



**SHAHEED BENAZIR BHUTTO WOMEN  
UNIVERSITY PESHAWAR**

**MINUTES OF THE MEETING OF BOARD OF STUDIES**

**DEPARTMENT OF MICROBIOLOGY**

**HELD ON**

**WEDNESDAY, 27<sup>TH</sup> NOVEMBER, 2015**



# SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

## MINUTES MEETING OF BOARD OF STUDIES, DEPARTMENT OF MICROBIOLOGY HELD ON WEDNESDAY, 27<sup>TH</sup> NOVEMBER, 2015

The meeting of the Board of Studies, Department of Microbiology, Shaheed Benazir Bhutto Women University was held on Wednesday, 27<sup>th</sup> November, 2015 at 10:00 AM in the Committee Room of Shaheed Benazir Bhutto Women University, Peshawar under the convener-ship of Prof. Dr. Razia Sultana, Vice-Chancellor / Dean, Faculty of Social Sciences, Shaheed Benazir Bhutto Women University, Peshawar.

The meeting was attended by the following members:

|    |   |          |
|----|---|----------|
| 1. | Prof. Dr, Razia Sultana,<br>Vice-Chancellor/Dean, Faculty of Social Sciences,<br>Shaheed Benazir Bhutto Women University, Peshawar. | Convener |
| 2. | Prof. Dr. Ghosia Lutfullah,<br>Centre of Biotechnology & Microbiology, University of Peshawar.                                      | Member   |
| 3. | Prof. Dr. Safia Ahmed ,<br>Department of Microbiology, Quaid- e- Azam University, Islamabad.  | Member   |
| 4. | Assistant Prof. Dr. Malik Badshah<br>Department of Microbiology, Quaid –e- Azam University, Islamabad.                              | Member   |
| 5. | Assistant Prof. Dr. Nafees Bacha,<br>Centre of Biotechnology & Microbiology, University of Peshawar                                 | Member   |
| 6. | Assistant Prof. Dr. Saeed Khattack,<br>Centre of Biotechnology & Microbiology, University of Peshawar                               | Member   |
| 7. | Assistant Prof. Dr. Irshad-Ur-Rehman,<br>Centre of Biotechnology & Microbiology, University of Peshawar                             | Member   |
| 8. | Mahrukh Khattak,<br>Lecturer/Incharge Department of Microbiology,<br>Shaheed Benazir Bhutto Women University, Peshawar.             | Member   |

The proceedings of the meeting started with the recitation from the Holy Quran.

Thereafter, the agenda was taken up for discussion and consideration with the board members.

| ITEM.NO | DESCRIPTION OF THE ITEM                                  |
|---------|--|
| I       | Approval of 4 Years-BS Curriculum (Session 2015 onwards) |

**ITEM # I: APPROVAL OF CURRICULUM OF BS(Hons) MICROBIOLOGY PROGRAM**

The curricula for 4 years BS(Hons) program was presented before the board for consideration and further recommendation to the Syndicate.

**Decision:** The board after having detailed discussion expressed their satisfaction over the curriculum and recommended to adopt the 4 years BS (Hons) program curriculum with following modifications.

1. Fundamentals of Microbiology-I Credit hours were changed from 4(2+2) to 4(3+1).
2. Human Physiology-I course in Ist semester was replaced by Biodiversity of Animals 3(2,1).
3. Biochemistry -I course in Ist semester was replaced by General Chemistry 3(2,1).
4. Fundamentals of Microbiology-II Credit hours were changed from 4(2+2) to 4(3+1).
5. Biochemistry-II was replaced by Biochemistry 3(2, 1).
6. Mathematics-II 3(2,1) was introduced in 2<sup>nd</sup> semester instead of Biostatistics.
7. English-III in 3<sup>rd</sup> semester was replaced by Biostatistics 3(2,1).
8. General immunology in 3<sup>rd</sup> semester was replaced by Cell Biology 3(2,1).
9. In forth semester as General genetics was moved to 2<sup>nd</sup> Semester so Biodiversity of Plants 3(2,1) was introduced instead of it.
10. General Virology was moved from 5<sup>th</sup> semester to 4<sup>th</sup> semester instead of Medical Microbiology and its credit hours were increased from 3 (2,1) to 4(3,1).
11. Mycology credit hours were Increased from 3 (2,1) to 4(3,1).
12. As General virology was moved to 4<sup>th</sup> semester so in 5<sup>th</sup> semester instead of it Microbial Metabolism 3(2,1) was introduced.
13. Fresh water Microbiology in 5<sup>th</sup> semester was replaced by Microbial Genetics having credit hours 4 (3+1).
14. Environmental Biotechnology in 5<sup>th</sup> semester was replaced by Medical Microbiology 3(2,1).
15. Research Methodology course name in 6<sup>th</sup> semester was modified to be Research Methodology & Literature Review, Review of Literature contents were suggested to be introduced in this course.
16. Molecular Mechanisms of Antimicrobial Drugs in 6<sup>th</sup> semester was replaced by Molecular Microbiology having credit hours 4(3,1)
17. Genetic Engineering course in 6<sup>th</sup> semester was moved to 7<sup>th</sup> semester and instead of it Immunology 3(2,1) was introduced.
18. Bacterial Genetics in 6<sup>th</sup> semester was replaced by Microbial Physiology 3(2,1).
19. Microbial Enzyme technology in 7<sup>th</sup> semester was replaced by Genetic Engineering in 3 (2,1).
20. Clinical Bacteriology credit hours were changed from 4(2,2) to 4(3,1)

21. Veterinary Microbiology in 8<sup>th</sup> semester was replaced by Environmental Microbiology and its credit hours were increased from 3(2,1) to 4 (3,1).
22. Veterinary Microbiology in 8<sup>th</sup> semester was suggested to be offered as optional subject for internship students in 8<sup>th</sup> semester but it's not compulsory Department can offer any other subject instead of it.
23. Bioinformatics, Protein structure/Function name was changed to be Bioinformatics while the contents will remain same.
24. Internship is decided to be of 0+3 credit hours.
25. It was suggested that course codes should be followed according to SBBWU, Peshawar

