepsin.
6. Ecological notes on animals of a few model habitats.
7. Field observation and report writing on animals in their ecosystem (a terrestrial and aquatic ecosystem study).

Recommended Books

1. Hickman, C.P., Roberts, L.S., Keen L.S., Larson, A., l'Anson, H. and Eisenhour, D.J., Integrated Principles of Zoology, 14th Edition (International), 2004. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 10th Edition (International), 2016. Singapore: McGraw Hill.
3. Campbell, N.A. Biology, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
4. Miller, S.A. General Zoology Laboratory Manual. 7th Edition (International), 2013. New York: McGraw Hill.
5. Hickman, C.P. and Kats, H.L., Laboratory Studies in Integrated Principles of Zoology. 2000. Singapore: McGraw Hill.
6. Molles, M.C. Ecology: Concepts and Applications. 9th Edition. 2022. McGraw Hill, New York, USA.
7. Odum, E. P. Fundamentals of Ecology. 3rd Edition. 1994. W.B. Saunders. Philadelphia.

SEMESTER-III (Cr. 15)

Course Code	Course Title	Lecture Credit's
BOT-4301	Cell Biology, Genetics and Evolution	3(2-1)
PKS-4302	Pakistan Studies	3(3-0)
ENG-4303	Report writing	3(3-0)
CHM-4304	Physical Chemistry	3(2-1)
ZOO-4305	Animal Diversity-I	3(2-1)
Total Credit Hour's		15

BOT-4301

Cell Biology, Genetics and Evolution

3(2-1)

Aims and Objectives

To understand structure and functions of cell, nature of genetic material and hereditary process and familiarization with evolutionary processes.

Course Contents

a) Cell biology

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

b) Genetics

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

c) Evolution

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

Practical

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

1. Measurement of cell size.
2. Study of mitosis and meiosis by smear/squash method and from prepared slides.
3. Study of chromosome morphology and variation in chromosome number.
4. 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*.

Recommended Books:

1. Hoelzel, A. R. 2001. Conservation Genetics. Kluwer Academic Publishers.
2. Dyonsager, V.R. (1986). Cytology and Genetics. Tata and McGraw Hill Publication Co. Ltd., New Delhi.
3. Lodish. H. 2001. Molecular Cell Biology. W. H. Freeman and Co.

4. Sinha, U. and Sinha, S. (1988). Cytogenesis Plant Breeding and Evolution, Vini Educational Books, New Delhi.
5. Strickberger, M.V. (1988), Genetics, MacMillan Press Ltd., London.
6. Carroll, S.B., Grenier, J.K. and Welnerbee, S.d. 2001. From DNA to Diversity - Molecular Genetics and the Evolution of Animal Design. Blackwell Science.
7. Lewin, R, 1997. Principles of Human Evolution. Blackwell Science.
8. Strickberger, M. W. 2000 Evolution. Jones & Bartlet Publishers Canada
9. Ingrouille M. J. & B. Eddie. 2006. Plant Diversity and Evolution. Cambridge University Press.

PKS-4302

Pakistan Studies

3(3-0)

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 Outlines:

Historical Perspective

Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam M. Ali Jinnah. Factors leading to Muslim separatism. PEOPLE AND LAND: Indus Civilization, Muslim advent, Location and geo-physical features. GOVERNMENT AND POLITICS IN PAKISTAN: Political and constitutional phases, 1947-58, 1958-71, 1971-77, 1977-88, 1988-99 and 1999 onward, CONTEMPORARY PAKISTAN: Economic institutions and issues, Society and social structure, Ethnicity, Foreign policy of Pakistan and challenges, Futuristic outlook of Pakistan

Books Recommended:

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

ENG-4303

Report writing

3(3-0)

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. Extensive reading is required for vocabulary building.

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. McGraw-Hill Higher Education. 2004.
 3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- b) Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: 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).

CHM-4304

Physical Chemistry

3(2-1)

Quantum theory and structure of atom

Bohr's atomic model, defects of Bohr's atomic model, classical mechanics, failure of classical mechanics, quantum mechanics, dual nature of matter, de-Broglie's equation, Heisenberg's uncertainty principle, limitation of Heisenberg's uncertainty principle, concept of atomic orbitals, quantum numbers, Pauli exclusion principle, electronic distribution of elements.

