



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

**SCHEME OF STUDY FOR SEMESTER SPRING 2024 (2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>TH</sup>, AND 8<sup>TH</sup>)**

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

**COURSE CONTENTS OF COMPULSORY/GENERAL FACULTY COURSES FOR BS (2<sup>nd</sup> SEMESTER) PROGRAM IN BOTANY (Session started in Fall 2023)**

Year	Semester	Course Code	Course Title	Credit Hrs.
Year-I	2 <sup>nd</sup>	GEN-3201	Expository Writing	3(3-0)
		GEN-3202	Arabic/Kashmir Studies/Introduction to History	2(2-0)
		GEN-3203	Application of Information & Communication Technologies	3(2-1)
		BOT-3204	Diversity of Plants	3(2-1)
		ZOO-3205	Animal Diversity-I	3(2-1)
		CHM-3206	Inorganic Chemistry	4(3-1)
			<b>Total credit hours.</b>	<b>18</b>

**GEN-3201**

**Expository Writing**

**3(3-0)**

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

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

**Course Contents:**

What is Communication?

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

Paragraph Writing.

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

### Essay Writing.

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

### CV and Job Application.

- Preparing a Curriculum Vitae
- Writing a formal job application

### Translation Skills.

- Urdu to English

(Practice at advanced level)

### Study Skills.

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

### Academic Writing.

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

### Presentation Skills.

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

### Academic Writing.

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

### Report Writing.

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

### E-mail writing.

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

### Preparing for Interview and Research proposal/ research paper defense

*Note: Documentaries to be shown for discussion and review*

### **Recommended Books:**

#### **Communication Skills**

##### a) Grammar

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

##### b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).

2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
- c) Reading
1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
  2. Reading and Study Skills by John Langan
  3. Study Skills by Richard York.
- d) Speaking
4. Ellen, K. 2002. Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top
  5. Hargie, O. (ed.) Handbook of Communications Skills
  6. Mandel, S. 2000. Effective Presentation Skills: A Practical Guide Better Speaking Mark, P. 1996. Presenting in English. Language Teaching Publications

GEN-3202

Arabic

2(2-0)

Objectives of the Course	<p>۱. طلباء کو عربی زبان کی علوم اسلامیہ میں اہمیت سے آگاہ کرنا</p> <p>۲. طلباء کو علم صرف اور نحو کے بنیادی قواعد سے آگاہ کرنا تاکہ اسلامی علوم سے کما حقہ استفادہ کیا جا سکے</p> <p>۳. طلباء کو علم صرف کے بنیادی اصولوں سے آگاہ کرنا</p> <p>۴. قرآن مجید سے قواعد عربیہ کی عملی مشق کروانا۔</p>
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Week	Lecture No.	قواعد	عملی مشق	
Week 1	Lecture 1	• اسم کی پہچان	• تعوذ اور سورۃ الفاتحة (4-1)	
	Lecture 2	• هُو، هُمْ، ضمائر منفصلہ	• سورۃ الفاتحة (5-7)، تکبیر، ثناء، تسبیحات	
Week 2	Lecture 3	• ل، مِنْ، عَنْ، مَعَ حروف جار	• تشهد، درود، دعا	
	Lecture 4	• فعل ماضی: فَعَلَ	• سورۃ الإخلاص	
Week 3	Lecture 5	• فعل مضارع: يَفْعَلُ	• سورۃ الفلق	

	Lecture 6	• فعل امر، فاعل، مفعول، فعل	• سورة النَّاس	<b>Quiz # 01</b>
<b>Week 4</b>	Lecture 7	• نَصَرَ، عَبَدَ	• سورة النصر	<b>Assignment# 01</b>
	Lecture 8	• ضَرَبَ، ظَلَمَ، سَمِعَ، عَلِمَ	• سورة الكافرون	
<b>Week 5</b>	Lecture 9	• كمزور أفعال: وَهَبَ، وَعَدَ	• سورة البقرة: 1-5	
	Lecture 10	• كمزور أفعال: قَالَ، زَادَ	• سورة البقرة: 6-10	
		• <b>Mid Term</b>		
<b>Week 6</b>	Lecture 11	• بمزه والى أفعال: أَمَرَ	• سورة البقرة: 11-13	
	Lecture 12	• يكسان حروف والى أفعال: ظَنَّ، ظَلَّ	• سورة البقرة: 14-18	
<b>Week 7</b>	Lecture 13	• فعل مجهول: نُصِرَ، جُعِلَ	• سورة البقرة: 19-20	
	Lecture 14	• فعل مجهول: وُعدَ، أَمَرَ	• سورة البقرة: 21-22	
<b>Week 8</b>	Lecture 15	• مزيد في: حَاسَبَ	• سورة البقرة: 23-25	
	Lecture 16	• مزيد في: أَسْلَمَ، اِخْتَلَفَ	• سورة البقرة: 26-29	
<b>Week 9</b>	Lecture 17	• مزيد في: اِسْتَعْفَرَ	• سورة البقرة: 30	<b>Quiz # 02</b>
	Lecture 18	• مزيد في: نَدَبَرَ، تَدَارَسَ، اِنْقَلَبَ	• سورة البقرة: 31-35	
<b>Week 10</b>	Lecture 19	• مزيد في: وَلَّى	• سورة البقرة: 36-37	<b>Assignment# 02</b>
	Lecture 20	• مزيد في: نَادَى، أَقَامَ	• سورة البقرة: 38-42	
<b>Week 11</b>	Lecture 21	• مزيد في: اِنْتَقَى، سَتَقَامَ	• سورة البقرة: 43-46	
	Lecture 22	• مؤنث ضمائر	• سورة البقرة: 47-50	
<b>Week 12</b>	Lecture 23	• مؤنث فعل كا تُبِيل	• سورة البقرة: 51-53	

	Lecture 24	• مؤنث فعل كا ثبيل، تثنيه (دو) ثبيل	• سورة البقرة: 54-57
Week 13	Lecture 25	• فعل مجهول (مزيد في) عُلِمَ، أَنْزَلَ	• سورة البقرة: 58-59
	Lecture 26	• فعل: كَرَّمَ، أَوْرَ فَعْلٍ مضارع	• سورة البقرة: 60-61
Week 14	Lecture 27	• لَمْ أَوْرَ مَضَارِعَ مَزِيدٍ فِي أفعال	• سورة البقرة: 62
	Lecture 28	• لَنْ أَوْرَ فَعْلٍ مَضَارِعَ، اسْمٍ مكان	• سورة البقرة: 63-66
Week 15	Lecture 29	• اسم مكان	•
	Lecture 30	• جمع تكسير ، جملة اسميه	• سورة البقرة: 67-70
Week 16	Lecturer 31	• جملة فعليہ	• سورة البقرة: 71-73
	Lecturer 32	• مضاف، مضاف اليه، موصوف، صفت	• سورة البقرة: 74
Week 17		<b>Terminal Examination</b>	

#### نصابی کتب

نام کتاب	نام مصنف	نمبر شمار
عربی کا معلم (چاروں حصے)	عبدالستار خان	1
تمرین صرف	معین اللہ ندوی	2
تمرین النحو	محمد مصطفیٰ ندوی	3
معلم الانشاء	مولانا عبدالماجد ندوی	4
مختار النحو	مولانا مختار احمد	5

#### حوالہ جاتی کتب

نام کتاب	نام مصنف	نمبر شمار
النحو الواضح	علی جارم	1
اساس عربی	نعیم الرحمن	2
مبادئ العربية في الصرف و النحو	رشيد الشريطی	3

كتاب النحو	عبدالرحمن امرتسرى	4
تمرين النحو	محمد مصطفى ندوى	5
قواعد القرآن	عبدالرحمن طاہر	6
اللغة العربية لغير الناطقين بها	جامعة الملك السعود، رياض	7
قرآنى عربىك	ڈاکٹر ابراہیم سورتى	8

OR

**GEN-3202**

**Kashmir Studies**

**Credit Hours: 2(2-0)**

**Objectives:** To impart the knowledge about the multicultural historical legacy, religious and cultural heritage.

**Course Contents:**

**Unit I: Geographic and Administrative Profile of divided State of Jammu & Kashmir**

- Geographic and Administrative Profile of Azad Jammu & Kashmir and Gilgit Baltistan.
- Geographic and Administrative Profile of Indian Occupied Jammu and Kashmir.
- Geographic and Administrative Profile of Indian Occupied Jammu and Kashmir,
- Current Political Status of divided regions of disputed state of Jammu and Kashmir,

**Unit II: Sources of Kashmir History:**

- Famous ancient and Medieval historians
- Famous books on ancient and Medieval history of Kashmir Ancient

**Unit III: Ruling Dynasties in Kashmir**

- Earlier inhabitants and Introduction to ancient ruling dynasties up to 1320 (selective Famous Ancient Rulers)
- Introduction to ancient Religions of Kashmir,
- Rise and fall of Buddhism in Kashmir
- Causes for decline of Hindu Rule in Kashmir

**Unit IV: Muslim Rule in Kashmir**

- Advent of Islam in Kashmir
- First Muslim Rule in Kashmir (1320-23)

**Unit V: Shah Miri Dynasty**

- Rise of Muslims in Kashmir
- Shahmir and his successors
- Zainul-ul-Abidin

- Successors of Zainulabidin
- Rule and development of Kashmir

**Unit VI: Development of Art and Culture during Shahmiri dynasty**

- Development of Art and Culture during Shahmiri dynasty

- b- Development of Industries
- c- Causes for the decline of Shahmiri dynasty.

**Unit VII: Role of Sufi Saints for spread of Islam in Kashmir**

- a. Role of Shah Hamdan for spread of Islam in Kashmir
- b. Role of Shah other Saints for spread of Islam in Kashmir
- c. Development of Islamic Culture in Kashmir and role of Sufi Saints

**Unit VIII: Chak Rule in Kashmir**

- a- Causes for decline of Chak Rule in Kashmir and Mughals' occupation of Kashmir.
- b- Ruling Era of Mughals and governing methods
- c- Condition of Kashmir during Mughal Era
- d- Causes for decline of Mughal Rule in Kashmir

**Unit IX : Kashmir under Afghans**

- a) Ruling Era of Afghans and governing methods
- b) Condition of Kashmir during Mughal Era
- c) Causes for decline of Afghan Rule in Kashmir

**Unit X: Occupation of Kashmir by Sikhs**

- a. Ruling Era of Sikhs and governing methods
- b. Condition of Kashmiris during Sikh Rule
- c. Rise of Dogras' Treaty of Lahore and Treaty of Amritsar

**Unit XI: Kashmir under Dogra rule in Kashmir**

- a. Successors of Gulab Singh in Kashmir
- b. Condition of Kashmiris during Dogra Rule, Muslim Subjects of Kashmir and Dogra rulers and Resistance movements in Kashmir during Dogra Rule

**Unit XII: Jammu and Kashmir in after 1947**

- a. Indian occupation
- b. Kashmir issue: genesis
- c. Kashmir issue in the United Nations
- d. Human rights violations in Indian Occupied Kashmir

**Unit XIII: Economic Resources of Jammu and Kashmir Cultural Heritages of Kashmir**

**Unit XIV: Languages Spoken in Kashmir**

**Recommended Books:**

1. Kalhana Pandit. (1991), Rajatarangint, Mirpur Verinag Publishers AJ& K
2. GMD Sufi (1962), Kashir, Lahore: University of Punjab
3. Somnath Dhar. Jammu & Kashmir. India: National Book Trust, 2013.
4. Ram Chandra Kak. Ancient Monuments in Kashmir. London: 1993.
5. Dr. S.C. Ray Early History and Cultural of Kashmir. New Dehli: 1969.
6. Dr. A.N. Rania. Geography & Jammu & Kashmir. New Dehli 1972.
7. Walter Lawrence. The Valley of Kashmir. London 1895.
8. G.M Rabani. Kashmir Social and Cultural History: Srinagar Gulshan Books 2007.
9. Muhammad Yusuf Saraf, Kashmiris Fight for Freedom.