The structure of BS (Hons) Microbiology program will be as follows:

| S.No                      | Semester        | Course Title                      | Course Code | Credit Hours     |
|---------------------------|-----------------|-----------------------------------|-------------|------------------|
| 1.                        | 1 <sup>st</sup> | English-1                         | MB – 311    | 3 (3,0)          |
| 2.                        |                 | Pakistan Studies                  | MB – 312    | 2 (2,0)          |
| 3.                        |                 | Fundamentals of Microbiology – I  | MB – 313    | 4 (3,1)          |
| 4.                        |                 | Biodiversity of Animals           | MB – 314    | 3 (2,1)          |
| 5.                        |                 | Mathematics – I                   | MB – 315    | 3 (3,0)          |
| 6.                        |                 | General Chemistry                 | MB – 316    | 3 (2,1)          |
| <b>Total Credit Hours</b> |                 |                                   |             | <b>18 (15,3)</b> |
| 7.                        | 2 <sup>nd</sup> | English-II                        | MB – 321    | 3 (3,0)          |
| 8.                        |                 | Islamic Studies                   | MB – 322    | 2 (2,0)          |
| 9.                        |                 | Fundamentals of Microbiology – II | MB – 323    | 4 (3,1)          |
| 10.                       |                 | General Genetics                  | MB – 324    | 3 (2,1)          |
| 11.                       |                 | Mathematics – II                  | MB – 325    | 3 (3,0)          |
| 12.                       |                 | Biochemistry                      | MB – 326    | 3 (2,1)          |
| <b>Total Credit Hours</b> |                 |                                   |             | <b>18 (15,3)</b> |
| 13.                       | 3 <sup>rd</sup> | Biostatistics                     | MB – 431    | 3 (2,1)          |
| 14.                       |                 | Sociology                         | MB – 432    | 3 (3,0)          |
| 15.                       |                 | Computer Applications             | MB – 433    | 3 (2,1)          |
| 16.                       |                 | Ecology & Ecosystem               | MB – 434    | 3 (2,1)          |
| 17.                       |                 | Cell Biology                      | MB – 435    | 3 (2,1)          |

|                           |                 |  |          |                   |
|---------------------------|-----------------|--|----------|-------------------|
| 18.                       |                 | Microbial Taxonomy                       | MB – 436 | 3 (2,1)           |
| <b>Total Credit Hours</b> |                 |  |          | <b>18 (13,5)</b>  |
| 19.                       | 4 <sup>th</sup> | Biodiversity of Plants                   | MB – 441 | 3 (2,1)           |
| 20.                       |                 | Environmental Current Issues             | MB – 442 | 3 (2,1)           |
| 21.                       |                 | General Virology                         | MB – 443 | 4(3,1)            |
| 22.                       |                 | Biotechnology                            | MB – 444 | 3 (2,1)           |
| 23.                       |                 | Mycology                                 | MB – 445 | 4 (3,1)           |
| <b>Total Credit Hours</b> |                 |  |          | <b>17 (12,5)</b>  |
| 24.                       | 5 <sup>th</sup> | Microbial Metabolism                     | MB – 551 | 3 (2,1)           |
| 25.                       |                 | Biosafety & Risk Management              | MB – 552 | 3 (3,0)           |
| 26.                       |                 | Microbial Genetics                       | MB – 553 | 4 (3,1)           |
| 27.                       |                 | Soil Microbiology                        | MB – 554 | 3 (2,1)           |
| 28.                       |                 | Medical Microbiology                     | MB – 555 | 3 (2,1)           |
| <b>Total Credit Hours</b> |                 |  |          | <b>16 (12,4)</b>  |
| 29.                       | 6 <sup>th</sup> | Research Methodology & Literature Review | MB – 561 | 3 (2,1)           |
| 30.                       |                 | Molecular Microbiology                   | MB – 562 | 4 (3,1)           |
| 31.                       |                 | Medical Virology                         | MB – 563 | 3 (2,1)           |
| 32.                       |                 | General Immunology                       | MB – 564 | 3 (2,1)           |
| 33.                       |                 | Microbial Physiology                     | MB – 565 | 3 (2,1)           |
| <b>Total Credit Hours</b> |                 |  |          | <b>16 (11, 5)</b> |
| 34.                       | 7 <sup>th</sup> | Food Microbiology                        | MB – 671 | 3 (2,1)           |
| 35.                       |                 | Clinical Bacteriology                    | MB – 672 | 4 (3,1)           |
| 36.                       |                 | Genetic Engineering                      | MB – 673 | 3 (3,0)           |
| 37.                       |                 | Cell & Tissue Culture Technology         | MB – 674 | 3 (2,1)           |
| 38.                       |                 | Mini Research Project                    | MB – 675 | 3 (0,3)           |
|                           |                 | OR                                       |          |                   |
| 39.                       |                 | Internship                               | MB – 676 | 0+3               |

|                             |                 |  |          |   |
|-----------------------------|-----------------|--|----------|---|
|                             |                 |  |          |   |
| <b>Total Credit Hours</b>   |                 |  |          | <b>16</b><br><b>Research (10,6)</b><br><b>Internship (10+6)</b>     |
| 40.                         | 8 <sup>th</sup> | Immunobiology  | MB – 681 | 3 (2,1)   |
| 41.                         |                 | Epidemiology, Public Health and Bioethics                  | MB – 682 | 3 (2,1)   |
| 42.                         |                 | Bioinformatics   | MB – 683 | 3 (2,1)   |
| 43.                         |                 | Environmental Microbiology                                 | MB – 684 | 4(3,1)  |
| 44.                         |                 | Veterinary Microbiology (Optional Subject With Internship) | MB – 685 | 3 (3,0)   |
| 45.                         |                 | Mini Research Project                                      |          | 3(0,3)  |
| <b>Total Credit Hours</b>   |                 |  |          | <b>16</b><br><b>Internship (12+4)</b><br><b>Research (9+7)</b>      |
| <b>Overall Credit Hours</b> |                 |  |          | <b>135</b><br><b>Internship (100+35)</b><br><b>Research (97+38)</b> |

### **FRAME WORK FOR BS MICROBIOLOGY (4 YEAR PROGRAMME)**

|                                |   |
|--------------------------------|---|
| Total numbers of Credit Hours  | 124-133                                       |
| Duration                       | 4 years                                       |
| Semester duration              | 16-18 weeks                                   |
| Semesters                      | 8   |
| Course Load per Semester       | 15-18 Cr hr                                   |
| Number of courses per semester | 4-6 (not more than 3 lab / Practical courses) |