Physical states of matter

1. Gases

General characteristics of gases, Gay Lussac's law, ideal gas equation, kinetic molecular theory of gases, molecular velocities (average velocity, mean square velocity, root mean square velocity, most probable velocity), ideal and real gases, deviation of gas from ideality, derivation of kinetic gas equation, molecular collisions, collision diameter, critical phenomenon of gases, liquefaction of gases, mean free path, Vander Waal's equation for real gases.

2. Liquid

General characteristics of liquids, physical properties like surface tension, viscosity, parachor value, rheochor value and their applications, refractive index, specific and molar refraction and their applications, optical activity, specific rotation, dipole moment and molecular structure.

3. Solids

General characteristics of solids, types of solids, isotropy and anisotropy, habit of a crystal, crystal lattice and unit cell, crystal systems and Bravais lattices.

Chemical Thermodynamics

Introduction, thermodynamic terms like system, surrounding, boundary of system, states and state function, internal energy, extensive and intensive properties, first law of thermodynamics, enthalpy of a system, relationship between free energy change and enthalpy change, heat capacity of gases at constant volume and at constant pressure, , heat capacities relationship, 2nd law of thermodynamics, change in free energy and equilibrium constant.

Chemical Kinetics

Introduction, concept of rate of chemical reaction, rate law, velocity constant, elementary and complex reaction, order and molecularity of reaction, zero, first and second order reactions, derivation of kinetic equation for first order and 2nd order reaction when initial concentration of both reactants is same, various methods for determining the rate of chemical reaction, Arrhenius equation, Lindemann's theory for unimolecular reaction, introduction to transition state theory, transition state theory for bimolecular reaction.

Basic Electrochemistry

Introduction, conductors and insulators, electrolytic and electronic conduction, specific conductance, measurement of specific conductance, cell constant and its determination, Ostwald's dilution law (dependence of degree of dissociation constant on dilution), electrochemical cells, types of cells, EMF and its measurement.

Solutions

Introduction, types of solution, concentration units, ideal and non-ideal solutions, Raoult's law, molecular interactions in solution, colligative properties (lowering of vapor pressure, elevation of boiling point, depression of freezing point, osmotic pressure and their determination), concept of zeotropic and azeotropic mixture.

Surface Chemistry

Absorption and adsorption, types of adsorptions, characteristics and factors which affect adsorption, applications of adsorption, catalysis, types of catalysis, enzyme catalysis, characteristics of catalysis.

Practicals:

- Determination of viscosity and parachor values of liquids.
- Determination of percent composition of liquid solutions viscometrically.
- Determination of refractive index and molar refractivity.
- Determination of percent composition of liquid solutions by refractive index measurements.
- Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).
- Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).

- Determination of heat of solution by solubility method.
- Determination of heat of neutralization of an acid with a base.

ZOO-4305

Animal Diversity-I

3(2-1)

(Classification, Phylogeny and Organization)

Aims and Objectives

The course is designed to provide students with:

1. Concepts of evolutionary relationship of animal kingdom.
2. Knowledge about animal kingdom, emphasizing their phylogenetic relationships and simple to complex mode of animal life.