OR

**GEN-3202**

**Introduction to History**

**Credit Hours: 2(2-0)**

## **Course Objectives:**

The purpose of this course is:

- To make students aware of the nature of historical knowledge and research.
- To introduce to the students, the basic concepts and controversies related to historical understanding.

## **Course Content:**

### **Unit I: What is History?**

Literal, terminological and conceptual meaning of history

History as Fact

History as Process

History as Narrative

### **Unit II: Memory, Record and History**

### **Unit III: Nature of History:**

Being and becoming.

Continuity and Change; Evolution, Progress and Development Macrocosm & Microcosm: Time, Space, Causation, Facts, and opinion/ objectivity & Subjectivity

### **Unit IV: Utility, Benefits & importance of History:**

History as a corrective/cohesive force.

History as a repetitive force

Continuity of History from Past to Future

Lessons from Past

Historical determinism, etc.

History as Mother of All Sciences/Knowledge

### **Unit V: Epistemological nature of History:**

Relationship of History with other forms of knowledge:

Natural Sciences

Social Sciences

Literature and Arts

### **Unit VI: Forms and Classification of History**

### **Suggested Readings:**

1. Burke, Varieties of Cultural History, Cornell University Press, 1977
2. Carlo, Ginzburg. Clues. Myths, and the Historical Method, John Hopkins: University Press, 1992
3. Carr, E. H., What is History? Harmondsworth: Penguin, 1961
4. Cohn, Bernard. An Anthropologist among Historians and Other Essay, Oxford University Press, 1988
5. Collingwood, R. G. The Idea of History. Oxford: Oxford University Press, 1978.
6. Daniels, Studying History: How and Why, New Jersey, 1981.
7. Gertrude Himmelfarb. The New History and the Old, Cambridge: Harvard University Press, 1987
8. Govranski. History Meaning and Methods, USA, 1969
9. Hegel. Elements of the Philosophy of Right. Cambridge University Press, 1991



10. Qadir, Khurram, Tarikh Nigari Nazriyat-o-Irtiqā, Lahore: Palgrave, 1994.
11. Qureshi, Muhammad Aslam. A Study of Historiography. Lahore: Pakistan Book Centre, Latest Edition.
12. Steedman. Caroline, Dust: The Archive and Cultural History, Manchester University Press, 2002
13. Stern Fritz, Varieties of History: from Voltaire to the Present, Vintage, 2nd Edition 1975
14. Tahir Kamran, The Idea of History Through Ages, Lahore: Progressive Publisher, 1993
15. Lemon, M. C., Philosophy of History, London: Routledge, 2003
16. Marwick, Arthur, The New Nature of History, London, 1989, pp.31-35.
17. Roberts, Geoffrey, ed., History and Narrative Reader, London: Routledge, 2001.
18. Shafique, Muhammad, British Historiography of South Asia: Aspects of Early Imperial Patterns and Perceptions, Islamabad, NIHCR, Quaid-i-Azam University, 2016

**Semester-II (Cr. 16) for session starting from Fall 2022 (Repeaters)**

Course Code	Course Title	Lecture Credit's
BOT-3201	Plant Systematics, Anatomy and Development	3(2-1)
ENG-3202	Academic Reading Writing	3(3-0)
ISL-3203	Islamic Studies/Ethics	2(2-0)
CHM-3204	Organic Chemistry	3(2-1)
ZOO-3205	Principles of Animal Life-II	3(2-1)
STA-3206	Introduction to Statistics	2(2-0)
<b>Total Credit Hour's</b>		<b>16</b>

**Note:** The course contents of courses other than Botany will be adopted as prescribed by the relevant departments/University/HEC.

**BOT-3201    Plant Systematics, Anatomy and development    3(2-1)**

**Aims and Objectives**

To understand, Various systems of classification, identification and nomenclature of higher plants and Structures and functions of tissues and organs at embryonic level.

**Course Contents:**

a. **Plant systematics**

1. Introduction to Plant Systematics: aims, objectives and importance.

2. Classification: brief history of various systems of classification (artificial, natural and phylogenetic and current).
3. Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to International Code of Botanical Nomenclature (ICBN). Principles of ICBN.
4. Morphology: a detailed account of various, morphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.
5. Diagnostic characters, economic importance of following families: Ranunculaceae, Brassicaceae (Cruciferae), Fabaceae (Leguminosae), Rosaceae, Euphorbiaceae, Cucurbitaceae, Solanaceae, Lamiaceae (Labiatae), Asteraceae (Compositae), Liliaceae and Poaceae (Gramineae)

**b. Anatomy**

Concept, structure and function of various tissues like: Parenchyma, Collenchyma, Sclerenchyma, Epidermis (including stomata and trichomes), Xylem, Phloem, Meristem: types, stem and root apices, Vascular cambium, Structure and development of root, stem and leaf. Primary and secondary growth of dicot stem, periderm, Characteristics of wood: diffuse porous and ring –porous, sap and heart wood, soft and hard wood, annual rings.

**c. Development / Embryology**

Early development of plant body: *Capsella bursa-pastoris*, Structure and development of Anther Microsporogenesis Microgametophyte, Structure of Ovule Megasporogenesis Megagametophyte, Endosperm formation, Parthenocarpy, 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.
4. Students shall submit 40 fully identified herbarium specimens.

**Recommended Books:**

1. Mauseth, J.D. 1998. An Introduction to Plant Biology: Multimedia Enhanced. Jones and Bartlett Pub. UK
2. Moore, R.C., W.D. Clarke and Vodopich, D.S. 1998. Botany. McGraw Hill Company, U.S.A.
3. Raven, P.H., Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants. W.H. Freeman and Company Worth Publishers.
4. Stuessy, T.F. 1990. Plant Taxonomy. Columbia University Press, USA.
5. Lawrence, G.H.M. 1951 Taxonomy of Vascular Plants. MacMillan & Co. New York.
6. Panday, B.P. 2004. A textbook of Botany (Angiosperms). S. Chand and Co. New Delhi.
7. Raymond E, S. E. Eichhorn. 2005. Esau's Plant Anatomy. Meristems cells and tissues of the plant body, 3<sup>rd</sup> ed. John Wiley & Sons. Inc.
8. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
9. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.
10. Maheshwari, P.1971. Embryology of Angiosperms, McGraw Hill. New York.
11. Eames A.J. and L.H Mac Daniels. 2002. An Introduction to Plant Anatomy. Tata-Mac Graw-Hill Publishing Company, Limited New Delhi.

12. Pullaiah, T. 2007. Taxonomy of Angiosperms. 3<sup>rd</sup> Edition Regency Publications, New Delhi.
13. Naik, V.N. 2005 Taxonomy of Angiosperms. 20<sup>th</sup> Reprint. Tata-Mac Graw-Hill Publishing Company, Limited New Delhi.

**ENG-3202**

**Academic Reading and Writing**

**3(3-0)**

**a) Grammar**

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. 3<sup>rd</sup> Edition. Oxford University Press 1986. ISBN 0 19 431350 6.

**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 45-53 (note taking).
2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

**c) Reading**

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 4534030.
2. Reading and Study Skills by John Langan
3. Study Skills by Riachard York.

**ISL-3203**

**Islamic Studies / Ethics**

**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.

**Course contents**

Basic Concepts of Quran, History of Quran, Uloom-ul –Quran, Verses of Surah Al-Baqra Related to Faith (Verse No-284-286), Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11), Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77), Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154), Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56, 57,58.), Verses of Surah Al-Hashar (18,19,20), Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14), Life of Muhammad Bin Abdullah ( Before Prophet Hood), Life of Holy Prophet (S.A.W) in Makkah, Important Lessons Derived from the life of Holy Prophet in Makkah, Life of Holy Prophet (S.A.W) in Madina, Important Events of Life Holy Prophet in Madina, Important Lessons Derived from the life of Holy Prophet in Madina ,Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom-ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah, Basic Concepts of Islamic Law & Jurisprudence, History & Importance of Islamic Law & Jurisprudence, Sources of Islamic Law & Jurisprudence, Nature of Differences in Islamic Law, Islam and Sectarianism, Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues, Basic Concepts of Islam & Science, Contributions of Muslims in the Development of Science, Quranic & Science, Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic

Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce, Basic Concepts of Islamic Political System, Islamic Concept of Sovereignty, Basic Institutions of Govt. in Islam, Period of Khlaft-E-Rashida, Period of Ummayyads, Period of Abbasids, Basic Concepts of Social System of Islam, Elements of Family, Ethical Values of Islam.

#### Reference Books:

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

**CHM-3204**

**Organic Chemistry**

**3(2-1)**

#### Properties of Organic Molecules

Dipole moment; inductive and field effects; resonance; aromaticity; tautomerism; hyperconjugation; hydrogen bonding; acids and bases; factors affecting the strengths of acids and bases.

#### Hydrocarbons

Discussion on the preparation, properties and reactions of alkanes, alkenes, alkynes and aromatics.

#### Oxygenated Hydrocarbons

Discussion on the preparation, properties and reactions of alcohols (phenols), ethers, aldehydes, ketones, carboxylic acids and derivatives.

#### Introductory Organic Spectroscopy

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

#### Practicals:

Qualitative analysis of compounds with different functional groups, synthesis of organic compounds using as a tool for understanding techniques like reflux, distillation, filtration, recrystallization and yield calculation, organic syntheses may include preparation of benzanilide from benzoyl chloride, succinic anhydride from succinic acid, phthalimide from phthalic anhydride, oximes and hydrazones from carbonyl compounds, and an ester from a carboxylic acid and alcohol etc.