| Compulsory Requirements (the student has no choice) |           | General Courses to be chosen from other departments |           | Discipline Specific Foundation Courses  |           |
|---|-----------|---|-----------|---|-----------|
| 07 courses  |           | 7-8 courses   |           | 9-10 courses                            |           |
| Subject   | Cr. Hr    | Subject   | Cr. Hr    | Subject                                 | Cr. hr    |
| 1. English I  | 3         | 1. Human Phy-I                                      | 2+1       | 1. Fundamentals of Microbiology-I       | 2+2       |
| 2. English II                                       | 3         | 2. Human Phy-II                                     | 2+1       | 2. Fundamentals of Microbiology II      | 2+2       |
| 3. Pakistan Studies                                 | 2         | 3. Biochemistry-I                                   | 2+1       | 3. Introduction to medical Microbiology | 2+1       |
| 4. Islamic Studies / Ethics                         | 2         | 4. Biochemistry-II                                  | 2+1       | 4. Gen.Imunology                        | 2+1       |
| 5. Mathematics-I                                    | 3         | 5. Sociology  | 3+0       | 5. Microbial Taxonomy                   | 2+1       |
| 6. Mathematics II OR Biostatistics                  | 3         | 6. Environmental Current Issues                     | 3+0       | 6. Gen.Virology                         | 2+1       |
| 7. Computer Application                             | 2+1       | 7.Genetics  | 2+1       | 7. Cell Biology-I                       | 2+1       |
|   |           | 8.Botany  | 2+1       | 8. Mycology                             | 2+1       |
|   |           | 9.Zoology   | 2+1       | 9. Research Methodology                 | 2+1       |
|   |           | 10. Chemistry                                       | 2+1       | 10. Biotechnology                       | 2+1       |
|   |           | 11. Biodiversity of animals                         | 2+1       | 11. Biosafety & Risk Mnagement          | 3+0       |
|   |           | 12. Biodiversity of plants                          | 2+1       |   |           |
|   |           | 13. Plant physiology                                | 2+1       |   |           |
|   |           | 14.Ecology and Ecosystem                            | 2+1       |   |           |
| <b>Note*</b>  |           | <b>Note***</b>                                      |           |   |           |
| <b>Note**</b>                                       |           |   |           |   |           |
| <b>07 courses</b>                                   | <b>19</b> |   | <b>24</b> |   | <b>33</b> |

| Major courses including research project/internship |           | Elective Courses within the major |           |
|---|-----------|-----------------------------------|-----------|
| 11-13 courses                                       |           | 4 courses                         |           |
|   |           | 12 Credit Hours                   |           |
| Subject   | Cr. hr    | Subject                           | Cr. Hr    |
| 1. Cell Biology-II                                  | 2+1       | Elective-I                        | 2+1       |
| 2. Microbial Anatomy & Physiology                   | 2+1       | Elective-II                       | 2+1       |
| 3. Fresh Water Microbiology                         | 2+1       | Elective-III                      | 2+1       |
| 4. Bacterial Genetics                               | 2+2       | Elective-IV                       | 2+1       |
| 5. Clinical Bacteriology                            | 2+2       |                                   |           |
| 6. Soil Microbiology                                | 2+1       |                                   |           |
| 7. Epidemiology, Public health and bioethics        | 2+1       |                                   |           |
| 8. Environment Biotechnology                        | 2+1       |                                   |           |
| 9. Molecular Mechanism of Anti microbial Agent      | 2+2       |                                   |           |
| 10. Genetic Engineering                             | 2+2       |                                   |           |
| 11. Medical Virology                                | 2+2       |                                   |           |
| 12. Immunobiology                                   | 2+1       |                                   |           |
| 13. Research Project                                | 0+6       |                                   |           |
| 14. Internship                                      | 0+3       |                                   |           |
| 15. Food Microbiology                               | 2+1       |                                   |           |
| <b>Note****</b>                                     |           |                                   |           |
|   | <b>42</b> |                                   | <b>12</b> |

\*\*\*\* Student may take 11 courses out of the list of 15 courses in major other than Research Project and Internship



## List of Elective Courses

University may recommend elective courses according to the faculties within the department.

- Cell & Tissue Culture Technology.
- Applied Microbial Technology.
- Plant Microbiology.
- Food and Dairy Microbiology.
- Marine Microbiology.
- Diagnostic Virology.
- Animal Virology.
- Clinical Bacteriology.
- Food Preservation Technology.
- Molecular Immunology.
- Clinical Parasitology.
- Plasmids, Episomes and Insertion Sequences.
- Microbial Enzyme Technology.
- Bioinformatics and Protein Structure/Function.
- Advances in Soil Microbiology.
- Environmental Microbiology and Public Health.
- Diagnostic Chemistry for Microbial Diseases.
- Veterinary Microbiology.
- Mycotic infections
- DNA Damage, Repair and Carcinogenesis.
- Management of Infectious Waste.
- Epidemiology: Analytical and Experimental Approaches.
- Advances in Microscopy and image analysis
- Nanobio technology.
- Structural and computational Biology.
- Industrial Microbiology
- Epigenetics

## DETAIL OF COURSES

### 1<sup>st</sup> Semester

#### **(ENGLISH –I) Functional English**

**Credit Hours: 3(3+0)**

**OBJECTIVES:** To enhance language skills and develop critical thinking

#### **Course Detail:**

##### **Basics of Grammar**

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

## **Comprehension**

- Answers to questions on a given text

## **Discussion**

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

## **Listening**

- To be improved by showing documentaries/films carefully selected by subject teachers)

## **Translation skills**

- Urdu to English

## **Paragraph writing**

- Topics to be chosen at the discretion of the teacher

## **Presentation skills**

- Introduction

*Note: Extensive reading is required for vocabulary building*

## **Recommended Books:**

### **1. Functional English**

#### a) Grammar

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

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

#### b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

#### c) Reading/Comprehension

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

#### d) Speaking

## **Pakistan Studies (Compulsory)**

### **Credit Hours: 2(2+0)**

(As Compulsory Subject for Degree Students)

### **OBJECTIVES**

- To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan.
- To study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

## **Course Detail**

### **1. Historical Perspective**

a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.

b. Factors leading to Muslim separatism

c. People and Land

i. Indus Civilization

ii. Muslim advent

iii. Location and Geo-Physical features.

## 2. **Government and Politics in Pakistan**

Political and constitutional phases:

a. 1947-58

b. 1958-71

c. 1971-77

d. 1977-88

e. 1988-99

f. 1999 onward

## 3. **Contemporary Pakistan**

a. Economic institutions and issues

b. Society and social structure

c. Ethnicity

d. Foreign policy of Pakistan and challenges

e. Futuristic outlook of Pakistan

### **Recommended Books**

1. Burki, Shahid Javed. *State & Society in Pakistan*, the MacMillan Press Ltd 1980.

2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.

3. S.M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.

4. Mehmood, Safdar. *Pakistan Political R*

5. Wilcox, Wayne. *The Emergence of Bangladesh.*, Washington: American Enterprise, Institute of Public Policy Research, 1972.

6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafate-Islamia, Club Road, nd.

7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.

8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.

9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.

10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.

11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.

12. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.

13. Muhammad Waseem, *Pakistan under Martial Law*, Lahore: Vanguard, 1987.

14. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.

## **FUNDAMENTAL MICROBIOLOGY-I**

**Credit Hours 4(3+1)**

### **OBJECTIVES**

- To enable the students to work with microorganisms.
- To understand the basic techniques of sterilization, culturing and isolation.
- Determining different characteristics of the microorganisms.