Course Contents

Introduction: Architectural pattern of an animal, taxonomy and phylogeny, major subdivisions of animal kingdom. **Animal-Like Protists:** The Protozoa Evolutionary perspective; life within a single plasma membrane; symbiotic lifestyles. Protozoan taxonomy: (up to phyla, subphyla and super classes, wherever applicable). Pseudopodia and amoeboid locomotion; cilia and other pellicular structures; nutrition; genetic control and reproduction; symbiotic ciliates; further phylogenetic considerations. **Multicellular and Tissue Levels of Organization** Evolutionary perspective: origins of multicellularity; animal origins. Phylum porifera: cell types, 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. **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. **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. **Molluscan Success:** Evolutionary perspective: relationships to other animals; origin of the coelom; molluscan characteristics; classification up to class. The characteristics of shell and associated structures, feeding, digestion, gas exchange, locomotion, reproduction and development, other maintenance functions and diversity in gastropods, bivalves and cephalopods; further phylogenetic considerations. **Annelida:** The Metameric Body Form Evolutionary perspective: relationship to other animals, metamerism and tagmatization; classification up to class. External structure and locomotion, feeding and the digestive system, gas exchange and circulation, nervous and sensory functions, excretion, regeneration, reproduction and development, in polychaeta, oligochaeta and hirudinea; further phylogenetic considerations. **Arthropods:** Blueprint for Success Evolutionary perspective: classification and relationships to other animals; metamerism and tagmatization; the exoskeleton; metamorphosis; classification up to class; further phylogenetic considerations. Crustaceans, Hexapods and Myriapods, general nature, classification, phylogeny and adaptive diversification. **Echinoderms:** Evolutionary perspective: relationships to other animals; echinoderm characteristics; classification up to class. Maintenance functions, regeneration, reproduction, and development in asteroidea, ophiuroidea, echinoidea, holothuroidea and crinoidea; further phylogenetic considerations; some lesser-known invertebrates: the lophophorates, entoprocts, cycliophores, and chaetognaths.

Practicals

1. Museum study of representative phyla, permanent slide preparations
2. Study of *Euglena*, *Amoeba*, *Entamoeba*, *Plasmodium*, *Trypanosoma*,
3. *Paramecium* as representative of animal like protists. (Prepared slides).
4. Study of sponges and their various body forms.
5. Study of principal representative classes of phylum Coelenterata.
6. Study of principal representative classes of phylum Platyhelminthes.
7. Study of representative of phylum Rotifera, phylum Nematoda.
8. Study of principal representative classes of phylum Mollusca.
9. Study of principal representative classes of phylum Annelida.
10. Study of principal representative classes of groups of phylum Arthropoda.
11. Brief notes on medical/economic importance of the following:
12. *Plasmodium*, *Entamoeba histolitica*, *Leishmania*, Liverfluke, Tapeworm, Earthworm,
13. Silkworm, Citrus butterfly.

Recommended Books

1. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles of Zoology, 15th Edition (International), 2011. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 8th Edition (International), 2011. Singapore: McGraw Hill.
3. Pechenik, J.A. Biology Of Invertebrates, 4th Edition (International), 2000. Singapore: McGraw Hill.
4. Campbell, N.A. Biology, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

SEMESTER-V (Cr. 16)

Course Code	Course Title	Lecture Credit's
BOT-5501	Bacteriology and Virology	3(2-1)
BOT-5502	Diversity of Vascular Plants	3(2-1)
BOT-5503	Phycology and Bryology	3(2-1)
BOT-5504	Mycology and Plant Pathology	3(2-1)
BOT-5505	Cell Biology	3(2-1)
BOT-5506	Field Botany-I	1(0-1)
Total Credit Hour's		16

BOT-5501

Bacteriology and Virology

3(2-1)

Aims and objectives

To understand the morphology, structure and economic importance of Viruses and Bacteria

Course Contents

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.

b. 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.

Recommended Books:

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

7. Tortora, G.J.; Funke, B.R. and Case C.L. , 2004, Microbiology. Pearson Education.

BOT-5502

Diversity of Vascular Plants

3(2-1)

Aims and objectives

To enable the students to understand and appreciate the biology and evolution of plant architecture

Course Contents:

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. *Cooksonia* General Characters, classification, affinities and comparative account of evolutionary trends of the following phyla: Psilopsida (*Psilotum*), Lycopsida (*Lycopodium*, *Selaginella*), Sphenopsida (*Equisetum*), Pteropsida (*Ophioglossum*, *Dryopteris* and *Azolla/Marsilea*).

b. **Origin and Evolution of seed habit**

c. **Gymnosperms:**

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

d. **Angiosperms:**

Origin, general characteristics, Importance, and life cycle of angiosperms

e. **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.

Practicals:

1. To study the morphological and reproductive features of available genera.
2. Study trips to different parts of Pakistan for the collection and identification of important pteridophytes, gymnosperms and angiosperms.