#### Books Recommended:

- 1) Furniss, B. S., Hannaford, A. J., Smith, P. W. G., Tatchell, A. R., Vogel's Textbook of Practical Organic Chemistry, 5th ed., Longman, UK, (1989).
- 2) Pavia, D. L., Kriz, G. S., Lampman, G. M. and Engel, R. G., A Microscale Approach to Organic Laboratory Techniques, 5th ed., Brooks/ Cole Cengage Learning, (2013).
- 3) Mayo, D. W., Pike, R. M. and Forbes, D. C., Microscale Organic to Laboratory with Multistep and Multisacle Syntheses, 5th ed., John-Wiley & Sons, Inc., (2011).
- 4) Gilbert, J. C. and Martin, S. F., Experimental Organic Chemistry: A Miniscale and Microscale Approach, 5th ed., Brooks/ Cole Cengage Learning, (2010).
- 5) Brown, W. H., Fotte, C. S., Iverson, B. L. and Anslyn, E. V., Organic Chemistry, 6th ed., Brooks/ Cole Cengage Learning, (2012).

**ZOO-3205**

**Principles of Animal Life-II**

**3(2-1)**

### **Aims and Objectives**

The course will impart knowledge and understanding of:

1. Cell division and its significance in cell cycle.
2. Concepts and mechanisms of inheritance pattern, chromosome and gene linkage and molecular basics of genetics.
3. Animal behavior and communication.
4. Theories of evolution, gene flow and mechanism of evolution with reference to animals and diversity.

### **Course Contents**

**Cell Division:** Cell cycles: Mitosis and meiosis; control of the cell cycle. **Inheritance Patterns:** Mendelian genetics; inheritance patterns; gene, structure, chemical composition and types. **Chromosomes and Gene Linkage:** Eukaryotic chromosomes; linkage and crossing over; chromosomal aberrations. **Molecular Genetics: Cellular Control: DNA:** the genetic material; DNA replication in prokaryotes and eukaryotes; control of gene expression in eukaryotes; gene mutation; recombinant DNA and applications of genetic technologies. **Animal Behaviour:** Behaviour and its types, proximate and ultimate causes; anthropomorphism; development of behavior; learning; factors controlling animal behavior; communication; behavioral ecology; social behavior. **Evolution:** A Historical Perspective: Theories of evolution: Lamarckism and natural selection, neo lamarckism, Darwinism, and neo-Darwinian. **Evolution and Gene Frequencies:** Hardy-Weinberg principle; evolutionary mechanisms: population size, genetic drift, gene flow, de Vries mutation theory and rates of evolution, polymorphism; species and speciation; molecular evolution; mosaic evolution.

### **Recommended Books**

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

### **Practicals**

1. Study of mitosis in onion root tip.
  1. Study of meiosis in grasshopper testis (students should prepare the slide).
  2. Problem based study of Mendelian ratio in animals.
  3. Multiple alleles study in blood groups.

4. Survey study of a genetic factor in population and its frequency.
5. Study of karyotypes of *Drosophila*, mosquito.
6. Study of cytochemical detection of DNA in protozoa and avian blood cell.
7. Study to demonstrate nervous or endocrine basis of behaviour (conditioned reflex or aggression or parental behavior).
8. Study to demonstrate social behaviour (documentary film be shown, honeybee, monkey group in a zoo).

*Note for 1-2: Prepared microscopic and/or projection slides and/or CD ROM computer projections must be used).*

### Recommended Books

1. Miller, S.A. General Zoology Laboratory Manual. 5<sup>th</sup> Edition (International), 2002. Singapore: McGraw Hill.
2. Hickman, C.P. and Kats, H.L. Laboratory Studies in Integrated Principles Of Zoology. 2000. Singapore: McGraw Hill.

**STA-3206**

**Introduction to Statistics**

**2 (2-0)**

### What is Statistics?

Definition of Statistics, Population, Observations, Data, Discrete and continuous variables, Errors of measurement, Significant digits, rounding of a number, Collection of primary and secondary data, Sources, Editing of Data.

#### 1. Presentation of Data

Introduction, basic principles of classification and Tabulation, Graphs and their Construction, Bar charts, Pie chart, Histogram, Frequency polygon and Frequency curve, Cumulative Frequency Polygon or Ogive, Histogram, Ogive for Discrete Variable. Types of frequency curves.

#### 2. Measures of Central Tendency

Introduction, Different types of Averages, Quantiles, The Mode, Empirical Relation between Mean, Median and mode, Relative Merits and Demerits of various Averages. Properties of Good Average, Box and Whisker Plot, Stem and Leaf Display, definition of outliers and their detection. Exercises.

#### 3. Sampling and Sampling Distributions

Introduction, sample design and sampling frame, bias, sampling and non-sampling errors, sampling with and without replacement, probability and non-probability sampling, Sampling distributions for single mean and proportion, Difference of means and proportions.

#### 4. Hypothesis Testing

Introduction, Statistical problem, null and alternative hypothesis, Type-I and Type-II errors, level of significance, Test statistics, general procedure for testing of hypothesis.

### Recommended Books:

1. Walpole, R. E. 1982. "Introduction to Statistics", 3<sup>rd</sup> Ed., Macmillan Publishing Co., Inc. New York.
2. Muhammad, F. 2005. "Statistical Methods and Data Analysis", Kitab Markaz, Bhawana Bazar Faisalabad.

**Semester-II (Cr. 17) For Session Starting from Fall 2019 (Repeaters)**

<b>Course Code</b>	<b>Course Title</b>	<b>Lecture Credit's</b>
BOT-3201	Plant Systematics, Anatomy and Development	4(3-1)
ENG-3201	English-II	3(3-0)
ISL-3202	Islamic Studies/Ethics	2(2-0)
CHM-3201	Organic Chemistry	3(2-1)
ZOO-3206	Principles of Animal Life-II	3(2-1)
STA-3203	Introduction to Biostatistics	2(1-1)
<b>Total Credit Hour's</b>		<b>17</b>

**Note:** The course contents of courses other than Botany will be adopted as prescribed by the relevant departments/University/HEC.

**BOT-3201 Plant Systematics, Anatomy and development 4(3-1)**

**Aims and Objectives**

To understand:

1. Various systems of classification, identification and nomenclature of higher plants.
2. Structures and functions of tissues and organs at embryonic level.

**Course Contents:**

d. **Plant systematics**

6. Introduction to Plant Systematics: aims, objectives and importance.
7. Classification: brief history of various systems of classification with emphasis on Takhtajan.
8. Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to International Code of Botanical Nomenclature (ICBN).Vienna code.
9. Morphology: a detailed account of various, orphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.
10. Diagnostic characters, economic importance and distribution pattern of the following families: Ranunculaceae, Brassicaceae (Cruciferae), Fabaceae (Leguminosae), Rosaceae, Euphorbiaceae, Cucurbitaceae, Solanaceae, Lamiaceae (Labiatae), Apiaceae (Umbelliferae), Asteraceae (Compositae), Liliaceae (Sen. Lato) and Poaceae (Gramineae)

e. **Anatomy**

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

f. **Development / Embryology**

Early development of plant body: Capsella bursa-pastoris, Structure and development of Anther Microsporogenesis Microgametophyte, Structure of Ovule Megasporogenesis Megagametophyte, Endosperm formation, Parthenocarpy, Polyembryony

**Practicals**

**Anatomy**

5. Study of stomata, epidermis,
6. Tissues of primary body of plant
7. Study of xylem 3-dimensional plane of wood.

8. T.S of angiosperm stem and leaf.

### **Taxonomy**

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

### **Recommended Books:**

14. Mauseth, J.D. 1998. An Introduction to Plant Biology: Multimedia Enhanced. Jones and Bartlett Pub. UK
15. Moore, R.C., W.D. Clarke and Vodopich, D.S. 1998. Botany. McGraw Hill Company, U.S.A.
16. Raven, P.H., Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants. W.H. Freeman and Company Worth Publishers.
17. Stuessy, T.F. 1990. Plant Taxonomy. Columbia University Press, USA.
18. Lawrence, G.H.M. 1951 Taxonomy of Vascular Plants. MacMillan & Co. New York.
19. Panday, B.P. 2004. A textbook of Botany (Angiosperms). S. Chand and Co. New Delhi.
20. Raymond E, S. E. Eichhorn. 2005. Esau's Plant Anatomy. Meristems cells and tissues of the plant body, 3<sup>rd</sup> ed. John Wiley & Sons. Inc.
21. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
22. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.
23. Maheshwari, P.1971. Embryology of Angiosperms, McGraw Hill. New York.
24. Eames A.J. and L.H Mac Daniels. 2002. An Introduction to Plant Anatomy. Tata-Mac Graw-Hill Publishing Company, Limited New Delhi.
25. Pullaiah, T. 2007. Taxonomy of Angiosperms. 3<sup>rd</sup> Edition Regency Publications, New Delhi.
26. Naik, V.N. 2005 Taxonomy of Angiosperms. 20<sup>th</sup> Reprint. Tata-Mac Graw-Hill Publishing Company, Limited New Delhi.

**ENG-3201**

**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)

**Note:** Documentaries to be shown for discussion and review

### **Communication Skills**

#### **b) Grammar**

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. 3<sup>rd</sup> Edition. Oxford University Press 1986. ISBN 0 19 431350 6.

#### **d) Writing**

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

#### **e) Reading**

4. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 4534030.
5. Reading and Study Skills by John Langan
6. Study Skills by Richard York.



**ISL-3202**

**Islamic Studies / Ethics**

**2(2-0)**

**Objectives**

This course is aimed at:

5. To provide Basic information about Islamic Studies
6. To enhance understanding of the students regarding Islamic Civilization
7. To improve Students skill to perform prayers and other worships
8. To enhance the skill of the students for understanding of issues related to faith and religious life.

**Course contents**

Basic Concepts of Quran, History of Quran, Uloom-ul –Quran, Verses of Surah Al-Baqra Related to Faith (Verse No-284-286), Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11), Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77), Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154), Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56, 57,58.), Verses of Surah Al-Hashar (18,19,20), Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14), Life of Muhammad Bin Abdullah ( Before Prophet Hood), Life of Holy Prophet (S.A.W) in Makkah, Important Lessons Derived from the life of Holy Prophet in Makkah, Life of Holy Prophet (S.A.W) in Madina, Important Events of Life Holy Prophet in Madina, Important Lessons Derived from the life of Holy Prophet in Madina, Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom-ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah, Basic Concepts of Islamic Law & Jurisprudence, History & Importance of Islamic Law & Jurisprudence, Sources of Islamic Law & Jurisprudence, Nature of Differences in Islamic Law, Islam and Sectarianism, Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues, Basic Concepts of Islam & Science, Contributions of Muslims in the Development of Science, Quranic & Science, Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce, Basic Concepts of Islamic Political System, Islamic Concept of Sovereignty, Basic Institutions of Govt. in Islam, Period of Khlaft-E-Rashida, Period of Umayyads, Period of Abbasids, Basic Concepts of Social System of Islam, Elements of Family, Ethical Values of Islam.

**Reference Books:**

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

**CHM-3201**

**Organic Chemistry**

**3(2-1)**

**Properties of Organic Molecules**

Dipole moment; inductive and field effects; resonance; aromaticity; tautomerism; hyperconjugation; hydrogen bonding; acids and bases; factors affecting the strengths of acids and bases.

**Hydrocarbons**

Discussion on the preparation, properties and reactions of alkanes, alkenes, alkynes and aromatics.