### **Course Detail**

- Fundamentals of microbiology.
- Microorganisms and their respective place in the living world.
- Differentiation between pro- and eukaryotic cells.
- Historical development of Microbiology and its scope.
- Microscopy: An outline of the principles and applications of light and electron microscope.
- Morphology, arrangement and detailed anatomy of bacterial cell.
- Bacterial taxonomy and nomenclature, basis of classification of bacteria.
- Growth, nutrition (physical and nutritional requirement and nutritional types; sources of energy, C, N, H, O, S, P, H<sub>2</sub>O, trace elements, growth factors) and reproduction.
- General methods of studying microorganisms: cultivation, isolation, purification and characterization.
- Control of microorganisms by physical and chemical methods.
- Chemotherapeutic agents and antibiotics. Modes of action of antibiotics on microorganisms.
- Basic properties of fungi, protozoa and algae.
- A brief introduction to structure and propagation of viruses and bacteriophages.

### **Practical**

1. Laboratory safety: Containment and decontamination.
2. An introduction to microscopy.
3. Principles of Staining Procedures: Simple staining, Gram's staining, Acid-fast staining, cell-wall staining, flagellar staining, capsule staining, spore staining and spirochaete staining. Study of cell motility by hanging drop preparation.
4. Preparation and sterilization of bacteriological media and glassware.
5. Inoculation techniques. Study of colony characteristics of microorganisms.
6. Standard plate count technique (SPC).
7. Microbiological analysis of air.

### **Recommended Books**

1. Baker , S., Khan , N., Nicklin, J. and Killington, R., 2006. Instant Notes in Microbiology, 3rd Ed edition, Taylor and Francis.
2. Black, J. G. 2005. Microbiology: Principles & Explorations, 6th edition, John Wiley and Sons, N.Y.
3. Talaro, K. P. 2008. Foundations in Microbiology: Basic Principles, McGraw-Hill Companies, N.Y.
4. Tortora, G. J., Funke, B. R. and Case, C. L. 2012. Microbiology: An

Introduction, Benjamin-Cummings Publishing Company, U.S.A.  
5. Tortora, G. J., Funke, B. R. and Case, C. L. 2012. Study Guide for Microbiology: An Introduction. 11th edition. Benjamin-Cummings Publishing Company, U.S.A.

## **GENERAL CHEMISTRY**

**Credit hours 3(2,1)**

### **OBJECTIVE**

- **Learn the basic concepts of chemistry and their applications in current events and health sciences**
- **Understand the experimental basis for the growth and development of modern chemistry**
- **Become familiar with the language of chemistry in measurements and nomenclature, and with the representation of chemical reactions using equations.**

### **Course Outline:**

- Chemistry: Methods and Measurement
- The Composition and Structure of the Atom
- Elements, Atoms, Ions and the Periodic Table
- Structure and Properties of Ionic and Covalent Compounds
- Calculations and the Chemical Equation
- States of Matter: Gases, Liquids and Solids
- Reactions and Solutions
- Chemical and Physical Change: Energy, Rate and Equilibrium
- Charge-Transfer Reactions: Acids and Bases and Oxidation-Reduction
- The Nucleus, Radioactivity and Nuclear Medicine
- An Introduction to Organic Chemistry: The Saturated Hydrocarbons
- The Unsaturated Hydrocarbons: Alkenes, Alkynes and Aromatics

### **Practicals**

- **Laboratory Safety rules and Principles**
- **Preparation of Molar, normal, percent solutions**
- **Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).**
- **Determination of heat of solution by solubility method.**

### **Recommended Books**

- **Textbook: Denniston, K.; Topping, J. and Caret, R.; "General, Organic and Biochemistry", 4th Edn, 2004, McGraw Hill. Study Guide: Denniston, K. and Topping, J.; "Student Study Guide/Solutions Manual to accompany General, Organic and Biochemistry", 4th Edn, 2004, McGraw Hill.**

## **BIODIVERSITY OF ANIMALS**

**Credit Hours: 3(2+1)**

### **OBJECTIVES**

To demonstrate the major groups of animals and introduce the variety of relationships within, as well as between, these organisms.

### **Course Detail**

- Introduction to animal biodiversity

- Reproduction
- Principles of development
- Architectural pattern of an animal
- Taxonomy and phylogeny of animals
- Protozoa
- Sponges
- Radiate animals
- Flatworms
- Molluscs
- Annelids
- Nematodes
- Introduction to arthropods
- Crustaceans
- Insects
- Echinoderms
- Introduction to chordates
- Fishes
- Amphibians
- Reptilian vertebrates
- Birds
- Mammals

#### **Practical**

- A study Visit to animal museum
- Body design and taxonomy of the Animalia
- Histology: animal cells and tissues
- Comparison of radial and bilateral invertebrates

#### **Recommended Books**

Integrated Principles of Zoology, fourteenth edition  
 Hickman CP, Roberts LS, Keen SL, Larson A, l'Anson H, Eisenhour DJ  
 McGraw Hill Companies Inc., 2008

#### **MATHEMATICS - I**

**Credit Hours: 3(3+0)**

#### **OBJECTIVES**

This is the first course of the basic sequence, Calculus I-III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts and skills needed for mathematical manipulation. Calculus I & II focus on the study of functions of a single variable.

#### **Course Detail**

- Limits and continuity.
- Derivative of a function and its applications.
- Optimization problems.
- Mean value theorem (Taylor's theorem and the infinite Taylor series with applications) and curve sketching; anti-derivative and integral.
- Definite integral and applications.

- The fundamental theorem of Calculus.
- Inverse functions (Chapters 1-6 of the text)

### **Recommended Books**

1. Anton H, *Calculus: A New Horizon* (6th edition), 1999. John Wiley, New York.
2. Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)
3. Thomas G. B, Finney A. R., *Calculus* (10th edition), 2002. Addison-Wesley, Reading, Ma, U.S.A.
4. Anton, H., 1999. *Calculus: A New Horizon*, 6th Edition, John Wiley, New York.
5. Stewart J, 1995. *Calculus*, 3rd Edition, Brooks/Cole
6. Thomas, G. B. and Finney, A. R, 2002. *Calculus* 10th Edition, Addison-Wesley, Reading, Ma, U.S.A.

### **2<sup>nd</sup> Semester**

#### **(ENGLISH –II) Communication Skills**

**Credit Hours: 3(3+0)**

**OBJECTIVES** To enable the students to meet their real life communication needs

#### **Course Detail**

#### **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 and minutes of the meeting, use of library and internet resources

#### **Presentation skills**

- Personality development (emphasis on content, style and pronunciation)

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

#### **Recommended Books**

##### a) Grammar

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

##### b) Writing

1. Writing. Intermediate by Marie-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 Y

## **MATHEMATICS - II**

**Credit hours 3(3+0)**

**Course Detail:**

- Continuation of Calculus .
- Techniques of integration.
- Further applications of integration.
- Parametric equations and polar coordinates.
- Sequences and series. • Power series representation of functions.

**Recommended Books:**

1. Anton, H., 1999. Calculus: A New Horizon, 6th Edition, John Wiley, New York.
2. Stewart J, 1995. Calculus ,3rd Edition, Brooks/Cole
3. Thomas, G. B. and Finney, A. R, 2002. Calculus 10th Edition, AddisonWesley, Reading, Ma, U.S.A.