Recommended Books

1. Beck, C.B. 1992. Origin and Evolution of Gymnosperms. Vol-1&II, Columbia University Press, New York,
2. Foster, A.S. and Gifford, E. M. Jr. 1998. Comparative Morphology of Vascular Plants. W. H. Freeman and Co.
3. Jones, D. 1983. Cycadales of the World, Washington, DC.
4. Mauseth, J.D. 1998. An Introduction to Plant Biology, Multimedia Enhanced, Jones and Bartlett Pub. UK.
5. Moore, R.c., W.d. Clarke and Vodopich, D.S. 1998. Botany McGraw Hill Company, USA
6. Raven, P.H. Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants, W.H. Freeman and Company Worth Publishers.
7. Ray, P.M. Steeves, T.A. and Fultz, T.A. 1998. Botany Saunders College Publishing, USA.
8. Taylor, T.N. and Taylor, E.D. 2000. The Biology and Evolution of Fossil Plants, Prentice Hall.
9. Stewart, W. N. and Rothwell, G.W. 1993. Paleobotany and the Evolution of Plants, University Press, Cambridge.
10. Faegri, K., P.E. Kaland & K. Krzywinski 1989. Text Book of Pollen Analysis, Jhon Wiley & Sons. N.Y.

BOT-5503 Phycology and Bryology

3(2-1)

Aims and objectives

To understand the classification, morphology and economic importance of Algae and Bryophytes

Course Contents

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, Anthocerosida 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*.

Recommended Books

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

BOT-5504

Mycology and Plant Pathology

3(2-1)

Aims and objectives

To introduce the students to Mycology and Diseases caused by Fungi.

Course Contents

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

- b. 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 chemotherapeutants.

Recommended Books:

1. Agrios, G.N., 2005. Plant Pathology, 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.
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.

BOT-5505

Cell Biology

3(2-1)

Aims and Objectives

To understand the structure and functions of cell and main functions of all of the major organelles in eukaryotic cells

Course outline:

1. **Introduction:** cell theory, structure of plant cell, prokaryotes and Eukaryotes cell
2. **Cell:** Physio-chemical nature of plasma membrane and cytoplasm.
3. **Ultrastructure of plant cell** with a brief description and functions of the following organelles

- a. Cell wall b. Endoplasmic reticulum c. Plastids
- d. Mitochondria e. Ribosomes f. Dictyosomes
- g. Vacuole h. Microbodies (Glyoxysomes and Peroxisomes)
- 4. **Nucleus:** Nuclear membrane, nucleolus, ultrastructure and morphology of chromosomes, karyotype analysis.
- 5. **Chromosomes:** Morphology and molecular structure of prokaryotic and eukaryotic chromosome, significance of histones and high mobility proteins in packing of chromosome and gene expression.
- 6. **Reproduction in somatic and embryonic cell:** general description of mitosis, cytokinesis and significance of Mitosis, types of meiosis, the first meiotic division, genetic consequences of meiosis, cell cycle.

Practical

1. Cell structure in the staminal hair of *Tradescantia*.
2. Measurement of cell size
3. Microchemical detection of following in the structure of the plant cell. Protein, carbohydrate, cellulose, cutin, pectin.
4. Plastids in various plants. *Spirogyra*, *Hydrilla*, *Tradescantia*, *Daucus carota*, *Arisaema*, *Solanum tuberosum*, *Lycopersicon esculentum*, and *Citrus*.
5. Mitosis: Smear / squash preparation of onion roots.
6. Meiosis: Smear / squash preparation from anthers of plants such as oat, onion, wheat, maize etc.
7. Germination of pollen grains of various vascular plants.
8. Demonstration of cell structure through photograph of electron microscope

Books Recommended

1. De. Robertis, E.P. and De. Robertis, E.M.F. Cell and Molecular Biology, 8th Edition, 2001, Holt Lea and Febiger, New York.
2. Lodish, H. Baltimor, D. Berk, A. Zipurshy, S.L. Matsudaira, P. Darnell, J. 2001. Molecular Biology of the Cell. Scientific American Books, W.H. Freeman and Company, New York.
3. Alberts, B., Bray, D. Lewis, J: Raff, M., Roberts, K and Watson, J.D 1994, Molecular Biology of the cell, Garland Publishing Inc. New York.
4. Darnell, Jr. J. Lodisch, H. and Baltimore, D. 1990. Molecular Biology of the cells, Scientific American Inc. N.Y.
5. Swanson, C.P., Merz, T. and Young, W.J. 1990 (second edition) Cytogenetics: The chromosome in division, inheritance and evolution. Prentice-Hall Inc.