**Oxygenated Hydrocarbons**

Discussion on the preparation, properties and reactions of alcohols (phenols), ethers, aldehydes, ketones, carboxylic acids and derivatives.

**Introductory Organic Spectroscopy**

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

**Practicals:**

Qualitative analysis of compounds with different functional groups, synthesis of organic compounds using as a tool for understanding techniques like reflux, distillation, filtration, recrystallization and yield calculation, organic syntheses may include preparation of benzanilide from benzoyl chloride, succinic anhydride from succinic acid, phthalimide from phthalic anhydride, oximes and hydrazones from carbonyl compounds, and an ester from a carboxylic acid and alcohol etc.

#### **Books Recommended:**

- 6) Furniss, B. S., Hannaford, A. J., Smith, P. W. G., Tatchell, A. R., Vogel's Textbook of Practical Organic Chemistry, 5th ed., Longman, UK, (1989).
- 7) Pavia, D. L., Kriz, G. S., Lampman, G. M. and Engel, R. G., A Microscale Approach to Organic Laboratory Techniques, 5th ed., Brooks/ Cole Cengage Learning, (2013).
- 8) Mayo, D. W., Pike, R. M. and Forbes, D. C., Microscale Organic to Laboratory with Multistep and Multiscale Syntheses, 5th ed., John-Wiley & Sons, Inc., (2011).
- 9) Gilbert, J. C. and Martin, S. F., Experimental Organic Chemistry: A Miniscale and Microscale Approach, 5th ed., Brooks/ Cole Cengage Learning, (2010).
- 10) Brown, W. H., Fotte, C. S., Iverson, B. L. and Anslyn, E. V., Organic Chemistry, 6th ed., Brooks/ Cole Cengage Learning, (2012).

### **ZOO-3206**

### **Principles of Animal Life-II**

**3(2-1)**

#### **Aims and Objectives**

The course will impart knowledge and understanding of:

5. Cell division and its significance in cell cycle.
6. Concepts and mechanisms of inheritance pattern, chromosome and gene linkage and molecular basics of genetics.
7. Animal behaviour and communication.
8. Theories of evolution, gene flow and mechanism of evolution with reference to animals and diversity.

#### **Course Contents**

**Cell Division:** Cell cycles: Mitosis and meiosis; control of the cell cycle. **Inheritance Patterns:** Mendelian genetics; inheritance patterns; gene, structure, chemical composition and types. **Chromosomes and Gene Linkage:** Eukaryotic chromosomes; linkage and crossing over; chromosomal aberrations.

**Molecular Genetics: Cellular Control: DNA:** the genetic material; DNA replication in prokaryotes and eukaryotes; control of gene expression in eukaryotes; gene mutation; recombinant DNA and applications of genetic technologies. **Animal Behaviour:** Behaviour and its types, proximate and ultimate causes; anthropomorphism; development of behavior; learning; factors controlling animal behavior; communication; behavioral ecology; social behavior. **Evolution:** A Historical Perspective: Theories of evolution: Lamarckism and natural selection, neo lamarckism, Darwinism, and neo Darwinian. **Evolution and Gene Frequencies:** Hardy-Weinberg principle; evolutionary mechanisms: population size, genetic drift, gene flow, de Vries mutation theory and rates of evolution, polymorphism; species and speciation; molecular evolution; mosaic evolution.

#### **Recommended Books**

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

#### **Practicals**

5. Study of mitosis in onion root tip.
9. Study of meiosis in grasshopper testis (students should prepare the slide).
10. Problem based study of Mendelian ratio in animals.
11. Multiple alleles study in blood groups.
12. Survey study of a genetic factor in population and its frequency.
13. Study of karyotypes of *Drosophila*, mosquito.
14. Study of cytochemical detection of DNA in protozoa and avian blood cell.

15. Study to demonstrate nervous or endocrine basis of behaviour (conditioned reflex or aggression or parental behavior).
16. Study to demonstrate social behaviour (documentary film be shown, honey bee, monkey group in a zoo).  
*Note for 1-2: Prepared microscopic and/or projection slides and/or CD ROM computer projections must be used).*

**Recommended Books**

3. Miller, S.A. General Zoology Laboratory Manual. 5<sup>th</sup> Edition (International), 2002. Singapore: McGraw Hill.
4. Hickman, C.P. and Kats, H.L. Laboratory Studies In Integrated Principles Of Zoology. 2000. Singapore: McGraw Hill.

**STA-3203**

**Introduction to Statistics**

**2 (1-1)**

**What is Statistics?**

Definition of Statistics, Population, Observations, Data, Discrete and continuous variables, Errors of measurement, Significant digits, Rounding of a Number, Collection of primary and secondary data, Sources, Editing of Data.

**Presentation of Data**

Introduction, basic principles of classification and Tabulation, Graphs and their Construction, Bar charts, Pie chart, Histogram, Frequency polygon and Frequency curve, Cumulative Frequency Polygon or Ogive, Histogram, Ogive for Discrete Variable. Types of frequency curves.

**Measures of Central Tendency**

Introduction, Different types of Averages, Quantiles, The Mode, Empirical Relation between Mean, Median and mode, Relative Merits and Demerits of various Averages. Properties of Good Average, Box and Whisker Plot, Stem and Leaf Display, definition of outliers and their detection. Exercises.

**Sampling and Sampling Distributions**

Introduction, sample design and sampling frame, bias, sampling and non-sampling errors, sampling with and without replacement, probability and non-probability sampling, Sampling distributions for single mean and proportion, Difference of means and proportions.

**Hypothesis Testing**

Introduction, Statistical problem, null and alternative hypothesis, Type-I and Type-II errors, level of significance, Test statistics, general procedure for testing of hypothesis.

**Recommended Books:**

3. Walpole, R. E. 1982. "Introduction to Statistics", 3<sup>rd</sup> Ed., Macmillan Publishing Co., Inc. New York.
4. Muhammad, F. 2005. "Statistical Methods and Data Analysis", Kitab Markaz, Bhawana Bazar Faisalabad.

**Year-II**

**SEMESTER-IV (Cr. 16) For Session Starting from Fall 2022**

Course Code	Course Title	Lecture Credit's
BOT-4401	Plant Physiology and Ecology	3(2-1)
BOT-4402	Environmental Biology	3(2-1)
ARB-4403	Arabic	3(3-0)
ZOO-4404	Animal Diversity-II	3(2-1)
CHM-4405	Inorganic Chemistry	3(2-1)

<b>Total Credit Hour's</b>	<b>15</b>
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**Note:** The course contents of courses other than Botany will be adopted as prescribed by the relevant departments/University/HEC.

**BOT-4401                      Plant Physiology and Ecology**

**3(2-1)**

**Aims and objectives.**

1. To enable the students to understand basic physiology of plants and to assess the effects of various environmental factors on plant growth and development.

**Course Contents**

**a. Plant Physiology**

1. Water relations (water potential, osmotic potential, pressure potential, matric potential). Absorption and translocation of water. Field capacity and soil water holding capacity. 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, Mechanism: light reactions (electron transport and photophosphorylation) and dark reactions (Calvin cycle). Differences between C<sub>3</sub> and C<sub>4</sub> plants. Factors affecting this process, Products of photosynthesis.

- b. Respiration:** Definition and respiratory substrates. Glycolysis, Krebs cycle. Electron transport and oxidative phosphorylation. Anaerobic respiration.

**c. Ecology**

1. Introduction of ecology from a physiological perspective and applications of ecological concepts in understanding the relationship of plants with abiotic factor of the environment.
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. Eco-physiological responses.
4. Wind: Wind as an ecological factor and its importance.

**Practical:**

**a. Plant Physiology.**

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

**b. Ecology**

1. Determination of physical and Chemical characteristics of soil.
2. Field trips to ecologically diverse habitats.
3. Measurements of wind velocity.

**Recommended Books:**

1. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4<sup>th</sup>. Ed. Sinauers Publ. Co. Inc. Calif.
2. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5<sup>th</sup> Edition. Wadsworth Publishing Co. Belmont CA.
3. Hopkins, W.B. 1999. Introduction to Plant Physiology. 2<sup>nd</sup> Ed. John Wiley and Sons. New York
4. Schultz, J.C. 2005. Plant Ecology. Springer-Verlag, Berlin.
5. Ricklefs, R.E. 2000. Ecology. W.H. Freeman and Co., UK.
6. Ricklefs, R.E. 2001. The Economy of Nature. W.H. Freeman and Co., UK.

**BOT-4402 Environmental Biology**

**3(2-1)**

**Aims and Objectives**

To provide updated knowledge of environmental problems and sustainable environmental management.

**Course Outline:**

1. Environment: Introduction, scope, pressure
2. Pollution: definition, classification and impact on habitats
3. Air pollution: Sources and effect of various pollutants (inorganic, organic) on plants, prevention, control, remediation. Photochemical smog. Smog. Acid rain: 1. Theory of acid rain, Adverse effects of acid rains. Chlorofluorocarbons and its effects.
4. Water pollution: Major sources of water pollution and its impact on vegetation, prevention, control remediation, eutrophication, thermal pollution.
5. Sediments pollution: fungicide, pesticides, herbicide, major sources of soil pollution and its impact. Prevention, control remediation. Heavy metal pollution. Tanneries. Hospital waste. Treatments of sewage, sludge, and polluted waters.
6. Noise pollution.
7. Radiation pollution (including nuclear): Measurement, classification and effects, Principle of radiation protection, waste disposal
8. Pollution by Pesticides
9. Environmental Buffers. Forest importance, deforestation, desertification and conservation
10. Ozone layer: Formation, Mechanism of depletion, Effects of ozone depletion, Greenhouse effect and global warming: causes, impacts.
11. National conservation strategy: Brief review of major problems of Pakistan and their solutions.
12. Range management: Types of rangelands, potential threats, sustainable management.
13. Aerobiology (Pollen allergy & dust allergy).
14. Natural disaster management
15. Environmental impact Assessment: (Sustainability of the Environment)

**Lab Outline:**

1. Examination of industrial wastewater 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. Examination of the Effects of Automobile Exhaust on the Adjacent Vegetation.
  - i) Lead Count
  - ii) Chlorophyll Content
  - iii) Symptoms
  - iv) Soot and Particulate Matter.
5. Visits to environmentally compromised sites and evolution of remediation methods.

**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.

ARB-4403

Arabic

3(3-0)

### اللغة العربية . I

#### الف) القواعد

تدرس في هذه المرحلة القواعد الأساسية للغة العربية ، التي تكون وسيلة لتقويم اللسان و صحة الكلام في القراءة والكتابة والتحدث . كما يلرب الطلاب على الترجمة من العربية إلى الأردية وبالعكس .