## **ISLAMIC STUDIES (Compulsory)**

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

**OBJECTIVES: To learn about Islam and its application in day to day life.**

**Course Detail**

### **INTRODUCTION TO QURANIC STUDIES**

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

### **STUDY OF SELECTED TEXT OF HOLLY QURAN**

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

### **STUDY OF SELECTED TEXT OF HOLLY QURAN**

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No. 6,21,40,56,57,58.)

- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment

- 3) Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14)

### **SEERAT OF HOLY PROPHET (S.A.W) I**

- 1) Life of Muhammad Bin Abdullah ( Before Prophet Hood)



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

### **SEERAT OF HOLY PROPHET (S.A.W) II**

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

### **INTRODUCTION TO SUNNAH**

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

### **SELECTED STUDY FROM TEXT OF HADITH**

### **INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE**

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

### **ISLAMIC CULTURE & CIVILIZATION**

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

### **ISLAM & SCIENCE**

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

### **ISLAMIC ECONOMIC SYSTEM**

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

### **POLITICAL SYSTEM OF ISLAM**

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

### **ISLAMIC HISTORY**

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

### **SOCIAL SYSTEM OF ISLAM**

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

### **REFERENCE BOOKS:**

- 1) 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).

## **FUNDAMENTAL MICROBIOLOGY-II**

**Credit Hours 4(3+1)**

### **OBJECTIVES**

- To know about the applications of the science of microbiology in the different fields of life.
- The course may initiate students' interest in agricultural, industrial and/or environmental microbiology.

### **Course Detail**

- Structure and chemical composition of nucleic acid. Role of RNA, DNA in protein synthesis.
- Mode of reproduction: Cell division (prokaryote), mitosis and meiosis (eukaryote), bacterial mutation and variation. Introduction to the genetical intermixing of bacteria including transformation, transduction and conjugation.
- Introduction to metabolism and role of phosphorus in energy transfer.
- Glycolysis and T.C.A. cycle.
- Microbiology of water and wastewaters. Water as a source of infection and methods of water purification. Methods of sewage treatment and disposal.
- Introduction to food and dairy microbiology. Methods of food preservation.
- Differentiation between food intoxication and food-infection.
- Microbiology of soil with particular reference to nitrogen cycle.
- Microbiology of air.

### **Practical**

1. Isolation of Chromosomal DNA from E.coli.
2. Electrophoresis of Microbial DNA.
3. Effect of UV light on phenotype and genotype of bacteria.
4. Enumeration of bacteria in drinking water, milk, soil and air.
5. Pure culture study of (on the basis of morphological, cultural and biochemical characteristics): *E. coli*, *Salmonella sp*, *Shigella sp*, *Staphylococcus aureus*, *S. epidermidis* and *S. fecalis*, *Corynebacterium*.
6. Microscopic study of *Leishmania*, *Entamoeba*, *Plasmodium* and *Giardia*.
7. MPN technique.

### **Recommended Books**

1. Black, J. G. 2005. Microbiology: Principles & Explorations, 6th edition, John Wiley and Sons, N.Y.
2. Talaro, K. P. 2008. Foundations in Microbiology: Basic Principles, McGraw-Hill Companies, N.Y.
3. Tortora, G. J., Funke, B. R. and Case, C. L. 2008. Microbiology: an introduction 9th Edition, Pearson Education.
4. Tortora, G. J., Funke, B. R. and Case, C. L. 2012. Study Guide for Microbiology: An Introduction. 11th edition. Benjamin-Cummings Publishing Company, U.S.A.
5. Tortora, G. J., Funke, B. R. and Case, C. L. 2012. Microbiology: An Introduction, Benjamin-Cummings Publishing Company, U.S.A.

### **GENERAL GENETICS**

#### **Credit Hours 3(2+1)**

#### **OBJECTIVE**

- To learn about the genetics of eucaryotes
- To learn about the structure and function of chromosome
- To understand the mechanism of heredity in animal.
- **Course Detail**
- Definition and genesis (history) of genetics.
- Heredity and variation. Chromosomal theory of inheritance.
- Mendel's laws of inheritance.
- Gene interaction; genotypic and phenotypic ratios.
- Multiple alleles, Multiple factor hypothesis and use of binomial theorem.
- Linkage and crossing over and their calculations, gene mapping. Sex linkage, sex determination and sex linked inheritance, sex influenced, sex limited and holandric genes.
- Genetic material. Gene and environment: penetrance, expressivity, pleiotropism and phenocopies. Twin studies, nature and nurture.
- Mutations. Extra-nuclear inheritance: maternal effects and maternal inheritance.
- Qualitative and quantitative inheritance.

#### **Practical**

1. Preparation of culture medium and maintenance of Drosophila cultures in lab.
2. Problems related to Mendelian inheritance, gene interaction, gene mapping.
3. Blood groups-ABO blood groups and Rh factors

#### **Recommended Books**

1. Costa, L. G. and Eaton, D. L. 2006. Gene-Environment Interactions; Fundamentals of Ecogenetics, John Wiley and Sons, N.Y.
2. Primrose, S. B. and Twyman, R. M. 2006. *Principles of Gene Manipulation and Genomics*, Blackwell Scientific Publications, U.S.A.
3. Philip, M., Advanced Genetic Analysis: Genes, Genomes and Networks in Eucaryotes. (2009). Oxford University Press.
4. Leland, H., Leroy, H. Genetics: From Gene to Genome. (2010) McGraw Hill Sciences.

5. Asche, 2013. Recent Advances in Cloning Genetics and Stem Cell Technology. RDM.

6. James D. W. 2013. Molecular Biology of Gene. Benjamin Cumming.

## **BIOCHEMISTRY**

**Credit Hours 3(2 +1)**

### **OBJECTIVES**

- The course will provide in depth knowledge about the polymerized organic compounds of life. The dynamism of the life proceeds with inter-conversion of the chemicals from feeding to the liberation of energy for work.
- In this course the concepts of the chemical basis of life and all the mechanisms involved in harvesting of energy for growth, duplication etc., are given.

### **Course Detail**

- Amino Acids; Peptides and Proteins; The Covalent and 3-D structure of proteins sequences and evolution.
- Carbohydrates: Monosaccharides, Oligosaccharides,
- Polysaccharides, Glycoconjugates, Glycosaminoglycans, Proteoglycans, Glycoproteins, Carbohydrates as informational molecules.
- Enzymes: Nature and Function of enzyme, Classification and Nomenclature.
- Mechanism of enzyme action and enzyme kinetics, Regulatory enzyme precursors and associates and Buffer and pH.
- Nucleic Acids: Nucleosides and nucleotides, Structure and function of DNA and RNA.
- Lipids: Storage Lipids, Fatty acids and their types, Triacylglycerols, Structural Lipids, Phospholipids, Sphingolipid, Glycolipid, Steroles and Isoprenoids.