BOT-5506

Field Botany-I

1(0-1)

Aims and Objectives

The basic objective of this course is to acquaint the students with natural flora and fauna in various regions through field trips.

Teaching Methodology

It will involve organizing botanical excursions and visits to various locations pertaining to the courses being taught in 1st semester. The students will have to go for field study trip to the place of the choice of the course incharge(s) and prepare a field report. The team of accompanying teachers will evaluate the level of academic interest, team-spirit, cooperativeness, discipline and other non-scholastic attributes, apart from the Field Report submitted by the students. The senior most teacher in the group will act as Convener of this course and will be responsible to submit the final award to departmental examination committee.

SEMESTER-VII (Cr. 18)

Course Code	Course Title	Lecture Credit's
BOT-6701	Plant Ecology-II	3(2-1)
BOT-6702	Genetics-I	3(2-1)
BOT-6703	Research Methodology	3(2-1)
BOT-6704	Plant Biochemistry-II	3(2-1)
BOT-6705	Plant Physiology-II	3(2-1)
BOT-6706	Thesis/Optional Paper	3(3-0)
BOT-6708	General Biotechnology (Optional)	3(2-1)
Total Credit Hour's		18

BOT-6701

Plant Ecology -II

3(2-1)

Aims and Objectives

To provide comprehensive knowledge of population, community, ecosystem ecology and its relevance to mankind.

Course Contents

1. The plant community: discrete and continuum concepts with modern synthesis.
2. Community attributes: leaf Spectra, life form distribution pattern, Periodicity, Phenology, Fidelity, Constancy, Raunkiaer law of frequency, Homogeneity and Heterogeneity, age class etc.
3. Species diversity concepts.
4. Plant community structure.
5. Plant community dynamics (succession):
6. Method of sampling of plant community: quadrat, line intercept, Point centered quarter methods.
7. Quantitative community description: Gradients analysis, ordination techniques and classification.
8. Productivity, measurement, energy flow and efficiency.
9. Flora of Azad Jammu and Kashmir.

Practical

1. Measurement of plant biomass and net primary productivity.
2. Measurement of water relation components: conductance.
3. Measurement of radiation, temperature, humidity and wind velocity.
4. Soil texture and structure. Measurement of plant biomass and net primary productivity.
5. Seed dispersal, seed bank, germination and reproductive allocations.
6. Community attributes.
7. Reconnaissance survey of different local communities.
8. Detailed sampling of local vegetation including gradient, ordination, and classification.
9. Study of local ecosystem.

Books Recommended:

1. Schultz J.C. 2005. Plant Ecology, Springer-Verlag .
2. Townsend C.R. Begon. M and J.L. Harper 2002. Essentials of Ecology, Blackwell Publishing,
3. Chapin, F.S. et al. 2002. Principle of Terrestrial Plant Ecology, Springer-Verlag
4. Gurevitch, et al., 2002. The Ecology of Plants, Sinauer Associates, Inc.
5. Barbour M. G. et al., 1999, Terrestrial Plant Ecology, the Benjamin-Cumming Publishing Co.
6. Smith, R. L. 1998. Elements of Ecology by Harper & Row Publishers,
7. Moore P.D. and Chapman S. B. 1986. Methods in Plant Ecology, Blackwell Scientific Publication, Oxford.
8. Hussain, S. Pakistan Manual of Plant Ecology,
9. Hussain, F. 1989. Field and Laboratory Manual of Plant Ecology, National Academy of Higher Education. Islamabad
10. Lambers, H., T. L. Pons and F. Stuart. 2008. Plant Physiological Ecology.
11. Larcher. W. 2003 Physiological Plant Ecology. Ecophysiology and Stress Physiology of Function Groups. Springer- Verlag.

BOT-6702

Genetics-I

3(2-1)

Aims and objectives

To understand the nature and function of genetic material.