#### ١- الأهداف :

- الف. تنمية قدرات الطلاب على ضبط إعراب الكلمات
- ب. توسيع مادة الطلاب اللغوية و تدريبهم على كيفية الاشتقاق
- ج. تعريفهم ما لؤدبه العوامل النحوية والمعوية في أواخر الكلمة
- د. تدريبهم على الترجمة من العربية إلى الأردية وبالعكس
- ٢- يراعى في تدريس هذه المادة:
- الف. أن العناية بالتطبيق هي أعظم وسيلة لترسيخ القاعدة في أذهان الطلاب
- ب. أن يتخذ المعلم من دروس القراءة والإنشاء مجالات يستغلها لتطبيقه و تمرين الطلاب على القواعد التي درسوها .
- ٣- الموضوعات :

أنواع الكلمة : اسم و فعل و حرف الملكر والمؤنث . أنواع الفعل . الإعراب . الجملة الاسمية والفعلية . المبتدأ والخبر . الفعل والمفاعل . المفعول به . إعراب الفعل المضارع . أهم حروف الجر . المركب : الإضافي والتوصيفي . كان وأخوهما . إن وأخوهما . أدوات الاستفهام . المفرد والمثنى والجمع .

## (ب) القراءة والتعبير

قراءة طريق للمعبر على جودة النطق وحسن الأداء والعبرين على تطبيق القواعد ومخارج الحروف ومقاطع الجمل وسرعة إدراك المعاني ودقة الفهم بواسطتها .

يراعى في القراءة :

- ✧ أن يالش المعلم للاميد على الانتباه وحسن الإصغاء والإحاطة بالمعاني وإدراك المناقشات التي تلوز في القراءة .
- ✧ أن ينظم المعلم القراءة بحيث يقرأ كل طالب بعد الآخر قراءة متصلة ، و يرشد التلاميذ إلى صحة القراءة أو إصلاح النطق والأخطاء النحوية .
- ✧ أن يقدم المفردات الجديدة مع مراعات اختيار الكلمات من ذوات المعنى الحسي الذي يمكن إيضاحه بالصورة .

والتعبير هو الإفصاح عما في النفس من أفكار ومشاعر بالكلمة والمحدثه . ينقسم التعبير إلى تحريري و شفوي .

يراعى في التعبير :

- ✧ أن يصوب التلاميذ الجمل الخاطئة
- ✧ أن يملأوا الفراغ بكلمات مناسبة
- ✧ أن يربوا الكلمات غير مرتبة حتى تكون جملة مفيدة
- ✧ أن يتمرروا على الأساليب العالوفة
- ✧ أن يجيبوا على الأسئلة بالعربية .

الكتب المقررة :

- ١- عبدالستار عربي كما معلم الجزء الأول
- ٢- علي الجارم ومصطفى أمين النحو الواضح في قواعد اللغة العربية ، الجزء الأول
- ٣- د. ف. عبدالرحيم دروس اللغة العربية ، الجزء الأول
- ٤- بهو الحسن علي الندوي قصص البين ، الجزء الأول
- ٥- تدريبات على كتاب قصص البين

**Objectives**

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

**Hemichordates and Invertebrate Chordates:** Evolutionary Perspective: Phylogenetic Relationships; Classification up to subphylum or class where applicable; Further Phylogenetic Considerations. **Fishes:** Vertebrate Success in Water: Evolutionary perspective: phylogenetic relationships; survey of super class agnatha and gnathostomata; evolutionary pressures: adaptations in locomotion, nutrition and the digestive system, circulation, gas exchange, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations. **Amphibians:** The First Terrestrial Vertebrates Evolutionary perspective: phylogenetic relationships; survey of order caudata, gymnophiona, and anura. Evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction, development, and metamorphosis; further phylogenetic considerations. **Reptiles:** The First Amniotes Evolutionary perspective: cladistic interpretation of the amniotic lineage; survey of order testudines or chelonina, rhychocephalia, squamata, and crocodilia; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations. **Birds:** Feathers, Flight, and Endothermy Evolutionary perspective: phylogenetic relationships; ancient birds and the evolution of flight; diversity of modern birds; evolutionary pressures: adaptation in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and regulation, nervous and sensory systems, excretion and osmoregulation, reproduction and development; migration and navigation. **Mammals:** Specialized Teeth, Endothermy, Hair, and Viviparity: Evolutionary perspective: diversity of mammals; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, behavior, reproduction and development.

**Recommended Books**

1. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles Of Zoology, 15<sup>th</sup> Edition (International), 2011. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 8<sup>th</sup> Edition (International) 2010. Singapore: McGraw Hill.
3. Kent, G.C. and Miller, S. Comparative Anatomy of Vertebrates. Latest Edition 200?. New York: McGraw Hill.
4. Campbell, N.A. BIOLOGY, 9<sup>th</sup> Edition. 2011. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

**Practicals:**

1. Museum study of representative phyla.
2. Study of a representative of Hemichordate and Chordate.
3. Study of representative groups of class Fishes.
4. Study of representative groups of class Amphibia.
5. Study of representative groups of class Reptilia.
6. Study of representative groups of class Aves.
7. Study of representative groups of class Mammalia.
8. 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.*

### **Recommended Books**

1. Hickman, C.P. and Kats, H.L. Laboratory Studies in Integrated Principles of Zoology. 2000. Singapore: McGraw Hill.
2. Miller, S.A. General Zoology Laboratory Manual. 5<sup>th</sup> Edition (International), 2002. Singapore: McGraw Hill.

**CHM-4405**

**Inorganic Chemistry**

**3(2-1)**

### **1. Introduction to Chemical Bonding**

Attainment of a stable configuration, types of bonds (ionic bonds, covalent bonds, coordinate bonds), oxidation number and formal oxidation number. The localized bonding approach (Introduction to valence bond theory and hybridization. The delocalized bonding approach (MOT applied to homonuclear diatomic molecules).

### **2. Acids and Bases**

Concepts of acids and bases (Arrhenius, Lowry-Bronsted, Lewis and SHAB concept), relative strength of acids and bases. pH, pKa, pKb and buffer solutions and their significance. Theory of Indicators, solubility, solubility product, common ion effect and their applications.

### **3. Chemistry of p-block Elements**

General characteristics of the following group of p-block elements with reference to the aspects given against each:

#### **Boron and Aluminum**

Gradation of the characteristic properties within the group. Structures, properties and applications of electron deficient molecules such as boron hydrides and aluminium hydrides.

#### **Carbon and Silicon**

Gradation of the characteristic properties within the group). Production of pure silicon for solar energy and silicon chips. Structural aspects of ortho and metasilicates and their industrial applications.

#### **Nitrogen and Phosphorus**

Gradation of the characteristic properties within the group. Oxides of nitrogen (NO and NO<sub>2</sub>) and their role in air pollution, oxyacids (HNO<sub>2</sub> and HNO<sub>3</sub>) of nitrogen. Industrial preparation of urea and superphosphate fertilizers.

Oxygen and Sulfur 26 Gradation of the characteristic properties within the group. Role of sulphur dioxide in air pollution. Thionic acids (H<sub>2</sub>SO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub>) and uses of hypo in photography.

#### **The Halogens**

Gradation of the characteristic properties within the group, anomalous behavior of fluorine. Preparation of oxyacids of halogens (HClO<sub>3</sub> and HClO<sub>4</sub>) and their uses. Interhalogens, pseudohalogens.

## The Noble Gases

Preparation, properties and uses of xenon fluorides; Commercial uses of noble gases.

## 4. Chemistry of d-block Elements

Electronic configuration and general characteristics of d-block elements. Industrial applications of transition metals. Werner's concept and nomenclature of coordination compounds.

## 5. Introduction to Modern Materials

Liquid crystals, engineering ceramics, fiber glass and thin films.

## Practicals

### 1. Laboratory Ethics and safety measures

Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations

### 2. Qualitative analysis

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

### 3. Quantitative analysis

a. Acid-Base Titrations (minimum 02)

b. Redox Titrations (minimum 02)

c. Complexometric Titrations (minimum 02)

### 4. Inorganic Preparations

a. Preparation of Ferrous sulphate

b. Preparation of Ferric alum

c. Preparation of Barium sulphate

## Recommended Books

1. 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

2. Cotton, F. A., Wilkinson, G. and Gaus, P. L., "Basic Inorganic Chemistry", 3rd Ed., Wiley, New York, 1995.

3. Clyde Day, M. & Selbin, J., "Theoretical Inorganic Chemistry", 2nd Ed., Van Nostrand Reinhold, 1969.

4. Lee, J.D., "Concise Inorganic Chemistry", Chapman and Hall, 5th Edition, 1996.

5. Shriver, D. F., Atkins, P. W. and Langford, C. H., "Inorganic Chemistry", Oxford University Press, 2nd Edition, 1994.
  6. Cartmell E. and Fowles G. W. A. "Valency and Molecular Structure" Adlard and Sons Limited 3rd Edition (1966)
  7. Douglas B., McDaniel D. and Alexander J. "Concepts and Models of Inorganic Chemistry" John Wiley & Sons, Inc. 3rd Edition (1994)
  8. Harvey K. B. and Porter G. B. "Introduction to Inorganic Physical Chemistry" Addison-Wesley Publishing Company, Inc. (1963)
  9. Hill J. W. and Petrucci R. H. "General Chemistry" Prentice-Hall, Inc. (1996)
  10. Marr G. and Rockett B. W. "Practical Inorganic Chemistry" Van Nostrand Reinhold Company. (1972)
  11. Miessler G. L. and Tarr Donald A. "Inorganic Chemistry" Prentice-Hall International, Inc. Prentice-Hall International Edition (1991)
  12. Moody B. "Comparative Inorganic Chemistry" Routledge, Chapman and Hall, Inc. 3rd Edition (1991)
  13. Kennedy, Friedlander, "Nuclear and Radiochemistry" (latest edition).
- 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.
- Vogel, A. I., "A Textbook of Micro and Semi-micro–Qualitative Inorganic Analysis" Longman Green & Co. 1995.

Course Code	Course Title	Lecture Credit's
BOT-4401	Plant Physiology and Ecology	4(3-1)
BOT-4402	Environmental Biology	3(2-1)
ARB-4401	Arabic	3(3-0)
ZOO-4404	Animal Diversity-II	3(2-1)
CHM-4401	Inorganic Chemistry	3(2-1)
<b>Total Credit Hour's</b>		<b>16</b>

**Note:** The course contents of courses other than Botany will be adopted as prescribed by the relevant departments/University/HEC.

**BOT-4401 Plant Physiology and Ecology 4(3-1)**

**Aims and objectives**

2. To provide comprehensive knowledge of functioning of organs, organelles and biomolecules,
3. To enable the students to assess the effects of various environmental factors on plant growth and development.

**Course Contents**

**d. Plant Physiology**

4. Water relations (water potential, osmotic potential, pressure potential, matric potential). Absorption and translocation of water. Stomatal regulation.
5. Mineral nutrition: Soil as a source of minerals. Passive and active transport of nutrients. Essential mineral elements, role and deficiency symptoms of macronutrients.
6. Photosynthesis: Introduction, Oxygenic and non-oxygenic photosynthesis Mechanism: light reactions (electron transport and photophosphorylation) and dark reactions(Calvin cycle). Differences between C<sub>3</sub> and C<sub>4</sub> plants. Factors affecting this process, Products of photosynthesis.
7. 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.