### **Practical**

1. Normal Solutions.
2. Acid and Bases.
3. Electrolytes.
4. Non Electrolytes.
5. Buffers and pH.
6. Study of hydrolysis of starch by using mineral acids.
7. Various qualitative tests for Monosaccharide, oligosaccharides and polysaccharides
8. Preparation of calibration curve for glucose
9. Estimation of serum glucose by using calibration curve
10. Detection of reducing sugars in the presence of non-reducing sugars
11. Qualitative tests for different lipids.
12. Paper and thin-layer chromatography of sugars.
13. Paper chromatography of various amino acids.
14. Determination of pK values of amino acids (Glycine, Alanine) by preparation of titration curves.

15. Qualitative and quantitative analysis of proteins by colorimetric methods (Biuret and Lowry's)

### **Recommended Books**

1. Voet, D., Voet, J. G. and Pratt, C. W., 2002. Fundamentals of Biochemistry; John Wiley and Sons. Inc., New York.
2. Berg, J. M., Tymoczko, J. L. and Stryer, L., 2002. Biochemistry 5th Edition. W.H. Freeman and Company, New York.
3. Devlin, T. M., 2002. Textbook of Biochemistry with Clinical Correlations 5th Edition. .John Wiley and Sons. Inc., New York,
4. Berg, J.M., Tymoczko, J.L., Stryer, L., 2006. Biochemistry: International 6th edition. W. H. Freeman and Co Ltd;
5. Cox, M. and Nelson, D. L., 2005. Lehninger Principles of Biochemistry 4th edition, Palgrave Macmillan.
6. Murray, R., Granner, D., Mayes, P., and Rodwell, V., 2006. Harper's Illustrated Biochemistry 27th Edition. McGraw-Hill Education.
7. Denniston, S., 2006. General, Organic and Biochemistry, 5th Edition. McGraw-Hill.

### **3<sup>rd</sup> Semester**

#### **BIO-STATISTICS**

**Credit Hours: 3(2+1)**

#### **OBJECTIVES**

- It will help the students to analyze data pertaining to their research work
- To assess the significance of their experimental designs. Without statistical analysis research articles are not accepted for publication by the scientific journals.
- Students must have sound knowledge of the statistical programs.

#### **Course Detail**

- Introduction to Biostatistics and its scope in Microbiology.
- Collection of Primary and Secondary data.
- Editing of data.
- Presentation of data: Tabulation, Classification, Visual Presentation (Diagrams and Graphs).
- Measures of Central Tendency: Arithmetic Mean by direct and shortcut method, Geometric Mean, Harmonic Mean, Mode, Median, ED50 (LD50 in detail ), Quantile.
- Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation by direct and short-cut method, Variance, and their Coefficient.
- Correlation: Simple Correlation Table, Rank Correlation, Partial and Multiple Correlation.
- Regression and method of least square.
- Probability: Concept of Probability, Laws of Probability.
- Permutation and Combination.
- Probability distributions: Binomial distribution, Poisson distribution and their fitting to observed data, Normal distribution.

- Sampling and Basic Design
- Hypothesis Testing.
- Chi-square test, Student's t-test, Analysis of variance.
- Laboratory Experiments pertaining to the course.

#### **Recommended Books**

1. Stanton, A.G., 2001. Primer of Biostatistics. McGraw-Hill.
2. Jekel, J., Elmore, J.G., Katz, D.L., 2001. Epidemiology, biostatistics and preventive medicine. W. B. Saunders.
3. Quinn, G., 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press.
4. Fernholz L.T, Morgenhaler, S., Stahel, W., 2000. Statistics in Genetics and in Environmental Sciences, Birkhauser Verlag.
5. Kuzma J. W. and Bohnenblust, S. E. 2001, Basis Statistics for the Health Sciences, McGraw-Hill International Education.

### **CELL BIOLOGY**

**Credit Hours: 3(2 +1)**

#### **Course Detail**

- Introduction to cell biology.
- Difference between prokaryotes and eukaryotes. • Physico-chemical properties of protoplasm.
- Ultra-structure, chemical composition and functions of cell wall, cell membrane, cellular organelles (mitochondria, endoplasmic reticulum, golgi apparatus, lysosome, glyoxysome, nucleus, ribosomes, etc.) cytoskeleton. • Chemical composition and molecular structure of chromosomes. • Cell cycle and apoptosis.
- Cell reproduction.
- Signal transduction.
- Cell culture

#### **Practicals:**

1. Study of different types of Prokaryotic and Eucaryotic cell .
2. Study of different cell organelle by staining: Karyotyping.
3. Study of meiosis (pollen) and mitosis (onion root).

#### **Recommended Books**

1. De Robertis, E. D. P and De Robertis Jr. E. M. F. 2001. Cell and Molecular Biology. 8th Edition. Lippincott, Williams and Wilkins Publishers.
2. Karp, G. 2000. Cell and Molecular Biology. Concepts and Experiments. John Wiley and Sons Publishers.
3. Lodish, H. 2001. Molecular and Cell Biology. W.H. Freeman and Co.
4. Gilmartin, P. M. and Bowler, C. 2002. Molecular Plant Biology. Vol 1 and 2. Oxford University Press. UK.
5. Malacinski. G. M. 2003. Essentials of Molecular Biology. 4th Edition. Jones and Bartlett Publishers, Massachusetts.
6. Watson J. D. 2004. Molecular Biology of the Gene. Pearson Education, Singapore.
7. Weaver, R. F. 2005. Molecular Biology. McGraw Hill, St. Louis.
8. Lodish, H., Matsudaira, P., Berk, A., Ploegh, H., Scott, M., Kaiser, C.A., Krieger, M., Bretscher, A., 2007. Molecular Cell Biology. W. H. Freeman Company.

9. Gartner, L. P., Hiatt, J. L. and Strum, J. M., 2003. Cell Biology and Histology. Lippincott Williams and Wilkins.
10. Walker, D., 2007. Cells and Life Processes. Smart Apple Media.
11. Alberts. B., 2007. Molecular Biology of the Cell Taylor and Francis, Inc.
12. Pollard, T. D., Lippincott-Schwartz, J., Earnshaw, W. C., 2007. Cell Biology: Saunders W. B. Co.
13. Karp, G., 2007. Cell and Molecular Biology, Study Guide: Concepts and Experiments.5 Edition. th Wiley, John and Sons Incorporated
14. Bruce Alberts, B., Bray, D., Roberts, K., Lewis, J., Raff, M. 2003. Essential Cell Biology Taylor and Francis Inc.
15. Alberts, E.A., 2006. Essential Cell Biology Academic Internet Publisher
16. Kierszenbaum, A., 2007. Histology and Cell Biology: An Introduction to Pathology Elsevier Health Sciences.
17. Gartner, L. P., Hiatt, J. L., and Strum, J. M., 2003. Cell Biology and Histology. Elsevier Health Sciences. MYC

## **COMPUTER APPLICATIONS**

**Credit Hours: 3(2 +1)**

### **Course Detail**

- Introduction to Computer and Window 98/2000.
- Word processing (Microsoft Word).
- Spread Sheets (Microsoft Excel) and other related software packages (at least two).
- Internet access and different data bases available on the internet.