Course Contents

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 meiosis, 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* chromosome, bacterial transformation, bacteriophage genetics, transduction, mapping of bacterial chromosomes, bacterial gene transfer.
6. The Structure of DNA: DNA: The genetic material, DNA replication in eukaryotes, DNA and the gene.
7. The Nature of the Gene: How genes work, gene- protein relationships, genetic observations explained by enzyme structure, genetic fine structure, mutational sites, complementation.
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, extranuclear genes in chlamydomonas, mitochondrial genes in yeast, extragenomic 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.

Practical:

1. Numerical problems

- a. Arrangement of genetic material:
 - i. Linkage and recombination.
 - ii. Gene mapping in diploid.
 - iii. Recombination in Fungi.
 - iv. Recombination in bacteria.
 - v. Recombination in viruses.
- b. Population Genetics:
 - i. Gene frequencies and equilibrium.
 - ii. Changes in gene frequencies,

2. Blood group and Rh-factor

3. Drosophila

- i. Culture technique
- ii. Salivary gland chromosome

4. Fungal genetics

Sacchomyces culture techniques and study.

5. Studies on variation in maize ear size and colour variation

6. Bacterial Genetics.

- i. Bacterial cultural techniques, Gram staining (*E. coli*, *B. subtilis*)
- ii. Transformation.
- iii. Conjugation.

Recommended Books:

1. Gelvin, S.B. 2000. Plant Molecular Biology Manual. Kluwer Academic Publishers.
2. Pierca, B.A. 2005. Genetics. A conceptual approach, W. H. Freeman and Company, New York.

3. Synder, L, and Champness, W. 2004. Molecular Genetics of Bacteria. ASM Press, Washington D.C.
4. Klug, W.S. and Cummings, M.R. 1997. Concepts of Genetics, Prentice Hall International Inc.
5. Roth Well, N.V. 1997. Understanding Genetics, second edition, Oxford University Press Inc.
6. Gardner, E.J., 2004. Principles of Genetics, John Willey and Sons, New York.
7. Ringo J, 2004. Fundamental Genetics, Cambridge University Press.
8. 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.
9. Snyder, L and Champness W, 2003, Molecular Genetics of Bacteria, ASM Press.
10. Hartl, D.L. and Jones, E.W. 2005, Genetics - Analysis of Genes and Genomes, Jones and Bartlett Publishers. Sudbary, USA.
11. Hedrick, P.W. 2005. Genetics of Population. Jones and Bartlett Publisher, Sudbury, USA.

BOT-6703

Research Methodology

3(2-1)

Aims and Objectives

To enable the students to know the theoretical aspects of planning research, handling, presentation of data, writing and submission of research papers and thesis.

Course Contents

Research Methods (planning research, various methods, analyzing results, giving reports, etc.). Research process including: formulating research questions; sampling (probability and no-probability). **Measurement (surveys, scaling, qualitative, unobtrusive).** Research design (experimental and quasi-experimental). **Data analysis; and writing the research paper.** The Major theoretical and philosophical underpinnings of research including: the idea of validity in research; reliability of measures; and ethics

Recommended Books

1. Brizuela, B.M., Stewart, J.P., Carrilo, R.G., and Berger, J.G. 2000. Acts of Inquiry in Qualitative Research. Harvard Education Press, Cambridge.
2. Leedy, P.D., and Ormond, J. E. 2004. Practical Research: Planning and Design. 8th Edition. Prentice Hall, Inc., London.
3. Shank, G.D. 2001. Qualitative Research: A Personal Skills Approach. 2nd Edition. Pearson Education Inc., New York.
4. Brandret, M., Mchille, L., and Peterson, L. 1996. Practical Methods in Mycorrhizal Research. Mycologue Publications, University of Guelph, Guelph, Ontario.
5. Harley, J.L., and Smith, S.E. 1983. Mycorrhizal Symbiosis. Academic Press, London.
6. Kendrick, B. 2001. The Fifth Kingdom. 3rd Edition. Focus Publishing/R. Pullins Company, Massachusetts.
7. Schenk, N.C. 1982. Methods and Principles of Mycorrhizal Research. The American Phytopathological Society. St. Paul, Minnesota.

BOT-6704

Plant Biochemistry-II

3(2-1)

Aims and Objectives

To explicit the fundamentals of metabolic energy, Metabolism and Plant constituents.

Course Outline

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.