**e. Ecology**

5. Introduction, aims and applications of ecology.
6. Soil: Physical and Chemical properties of soil (soil formation, texture. pH, EC, organism and organic matter etc) and their relationships to plants.
7. Light and Temperature. Quality of light, diurnal and seasonal variations. Ecophysiological responses.
8. Water: Field capacity and soil water holding capacity. Characteristics of xerophytes and hydrophytes. Effect of precipitation on distribution of plants.
9. Wind: Wind as an ecological factor and its importance.

**Practical:**

**c. Plant Physiology.**

8. Determination of uptake of water by swelling seeds when placed in sodium chloride solution of different concentrations.
9. Determination of the temperature at which beet root cells lose their permeability.
10. 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.
11. Extraction of chlorophyll from the leaves and separation of component pigments on a paper chromatogram. Study of absorption spectra using spectrophotometer.
12. Estimation of oxygen utilized by a respiring plant by Winkler's method.
13. Measurement of carbon dioxide evolution during respiration of germinating seeds by the titration method.
14. Effect of light and temperature on seed germination.

**d. Ecology**

4. Determination of physical and Chemical characteristics of soil.
5. Field trips to ecologically diverse habitats.
6. Measurements of wind velocity.

**Recommended Books:**

7. Ihsan Illahi 1995. Plant Physiology, Biochemical Processes in Plants, UGC Press.
8. Witham and Devlin. 1986 Exercises in Plant Physiology, AWS Publishers, Boston.
9. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4<sup>th</sup>. Ed. Sinuers Publ. Co. Inc. Calif.
10. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5<sup>th</sup> Edition. Wadsworth Publishing Co. Belmont CA.
11. Hopkins, W.B. 1999. Introduction to Plant Physiology. 2<sup>nd</sup> Ed. John Wiley and Sons. New York
12. Schultz, J.C. 2005. Plant Ecology. Springer-Verlag, Berlin.
13. Ricklefs, R.E. 2000. Ecology. W.H. Freeman and Co., UK.
14. Ricklefs, R.E. 2001. The Economy of Nature. W.H. Freeman and Co., UK.

**BOT-4402 Environmental Biology**

**3(2-1)**

**Aims and Objectives**

To provide updated knowledge of environmental problems and sustainable environmental management.

**Course Contents**

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, 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 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. Heavy metal pollution. Tanneries. 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. Environmental Buffers. 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. 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.
3. Examination of water samples forms different sites for the presence and diversity of organisms.
4. Effect of air pollutants on plants.
5. Visits to environmentally compromised sites and evolution of remediation methods.

**Books Recommended:**

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.

## اللغة العربية . I

## الف &gt; القواعد

تدرس في هذه المرحلة القواعد الأساسية للغة العربية ، التي تكون وسيلة لتقويم اللسان و صحة الكلام في القراءة والكتابة والتحدث . كما يلرب الطلاب على الترجمة من العربية إلى الأردية وبالعكس .

## ١ - الأهداف :

- الف. تنمية قدرات الطلاب على ضبط إعراب الكلمات
- ب. توسيع مادة الطلاب اللغوية و تدربهم على كيفية الاشتقاق
- ج. تعريفهم ما تؤديه العوامل اللفظية والمعوية في أواخر الكلمة
- د. تدربهم على الترجمة من العربية إلى الأردية وبالعكس

## ٢ - يراعى في تدريس هذه المادة :

- الف. أن العناية بالتطبيق هي أعظم وسيلة لترسيخ القاعدة في أذهان الطلاب
- ب. أن يتخذ المعلم من دروس القراءة والإنشاء مجالات يستغلها لتطبيق ، و تمرين الطلاب على القواعد التي درسوها .

## ٣ - الموضوعات :

أنواع الكلمة : اسم و فعل و حرف . المذكر والمؤنث . أنواع الفعل . الإعراب . الجملة الاسمية والفعلية . المبتدأ والخبر . الفعل والفاعل . المفعول به . إعراب الفعل المضارع . أهم حروف الجر . المركب : الإضافي والتوصيفي . كان وأخواتها . إن وأخواتها . أدوات الاستفهام . المفرد والمثنى والجمع .

## (ب) القراءة والتعبير

قراءة طريقين للمعبرون على جودة النطق وحسن الأداء والعبرين على تطبيق القواعد ومخارج الحروف ومقاطع الجمل وسرعة إدراك المعاني ودقة الفهم بواسطتها .

يراعى في القراءة :

✧ أن يالش المعلم للاميد على الانتباه وحسن الإصغاء والإحاطة بالمعاني وإدراك المناقشات التي تلوز في القراءة .

✧ أن ينظم المعلم القراءة بحيث يقرأ كل طالب بعد الآخر قراءة متصلة ، و يرشد التلاميذ إلى صحة القراءة أو إصلاح النطق والأخطاء النحوية .

✧ أن يقدم المفردات الجديدة مع مراعات اختيار الكلمات من ذوات المعنى الحسي الذي يمكن إيضاحه بالصورة .

والتعبير هو الإفصاح عما في النفس من أفكار ومشاعر بالكلمة والمحدثة . ينقسم التعبير إلى تحريري و شفوي .

يراعى في التعبير :

- ✧ أن يصوب التلاميذ الجمل الخاطئة ✧ أن يملأوا الفراغ بكلمات مناسبة
- ✧ أن يربوا الكلمات غير مرتبة حتى تكون جملة مفيدة ✧ أن يتمرروا على الأساليب المألوفة
- ✧ أن يجيبوا على الأسئلة بالعربية .

الكتب المقررة :

- ١- عبدالستار عربي كما معلم الجزء الأول
- ٢- علي الجارم ومصطفى أمين النحو الواضح في قواعد اللغة العربية ، الجزء الأول
- ٣- د. ف. عبدالرحيم دروس اللغة العربية ، الجزء الأول
- ٤- بهو الحسن علي الندوي قصص البين ، الجزء الأول
- ٥- تدريبات على كتاب قصص البين



**Objectives**

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

**Hemichordates and Invertebrate Chordates:** Evolutionary Perspective: Phylogenetic Relationships; Classification up to subphylum or class where applicable; Further Phylogenetic Considerations. **Fishes:** Vertebrate Success in Water: Evolutionary perspective: phylogenetic relationships; survey of super class agnatha and gnathostomata; evolutionary pressures: adaptations in locomotion, nutrition and the digestive system, circulation, gas exchange, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations. **Amphibians:** The First Terrestrial Vertebrates Evolutionary perspective: phylogenetic relationships; survey of order caudata, gymnophiona, and anura. Evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction, development, and metamorphosis; further phylogenetic considerations. **Reptiles:** The First Amniotes Evolutionary perspective: cladistic interpretation of the amniotic lineage; survey of order testudines or chelonia, rhychocephalia, squamata, and crocodilia; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations. **Birds:** Feathers, Flight, and Endothermy Evolutionary perspective: phylogenetic relationships; ancient birds and the evolution of flight; diversity of modern birds; evolutionary pressures: adaptation in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and regulation, nervous and sensory systems, excretion and osmoregulation, reproduction and development; migration and navigation. **Mammals:** Specialized Teeth, Endothermy, Hair, and Viviparity: Evolutionary perspective: diversity of mammals; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, behavior, reproduction and development.

**Recommended Books**

- Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles Of Zoology, 15<sup>th</sup> Edition (International), 2011. Singapore: McGraw Hill.
- Miller, S.A. and Harley, J.B. Zoology, 8<sup>th</sup> Edition (International) 2010. Singapore: McGraw Hill.
- Kent, G.C. and Miller, S. Comparative Anatomy Of Vertebrates. Latest Edition 200?. New York: McGraw Hill.
- Campbell, N.A. BIOLOGY, 9<sup>th</sup> Edition. 2011. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

**Practicals:**

- Museum study of representative phyla.
- Study of a representative of Hemichordate and Chordate.
- Study of representative groups of class Fishes.
- Study of representative groups of class Amphibia.
- Study of representative groups of class Reptilia.
- Study of representative groups of class Aves.
- Study of representative groups of class Mammalia.
- 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.*

**Recommended Books**

- Hickman, C.P. and Kats, H.L. Laboratory Studies In Integrated Principles of Zoology. 2000. Singapore: McGraw Hill.
- Miller, S.A. General Zoology Laboratory Manual. 5<sup>th</sup> Edition (International), 2002. Singapore: McGraw Hill.

Attainment of a stable configuration, types of bonds (ionic bonds, covalent bonds, coordinate bonds), oxidation number and formal oxidation number. The localized bonding approach (Introduction to valence bond theory and hybridization. The delocalized bonding approach (MOT applied to homonuclear diatomic molecules).

## 2. Acids and Bases

Concepts of acids and bases (Arrhenius, Lowry-Bronsted, Lewis and SHAB concept), relative strength of acids and bases. pH, pKa, pKb and buffer solutions and their significance. Theory of Indicators, solubility, solubility product, common ion effect and their applications.

## 3. Chemistry of p-block Elements

General characteristics of the following group of p-block elements with reference to the aspects given against each:

Boron and Aluminum

Gradation of the characteristic properties within the group. Structures, properties and applications of electron deficient molecules such as boron hydrides and aluminium hydrides.

Carbon and Silicon

Gradation of the characteristic properties within the group). Production of pure silicon for solar energy and silicon chips. Structural aspects of ortho and metasilicates and their industrial applications.

Nitrogen and Phosphorus

Gradation of the characteristic properties within the group. Oxides of nitrogen (NO and NO<sub>2</sub>) and their role in air pollution, oxyacids (HNO<sub>2</sub> and HNO<sub>3</sub>) of nitrogen. Industrial preparation of urea and superphosphate fertilizers.

Oxygen and Sulfur 26 Gradation of the characteristic properties within the group. Role of sulphur dioxide in air pollution. Thionic acids (H<sub>2</sub>SO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub>) and uses of hypo in photography.

The Halogens

Gradation of the characteristic properties within the group, anomalous behaviour of fluorine. Preparation of oxyacids of halogens (HClO<sub>3</sub> and HClO<sub>4</sub>) and their uses. Interhalogens, pseudohalogens.

The Noble Gases

Preparation, properties and uses of xenon fluorides; Commercial uses of noble gases.

## 4. Chemistry of d-block Elements

Electronic configuration and general characteristics of d-block elements. Industrial applications of transition metals. Werner's concept and nomenclature of coordination compounds.

## 5. Introduction to Modern Materials

Liquid crystals, engineering ceramics, fiber glass and thin films.