## **SOCIOLOGY**

**Credit Hours 3(3+0)**

### **OBJECTIVES**

- The course is designed to introduce the basic concepts of sociology with particular reference to environment and social relationships.
- It provides understanding of the role of human being in creating and recreating the environment.
- It evaluates the development and environment relationships, environmental policies and environmental movements with reference to environmental issues.

### **Course Detail**

- Introduction: Sociology, the Science of Society, Scope and significance, Fields of Sociology, Sociology and other Social Sciences.
- Social interaction and social structure, Social Interaction, the Nature and Basis of Social Interaction.
- Social Processes, Social Structure, Status, Roles, Power and Authority and Role Allocation.
- Culture, Meaning and nature of culture, Elements of culture, Norms, values, beliefs, sanctions, and customs.
- Culture and Socialization Formal and non-formal socialization, and Transmission of Culture.
- Cultural Lag. Cultural Variation, Cultural Integration, Cultural Evolution, Cultural Pluralism Culture and personality.

- Deviance and social control, Deviance and conformity, Mechanism and techniques of social control, Agencies of social control.
- Social organization, Social organization-Definition, meaning and forms, Social groups -Types and functions of groups, Social Institutions: forms, nature and inter-relationship.
- Community: definition and forms (Urban and rural).
- Social change, Processes of social change, Social change and conflict, Social change and social problems, Resistance to social change.
- Human ecology, Ecological processes, Ecological problems of Pakistan.

## **ECOLOGY & ECOSYSTEM**

**Credit Hours 3(2+1)**

### **OBJECTIVE**

- To learn about different ecosystems
- To learn about food dependency of organisms in an ecosystems.

### **Course Detail**

- Concept, structure and components of Ecosystem.
- Energy flow in ecosystems and energy transformation in nature.
- Food chain, Food webs, Food cycle,
- Trophic levels, Ecological pyramids.
- Biogeochemical cycles (carbon, nitrogen, phosphorus).
- Productivity of ecosystems.
- Impact of man on ecosystem.
- Fundamental of population ecology.

### **Practical**

1. Study of pond freshwater ecosystem.
2. Study of vegetation profile grassland and forest.
3. Study of some biotic and abiotic factors of grassland and aquatic ecosystem, methods of sampling.
4. Measurements and description of plant communities by different methods.
5. Study of decomposition of leaf litter by organisms.

### **Recommended Books**

1. Prakash, 2008. Molecular Biology of Ecology. DPH
2. Joanne W. and Linda S., Chris W. 2010 Prescott's Microbiology. McGraw-Hills Science.
3. Larry L. B. and Dian E. W. 2011. Microbial Ecology. Wiley Blackwell.
4. Thomas M. S. and Robert L. S. 2012. Elements of Ecology. Benjamin Cumming.
5. Manuel M. 2012. Ecology: Concepts and Application. McGraw-Hill Science.

## **MICROBIAL TAXONOMY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- Identify the OBJECTIVES of classification.
- Identify traits used to classify microorganisms.



- Locate microorganisms in the realm of living world.

### **Course Detail**

- Basic concepts and aims of classification.
- Classical and molecular basis of classification of prokaryotes and eukaryotes.
- Bacterial nomenclature.
- Classification of Enterobacteriaceae, spore formers, Actinomycetes (*Mycobacterium* & *Nocardia*), Spirochetes (*Treponema* & *Leptospira*).
- Detailed classification of viruses, fungi, protozoa and Algae.
- A brief introduction of Rickettsia, Chlamydia and Mycoplasma.
- An introduction to Prions and Viroids.

### **Practical**

1. Characterization of bacteria (enteric & nosocomial) and fungi on the basis of different biochemical and cultural characteristics.
2. Study of phylogenetic relationship using appropriate computer software.

### **Recommended Books**

1. Garrity, G. M., Krieg, N. R., Brenner, D. J., 2006. Bergey's Manual of Systematic Bacteriology: The Proteobacteria, Vol. 2. Williams and Wilkins Co, Baltimore.
2. Scott F. and Jon c. H., 2007. Evolutionary Analysis. Benjamin Cumming.
3. Roberto K. and Stanley M. 2012. Microbes and Evolution: The World That Darwin Never Saw. ASM. Press.
4. David L. K. 2012. Process in Microbial Ecology. Oxford University Press.
5. Ralf G. Dietzgen, R.F., and Ivan V. Kuzmin, I.V., 2012. Rhabdoviruses: Molecular Taxonomy, Evolution, Genomics, Ecology, Host-Vector Interactions

## **4<sup>th</sup> Semester**

### **BIODIVERSITY OF PLANTS**

**Credit Hours 3(2+1)**

#### **OBJECTIVE**

- **To learn about the phylogenetic relation between plants and fungi.**
- **To learn about the evolutionary history and of fungi and plant.**

#### **Course Detail**

Introduction: Diversity of life.

- Arranging the diversity of life into Kingdoms.
- Prokaryotes and origin of metabolic diversity
- The origin of eukaryotic diversity: Eukaryotic origin by symbiosis among prokaryotes.
- Eukaryotic algae as key producers in aquatic ecosystem.
- Major characteristics of phyla of kingdom Plant and colonization of land.
- Plant diversity and evolutionary history of plant kingdom, structural and reproductive adaptation for colonization of land.
- Plant structure and Growth
- Reproduction & Development: Life cycle of plant.

- Evolutionary adaptation in germination of seeds, methods of reproduction and their role in agriculture, overview of developmental mechanism in plants.
- Control systems of Plants to cope with environmental stresses

### **Recommended Books**

1. Schafer, 2006. Photomorphogenesis in plant and Bacteria.
2. Barbara J. E.s., Christine J. C. B. and Thomas N. S. 2010. Microbial Roots Endophytes. Springer.
3. Shelly, 2010. Stern's Introductory Plant Biology. McGraw-Hill Sciences. 37
4. Anna M. P. and A. Carolina F. 2011. Endophytes of forest Trees. Springer.
5. Alexopoulos, 2012. Introductory Mycology.
6. Teiji S., Hideki K. et al. 2013. Species Diversity and Community Structure. Springer.

Biology of Gene.

## **ENVIRONMENTAL CURRENT ISSUES**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- This course aims to provide knowledge about various environmental issues in multidimensional perspectives. It uses critical approach to global, regional and local environmental issues.
- The course provides review of the different environmental issues including ecological, conservation, pollution, resources, population and socioeconomic issues.
- It deals with the management and planning issues using case studies. This will enable the students to identify and analyze various environmental issues critically.
- They will be able to draw and formulate different strategies to address the multidisciplinary issues in different countries in general and in Pakistan in particular.