Recommended Books:

1. Conn E. E. and Stumpf, P.K. 2002. Outlines of Biochemistry, John Wiley and Sons Inc. New York.
2. Albert L. Lehninger, 1998. Principles of Biochemistry. Worth Publishers Inc.
3. Voet, D. Voet J.G. and Pratt, C.W. 1998. Fundamentals of Biochemistry, John Wiley and Sons, New York.
4. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
5. 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.
6. Zubay. G. 2003, Biochemistry, MacMillan Publishing Co., New York.
7. Chesworth, J.M., Strichbury T. and Scaife, J. R. 1998. An introduction to agricultural biochemistry. Chapman and Hall, London.
8. Goodwin T.W. and Mercer, E.I. 1997. Introduction to Plant Biochemistry. Pergamon Press, Oxford.
9. Heldt, H-W. 2008. Plant Biochemistry. 3rd Edition, Academic Press, U.K.
10. Campbell, M.K. and F. Shawn. 2008. Biochemistry 6th Edition.

BOT-6705

Plant Physiology-II

3(2-1)

Aims and Objective

To give it comprehensive and advance knowledge of growth regulators, mechanism of water uptake and role of essential nutrients in plant metabolism

Course Contents

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. Hoffer 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 energetics. 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.

Recommended Books

1. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
2. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
3. Taiz, L. and Zeiger, E. 2002. Plant Physiology. 3rd Edition. Sinauer's Publ. Co. Inc. Calif.
4. W.B. Hopkins. 1999. Introduction to Plant Physiology. 2nd Ed. John Wiley and Sons. New York.
5. Epstein, E. and Bloom, A.J. 2004. Mineral Nutrition of Plants: Principles and Perspectives. 2nd Edition. Sinauer Associates, California, USA.
6. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
7. Barton, w. 2007. Recent Advances in Plant Physiol

ELECTIVE COURSE

BOT-6708

General Biotechnology

3(2-1)

Aims and Objectives

To understand the basic techniques and principles of tissue culture and DNA Recombinant Technology

Course Contents

Restriction and modification system: Types, Enzyme, classification, Nomenclature, Genetics and applications. Cloning Vectors: Plasmids (Bacterial and yeast), Viruses (Ca, MV, SV40, BPV) phages (Lambda, Mu, M13). Cosmids and phagmids. Cutting and joining of DNA: Isolation and purification of DNA, Ligation of DNA molecules, blunt ends and cohesive termini. Cloning Strategies; selection and characterization molecules, verification and amplification of desired genes, Gene Banks, PCR, RFLP, DNA sequencing techniques, DNA cloning, Southern blotting, Northern blotting, western blotting, site specific mutagenesis. Protein engineering. Applications of recombinant DNA technology with comprehensive theoretical know-how macromolecules of desired characters for transgenic.

Practical

1. Isolation of plasmids and chromosomal DNA from bacteria and yeast.
2. Screening of bacteria for plasmids by electrophoresis of total cell lysate.
3. Gel electrophoresis of plasmids DNA chromosomal DNA & RNA.
4. Comparing plasmids of different molecular weights using Molecular Weights markers.

Recommended Books

1. Rehm, J.J. 1998. Fundamentals of Biotechnology, VCH Publishers, N.Y.
2. Lee, B.H. 1996. Fundamentals of Food Biotechnology, VCH Publishers, N.Y.
3. Pirt, J.B. 1975. Microbes and Cell Cultivation, Blackwell Scientific Publishers, London.
4. Bailey, J.E. and Ollis, D. F., 1986. Biochemical Engineering Fundamentals, McGraw Hills.
5. Watson, J.D., Tooze, J. and Kurta, D.T. 1983. Recombinant DNA-A short Course, Scientific American Books, New York.
6. Old, R.W. and Primrose, S.B. 1989. Principles of gene manipulation. 4th edition, Blackwell Scientific Publishers, London.
7. Molecular cloning, 1989. A Laboratory manual, 2nd edition, Cold spring Harbor Laboratory.
8. Higgins, I.J., Best, D.J. and Jones, J. 1988. Biotechnology Principles and Applications. Blackwell Scientific Publishers, London.
9. Rehm, J.J. 1988. Biotechnology: Special Microbial Process, Vol. 6 (b), VCH Publishers, N.Y.