## Practicals

1. Laboratory Ethics and safety measures

Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations

2. Qualitative analysis

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

3. Quantitative analysis

a. Acid-Base Titrations (minimum 02)

b. Redox Titrations (minimum 02)

c. Complexometric Titrations (minimum 02)

4. Inorganic Preparations

a. Preparation of Ferrous sulphate

b. Preparation of Ferric alum

c. Preparation of Barium silphate

## Recommended Books

1. 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

2. Cotton, F. A., Wilkinson, G. and Gaus, P. L., "Basic Inorganic Chemistry", 3rd Ed., Wiley, New York, 1995.
  3. Clyde Day, M. & Selbin, J., "Theoretical Inorganic Chemistry", 2nd Ed., Van Nostrand Reinhold, 1969.
  4. Lee, J.D., "Concise Inorganic Chemistry", Chapman and Hall, 5th Edition, 1996.
  5. Shriver, D. F., Atkins, P. W. and Langford, C. H., "Inorganic Chemistry", Oxford University Press, 2nd Edition, 1994.
  6. Cartmell E. and Fowles G. W. A. "Valency and Molecular Structure" Adlard and Sons Limited 3rd Edition (1966)
  7. Douglas B., McDaniel D. and Alexander J. "Concepts and Models of Inorganic Chemistry" John Wiley & Sons, Inc. 3rd Edition (1994)
  8. Harvey K. B. and Porter G. B. "Introduction to Inorganic Physical Chemistry" Addison-Wesley Publishing Company, Inc. (1963)
  9. Hill J. W. and Petrucci R. H. "General Chemistry" Prentice-Hall, Inc. (1996)
  10. Marr G. and Rockett B. W. "Practical Inorganic Chemistry" Van Nostrand Reinhold Company. (1972)
  11. Miessler G. L. and Tarr Donald A. "Inorganic Chemistry" Prentice-Hall International, Inc. Prentice-Hall International Edition (1991)
  12. Moody B. "Comparative Inorganic Chemistry" Routledge, Chapman and Hall, Inc. 3rd Edition (1991)
  13. Kennedy, Friedlander, "Nuclear and Radiochemistry" (latest edition).
- 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.
- Vogel, A. I., "A Textbook of Micro and Semi-micro Qualitative Inorganic Analysis" Longman Green & Co. 1995.

**Year-III**  
**SEMESTER-VI (Cr. 16)**

<b>Course Code</b>	<b>Course Title</b>	<b>Lecture Credit's</b>
BOT-5601	Plant Ecology-1	3(2-1)
BOT-5602	Plant Systematics	3(2-1)
BOT-5603	Plant Biochemistry-I	3(2-1)
BOT-5604	Plant Physiology- I	3(2-1)
BOT-5605	Biostatistics	3(2-1)
BOT-5606	Field Botany-II	1(0-1)
<b>Total Credit Hour's</b>		<b>16</b>

**BOT-5601**

**Plant Ecology I**

**3(2-1)**

**Aims and objectives:**

To understand the role and interaction of plants with their environment.

**Course Contents:**

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 CO<sub>2</sub>-assimilation rates of plants in contrasting environments. Ecophysiological effects of changing atmospheric CO<sub>2</sub> concentration. Functional significance of different pathways of CO<sub>2</sub> 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.

**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 CO<sub>2</sub> and O<sub>2</sub> 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 CO<sub>2</sub> exchange in plants in relation to various environmental conditions.

**Recommended Books:**

1. Schultz, J. C. 2005. Plant Ecology, Springer-Verlag
2. Bazzaz, F.A. 2004. Plants in Changing Environments: Linking Physiological, Population, and Community Ecology, Cambridge University Press
3. Chapin, F.S. et al. 2002. Principle of Terrestrial Plant Ecology, Springer-Verlag
4. Lambers, H. et al. 2002. Plant Physiological Ecology, Springer-Verlag
5. Larcher, W. 2003., Physiological Plant Ecology: Ecophysiology and Stress Physiology of Function Groups - Springer-Verlag
6. Nobel, P.S 1999, Physico-chemical and Environmental Plant Physiology,.Academic Press.
7. Lambers, H., T. L. Pons and F. Stuart. 2008. Plant Physiological Ecology.
8. Smith, R. L. 2004. Ecology and field Biology. Addison Wesley Longman, Inc., New York.

9. Barbour, M.G., Burke, J.H and Pitts, W.D. 2004 Terrestrial Plant Ecology, The Benjamin, Cumming Publishing C. Palo Alto, California, USA.
10. Smith R.L. 1998 Elements of Ecology. Harper & Row Publishing.
11. Townsend. C.R. Begon. M and J.L Harper. 2002 Essentials of ecology. Blackwell Publishing.
12. Gurevitch. J. Scheiner, S.M. and G.A Fox. 2006 The Ecology of Plants\.. Sinaur Assoicate Inc.
13. Hussain. F. 1989 Field and Laboratory Manual of Plant Ecology, National Academy of Higher Education, Islamabad.
14. Hussain. S.S. 1989 Pakistan Manual of Plant Ecology. National Book Foundation Islamabad.

**BOT-5602**

**Plant Systematics**

**3(2-1)**

**Aims and objectives**

To know floral composition/ system of classification focusing on identification, classification, description nomenclature and flora writings, monographs.

**Course Contents**

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, Clonal 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:  
 Apiaceae (Umbelliferae), Juncaceae, Arecaceae (Palmae), Lamiaceae (Labiatae), Asclepiadaceae, Liliacea, Asteraceae (Compositae), Magnoliaceae, Boraginaceae, Malvaceae, Brassicaceae (Cruciferae), Myrtaceae, Cannaceae, Orchidaceae  
 Capparidaceae, Papaveraceae, Caryophyllaceae, Poaceae (Gramineae), Casuarinaceae, Ranunculaceae, Chenopodiaceae, Rosaceae, Convolvulaceae, Salicaceae, Cucurbitaceae, Scrophulariaceae, Cyperaceae, Solanaceae, Euphorbiaceae, Trochodendraceae, Fabaceae (Leguminosae), 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.

### Recommended Books:

1. Ali, S.I. and Nasir, Y. 1990-92. Flora of Pakistan. Karachi Univ. Press, Karachi
2. Ali, S.I. and Qaiser, M. 1992-2007 -todate. Flora of Pakistan. Karachi Univ. Press, Karachi.
3. Greuter,W., McNeill, J., Barrie, F.R., Burdet, H. M., Demoulin, V., Filguerras, 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.)
4. Davis, P.H. & Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd, London
5. Ingrouille, M. 1992. Diversity and Evolution of Land Plants, Chapman & Hall. London
6. Nasir, E. & Ali, S.I. 1970-89. Flora of Pakistan. Karachi Univ. Press, Karachi.
7. Stace, C. (1992). Plant Taxonomy and Biosystematics, Edward Arnold..
8. Takhtajan, A. (1986). Flowering Plant: Origin and Dispersal, Oliver and Boyd, Edinburgh
9. Jones, S. B. and Luchsinger, A.E. 1987. Plant Systematics. McGraw Hill, Inc. New York.
10. Naik, V.N. 2005. Taxonomy of Angiosperms. Tata McGraw Hill Publishing Company, New Delhi.

**BOT-5603**

**Plant Biochemistry-I**

**3(2-1)**

### Aims and objectives:

To elucidate the structure and role of primary metabolites in plants

### Course Contents:

#### 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 R<sub>f</sub> 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 R<sub>f</sub> 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 PK<sub>a</sub> and isoelectric point of an amino acid.

### Recommended Books:

1. Conn E E. and Stumpf P.K., 2002. Outlines of Biochemistry, John Wiley and Sons Inc. New York.
2. Lehninger, A L. 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. Handler and Abraham. 2003, 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. Mckee, T. and Mckee, J.R. 1999. Biochemistry – An Introduction. WCB/McGraw-Hill, New York, Boston, USA.
9. Lea, P.J. and Leegood, R.C. 1993. Plant Biochemistry and Molecular Biology. Wiley and Sons, New York.
10. Abdes, R.H. Frey, P.A. and Jencks W.P. 2004, Biochemistry, Jones and Bartlet, London.
11. Goodwin T.W. and Mercer, E.I. 1997. Introduction to Plant Biochemistry. Pergamon Press, Oxford.
12. Heldt, H-W. 2008. Plant Biochemistry. 3<sup>rd</sup> Edition, Academic Press, U.K.
13. Bowsher, C. 2008. Plant Biochemistry. Campbell, M.K. and F. Shawn. 2008. Biochemistry 6<sup>th</sup> Edition.

**BOT-5604**

**Plant Physiology-I**

**3(2-1)**

### Aims and objectives

To provide comprehensive knowledge on some vital functions and mechanisms of plants.

### Course Contents

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. CO<sub>2</sub> reduction (dark reactions) - C<sub>3</sub> pathway and Photorespiration, Regulation of C<sub>3</sub> pathway, C<sub>4</sub> pathway and its different forms, C<sub>3</sub>-C<sub>4</sub> 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 regulation. Factors affecting stomatal regulation.
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.

### Practical:

1. To determine the volume of CO<sub>2</sub> evolved during respiration by plant material.
2. To determine the amount of O<sub>2</sub> 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 C<sub>3</sub> and C<sub>4</sub> plants through their anatomical and physiological characters.
6. To regulate stomatal opening by light of different colours and pH.

#### **Recommended Books:**

1. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2<sup>nd</sup> Edition. Longman Group, U.K.
2. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
3. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
4. Heldt, H-W. 2004. Plant Biochemistry. 3<sup>rd</sup> Edition, Academic Press, U.K.
5. Ihsan Illahi, 1991. Plant Growth, UGC Press, Islamabad.
6. Ihsan Illahi, 1995. Plant Physiology, Biochemical Processes in Plants, UGC Press.
7. Nobel, P.S. 1999. Physicochemical and Environmental Plant Physiology. Academic Press, UK.
8. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
9. Salisbury F.B. and Ross C.B. 1992. Plant Physiology. 5<sup>th</sup> Edition. Wadsworth Publishing Co. Belmont CA.
10. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4<sup>th</sup> Edition. Sinauer's Publ. Co. Inc. Calif.
11. W.B. Hopkins. 1999. Introduction to Plant Physiology. 2<sup>nd</sup> Ed. John Wiley and Sons. New York.
12. Epstein, E. and Bloom, A.J. 2004. Mineral Nutrition of Plants: Principles and Perspectives. 2<sup>nd</sup> Edition. Sinauer Associates, California, USA.
13. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
14. Barton, w. 2007. Recent Advances in Plant Physiology

#### **BOT-5605**

#### **Biostatistics**

**3(2-1)**

#### **Aims and Objectives**

The objective of this course is to equip the students with statistical concepts and methods: The emphasis will be on learning how to collect, summarize, analyze, and interpret real-world data in a practical manner.

#### **Course Contents**

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 and standard deviation, standard error of the mean, mean deviation, semi-interquartile range.
4. **Tests of significance:** Introduction:
  - 1- t-test: Basic idea, confidence limits of means, significant difference of means.
  - 2- X<sup>2</sup> – test: Basic idea, testing goodness of fit to a ratio, testing association (contingency table).
  - 3- F-test: Introduction and application in analysis of variance.
  - 4- L.S. D. test, Dancunn Multiple Range Test (for comparison of individual means).
5. **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.
6. **Correlation and regression:** Brief account of correlation and regression.

#### **Lab Outlines:**

1. Probability of simple events.
2. Data collection, arrangement of data in frequency table.
3. Calculation of mean from group and ungrouped data.



4. Calculation of variance and standard deviation from grouped and ungrouped data.
5. T-test.
6. X<sup>2</sup> – test.
7. Analysis of variance – one factor design
8. Analysis of variance – two-way analysis
9. Analysis of variance – for latin square
10. Analysis of variance – for factorial design.
11. Correlation.
12. Linear Regression.

**Books Recommended**

1- Bailey. N.T.J. 1994. Statistical Methods in Biology, Cambridge University Press. 2- Quinn, G. 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press. 3- Wonnacott, T.H. and Wonnacott, R.J. 1990. Introductory Statistics, John Willey and Sons.

**BOT-5606**

**Field Botany-II**

**1(1-0)**

**Aims and objective.**

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 2nd 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.

**Year-IV  
SEMESTER-VIII (Cr. 15)**

Course Code	Course Title	Lecture Credit's
BOT-6801	Principals of Biotechnology	3(2-1)
BOT-6802	Plant Anatomy	3(2-1)
BOT-6803	Biodiversity and Conservation	3(2-1)
BOT-6804	Genetics-II	3(2-1)
BOT-6706	Thesis/Optional Paper	3(3-0)
BOT-6805 (Elective)	Bioremediation & Environmental Biotechnology	3(2-1)
<b>Total Credit Hour's</b>		<b>15</b>

**BOT-6801**

**Principles of Biotechnology**

**3(2-1)**

**Aims and Objectives**

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

**Course Contents**

**1. Introduction**

**2. Plant tissue culture**

Micro propagation: Explant Sources, Comparison with field multiplication, Virus Elimination, Advantages. Callus culture, Cell culture, Protoplast culture and Somatic hybridization, Regeneration: Organogenesis, Somatic Embryogenesis, Haploid culture.

**3. Recombinant DNA Technology**

Cloning and expression techniques, Cutting and joining DNA molecules, Polymerase Chain Reaction, Molecular Characterization, RFLP, RAPD and AFLP, Microarray, electrophoresis Gene Libraries and cDNA cloning, Analyzing DNA sequences, Restriction Analysis, Sequencing

**4. Genetic engineering of plants:** -Transformation with the Ti plasmid of *Agrobacterium tumefaciens*. – Biolistics mediated transfer genetically modified crops: species, concerns, future scope

**Practical**

1. Overview of plant tissue culture/plant biotechnology lab.

2. Preparation of MS medium
3. Micro propagation of potato Initiation and maintenance of callus Organogenesis
4. Isolation and quantification of DNA
5. Agarose gel electrophoresis of DNA
6. SDS PAGE
7. Plasmid isolation
8. RE digestion

**Books Recommended**

1. Dodds, J. H. and L.W Roberts, 1997. Experiments in Plant Tissue Culture. Cambridge University Press, Cambridge.
2. Old, R.W and S.B. Primerose, 1994. Principles of Gene Manipulation. Blackwell, Oxford, London.
3. Glick, B.R. and J.J. Pasternak. 2003. Molecular Biotechnology: principles and applications of recombinant DNA.

**BOT-6802**

**Plant Anatomy**

**3(2-1)**

**Aims and Objectives:**

To provide comprehensive knowledge about internal organization and anatomy of vascular plants.

**Course Contents**

1. The plant body and its development: fundamental parts of the plant body, internal organization, 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, 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, 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:
  - Flower
  - Seed
  - Fruit
9. Economic aspects of applied plant anatomy
10. Anatomical adaptations
11. Molecular markers in tree species used for wood identification.

**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.

**Recommended Books:**

1. Dickson, W.C. 2000. Integrative plant anatomy. Academic Press, U.K.
2. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
3. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.

4. Metcalf, C.R. and Chalk, L. 1950. Anatomy of the Dicotyledons. Clarendon Press. Oxford.
5. Anon. Manual of Microscopic Analysis of Feeding Stuffs. The American Association of feed Microscopists.
6. Vaughan, J.G. 1990. The structure and Utilization of Oil Seeds. Chapman and Hall Ltd. London.
7. Metcalfe, C.R. 1960. Anatomy of the Monocotyledons. Gramineae. Clarendon Press, Oxford.
8. Metcalfe, C.R. 1971. Anatomy of the Monocotyledons.V. Cyperaceae. Clarendon Press, Oxford.
9. Cutler, D.F. 1969. Anatomy of the Monocotyledons. IV. Juncales. Clarendon Press, Oxford.
10. Cutler, D.F. 1978. Applied Plant Anatomy. Longman Group Ltd. England
11. Raymond, E.S. and E. Eichhorn. 2005. Esau's Plant Anatomy; Meristematic cells and tissues of plant body. John Willey Sons.
12. Eames, A.J. and L.H. Mac Daniels. 2002. An introduction to Plant Anatomy. Tat Mac-Graw Hill Publishing Company Limited, New Delhi.

**BOT-6803**

**Biodiversity and Conservation**

**3(2-1)**

**Aims and Objectives**

To familiarize the students with the diversity of nature. Importance of biodiversity for survival and proper functioning of ecosystems

**Course Contents**

1. Definition of biodiversity as defined in the convention of biological diversity (CBD).
2. Introduction of species on each other for their survival.
3. Extent of known and estimated biodiversity of earth.
4. Measuring biodiversity: Alpha, Beta, and Gamma diversity, Systematic diversity, functional diversity, taxic diversity.
5. Ecological services, indirect value of ecosystem by virtue of their ecological functions, direct value of ecosystem (i.e. Utility of living resources).
6. Sustainable and unsustainable use of ecosystem resources, consequences of unsustainable use, ecosystem degradation, extinct species, desertification and deforestation.
7. Biodiversity Hot spots of the world.
8. International treaties/agreements regarding Biodiversity and conservation; CBD, CITES, Ramsar.
9. IUCN categorised protected areas in Pakistan.
10. Environmental Impact Assessment.
11. Use of herbarium and Botanical Garden in biodiversity and conservation.

**Practical**

1. Inventory of plant biodiversity in various habitats.
2. Field survey for baseline studies and Impact Assessment.
3. Identification of wild plant species used by local communities in different ecosystems.

**Books Recommended**

1. Heywood, V. (Ed.). 1995. Global Biodiversity Assessment. Published for the United Nations Environment Programme. Cambridge University Press, Cambridge, UK.
2. Falk, D.A. & Holsinger, K.E. 1991. Genetics and Conservation of Rare Plants. Center for Plant Conservation. Oxford University Press, Oxford, UK.
3. Frankel, O.H., Brown, A.H.D. & Burdon, J.J. 1995. The Conservation of Plant Biodiversity. Cambridge University Press, Cambridge, UK.
4. IUCN. 1994. IUCN Red List Categories. As Approved by the IUCN Council. IUCN.
5. Leadlay, E. and Jury, S. 2006 Taxonomy and Plant Conservation. CUP.
6. Bush, M.B. 1997 Ecology of a changing Planet. Prentice hall. New Jersey.
7. French, H. 2000 Vanishing Borders- protecting the Planet in the age of globalization. W.W. Norton & Co.
8. Swanson, T. 2005 Global Action for Biodiversity. Earth Scan Publication Ltd.

**BOT-6804**

**Genetics II**

**3(2-1)**

**Aims and Objectives**

To introduce students to recombination of genetic material at molecular levels with emphasis on introduction to biotechnology and genomics

### Course Contents

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: Insertion sequences, transposons, rearrangements mediated by transposable elements, review of transposable elements in prokaryotes, controlling elements in maize.
7. Human Genome Project: Strategies and application, achievement, and future prospects.
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

Problems relating to the theory.

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

### Recommended Books

1. Trun, N and Trempey J., 2004, Fundamental Bacterial Genetics, Blackwell Publishing House.
2. Winnacker, E.L. 2003, From Gene to Clones – Introduction to Gene Technology, Panima Publishing Corporation, New Delhi.
3. Beaycgamp T.L. and Walters L., Contemporary Issues in Bioethics, Wadsworth Publishing Company.
4. Brown, T.A., 2002 Genomes, Bios Scientific Publishers Ltd.
5. The Genome of Homo Sapiens, 2003, Cold Spring Harbor Laboratory Press.
6. Ignacimuthu, S. 2005, Basic Bioinformatics, Narosa Publishing House, India,.
7. Lwein, B. 2004, Gene VIII, Pearson Education Int..
8. Miglani, 2003, Advanced Genetics, Narosa Publishing House, India,.
9. Hartt, D. L, and Jones, E.W. 2005. Genetics, Analysis of Gene and Genomes. Jones and Bartlett Publishers, Sudbury, USA
10. Gelvin, S.B. 2000. Plant Molecular Biology Manual. Kluwer Academic Publishers.
11. 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.
12. Snyder, L and Champness W, 2003, Molecular Genetics of Bacteria, ASM Press,.

### ELECTIVE COURSE

**Aims and Objectives**

To remediate various pollutants using advanced biological techniques.

**Course Contents**

Concept of bioremediation; Bioremediation of heavy metals, xenobiotic compounds and hazardous wastes; techniques used in bioremediation, bioremediation through consortia of microbes and invertebrates; renewable and non-renewable resources; bioleaching and biomining (low grade and sulfide containing ores processing); domestic solid waste and management. Waste water, sludge and sewage management; biological methods of wastes treatment; sample collection and preservation; bioremediation of crude and petroleum oils. Role of yeast in bioremediation. Biological fuel generation; Bioremediations of industrial effluents.

**Practical**

Bioremediation of heavy metals through invertebrates, consortia of microorganism, mycoremediation.

**Recommended Books**

1. Environmental Science (Earth as a living planet). 2000. 1st ed. Botkin, D. and Keller, E. John Wiley and Sons Inc. New York, USA.
2. Practical Environmental bioremediation the field guide, 1977. R. Barry. King, Gilbert M. Long John K. Sheldon, Lewis Publishers.
3. General Microbiology, 1995. Schlegel, H.G., Cambridge University Press.
4. Biotechnology, 1996. Smith, J.F., Cambridge University Press.
5. Environmental Biotechnology Principles and Applications, 2000. Pruce, R. Hmana, Parry McCarty, McGraw Hill.
6. Biodegradation and Remediation, 1999. Martin Alexander Academic Press Inc.
7. Bailey, J.E. and Ollis, D. F., 1986. Biochemical Engineering Fundamentals, McGraw Hills.
8. Watson, J.D., Tooze, J. and Kurta, D.T. 1983. Recombinant DNA-A short Course, Scientific American Books, New York.
9. Old, R.W. and Primrose, S.B. 1989. Principles of gene manipulation. 4th edition, Blackwell Scientific Publishers, London.
10. Molecular cloning, 1989. A Laboratory manual, 2nd edition, Cold spring Harbor Laboratory.
11. Higgins, I.J., Best, D.J. and Jones, J. 1988. Biotechnology Principles and Applications. Blackwell Scientific Publishers, London.
12. Rehm, J.J. 1988. Biotechnology: Special Microbial Process, Vol. 6 (b), VCH Publishers, N.Y.