### **Course Detail**

- The Atmosphere: Composition, Minor and major gases, Water in atmosphere, Aerosols, Global circulation pattern.
- Human Population: Population trends, Causes of population growth, Biological reasons, Social reasons, increasing population and anticipated changes.
- Drought and Famine: Types, Human responses to drought, Seasonal drought, Drought and Famine in different regions, Desertification.
- Pollution: Air pollution, Water pollution, Land pollution, Thermal pollution, Radiation pollution, Noise pollution.
- Acid Rain: Nature and Development, Source, Acid rain and Geology.
- Effects of Acid Rain on: Aquatic environment, Terrestrial environment, built environment, Human health.
- Climate Change: Green House Effect and Global Warming.
- Global chilling, Greenhouse effect, Greenhouse gases, Changes in CO<sub>2</sub>- Carbon Cycle, Changes in temperature, Socioeconomic effect, Environmental effects.
- Ozone Depletion: Ozone-structure, Properties/Significances, Ozone destroying catalysts, Natural, Anthropogenic, Antarctic ozone hole, Changing ozone Level, Impact on biosphere.

- Natural Resources and Reserves: Use, Renewable and Nonrenewable, Depletion and Management.
- Waste: Type, Disposal and Management.
- Biodiversity: Concept and Significance, Causes of extinction, Conservation practices, Biodiversity and Climate changes, Introduced species and their effects.
- Deforestation: Causes, Effects, Reforestation
- Genetically Engineered Foods: Safety, Benefits, Public concerns, Food patents.
- Cloning, Use and Misuse, Threat to environment, Ethical and Religious reasoning.
- Natural Disasters: Earthquakes, Volcanoes, Lava, Cyclones, Tornadoes, Asian disasters (Tsunami disaster, Earthquake etc.).

### **Recommended Books**

1. Andrew, L., Stephen, H., and Paul, A., 2004. Ecological Genetics, Blackwell Publishing.
2. Cooper, G.J., 2003. The Science of the Struggle for Existence (On The Foundation of Ecology, Cambridge University Press.
3. Baker, A.J., 2000. Molecular Methods in Ecology, Science.
4. Nico, M., Straalen, V., and Roelofs, D., 2006. An Introduction to Ecological Genomics. Oxford University Press.
5. Aston, A., Harris, S., Lowe, A., 2004. Ecological Genetics: Planning and Application. Blackwell Science (UK).
6. Costa, L. G., and Eaton, D. L., 2006. Gene-Environment Interactions: Fundamentals of Ecogenetics. John-Wiley and Son Limited.
7. Freeland, J. R., 2005. Molecular Ecology. John-Wiley and Son Limited.
8. Light. A and Rolston III. H. 2003. Environmental Ethics. Blackwell Publishers Ltd. U.S.A.
9. Wenz, P. S., 2001. Environmental Ethics Today, Oxford University Press.
10. Louis P. and Pojman, L. P., 2004. Environmental Ethics: Readings in Theory and Application, 4th edition. Wadsworth Publishing.
11. Light, A., and Rolston, III. H., 2005. Environmental Ethics. Blackwell Publishing Incorporated.
12. Raven, P. H., and Berg, L. R., 2005. Environment, 5th Edition. John-Wiley and Son Limited
13. Bradshaw, V., 2006. The Building Environment: Active and Passive Control Systems, 3rd Edition. John-Wiley and Son Limited.

### **GENERAL VIROLOGY**

**Credit Hours 4(3+1)**

#### **OBJECTIVES**

- To identify major components of viruses.
- System of traits used for classification of viruses.
- Describe how viruses interact with cells.
- Examine the ways that viruses persist in host cells.

#### **Course Detail**

- Principles of electron microscopy.
- Origin and evolution of viruses.
- Nature of animal and plant viruses.
- Classification: structural and functional groups.
- Cell culture: various types of cell lines (plants and animals).
- Replication of viruses (RNA & DNA).
- Principles of viral diagnostic procedures.
- Introduction to bacterial viruses.
- Receptors for bacteriophages, somatic, non-somatic viruses and sex specific viruses. Adsorption sites and mode of replication.
- Transducing viruses of eukaryotes and cross-phylogenetic transfer.
- Prion and viriod.
- Origin of life and Evolution.

#### **Practical**

1. Molecular detection and quantification of viruses.
2. Heme-agglutination Inhibition assays.
3. Chick embryo for propagation of virus and titration.
4. Plaque assay.
5. Transmission electron microscopy (virtual presentation, field trip).
6. Sample preparation for electron microscopy.
7. Isolation and identification of phages from various sources.

#### **Recommended Books**

1. Mahy, B.W.J., & Van Regenmortel, M.H.V., 2008. Encyclopedia of Virology 3rd. Edition. Elsevier 46
2. Cann, A. J., 2011. Principles of Molecular Virology. 5th Edition. Academic Press.
3. Robert, W. Molecular Biology. 2011. McGraw-Hill Sciences
4. Ralf G. Dietzgen, R.F., and Ivan V. Kuzmin, I.V., 2012. Rhabdoviruses: Molecular Taxonomy, Evolution, Genomics,
5. Caister. 2012. Ecology, Host-Vector Interactions, Cytopathology and Control Academic Press. USA.

## **MYCOLOGY**

**Credit Hours 4(3+1)**

### **OBJECTIVES**

- To learn characteristics of fungi for classification.
- Examine fungal metabolism.
- To learn about pathogenic fungi and their infections in plant and animal.

### **Course Detail**

- Introduction to mycology.
- Fundamentals of fungal classification.
- Structure and physiology of fungi.
- Physical and nutritional factors affecting the growth of fungi.
- Structural development and reproduction in fungi including cell cycle.
- Fungal metabolism (with reference to food and beverages).
- Economic impact of fungal plant, animal and human diseases and

their control.

- Mycotoxins.
- Use of fungi in biotechnology.
- Edible fungi.

#### **Practical**

1. Isolation and identification of fungi from:
  - Environment
  - Rhizosphere
  - Clinical samples.
2. Effect of temperature on growth of fungi.
3. Determination of antifungal activity of (nystatin, actidion, amphotericin B etc.)
4. Propagation of edible mushroom.

#### **Recommended Books**

1. Hocking, A.D., Pitt, J.I., Samson, R.A., Thrane, U., 2006. Advances in Food Mycology, Springer.
2. Webster, J. and Weber, R. 2008. Introduction to Mycology, Cambridge University Press.
3. Ainsworth, G.C., 2009. Overview: Introduction to the History of Mycology. Cambridge University Press.
4. Inderjeet K. S. and Surinder K. W., 2010. Text Book of Fungi and Their Allies.
5. Katherine B., Daniel J. E, 2010. Cellular and Molecular Biology of Filamentous Fungi. ASM Press
6. Caister Gioconda, S-B. and Richard, C. A., 2012. Pathogenic Fungi: Insights in Molecular Biology. Academic Press.

## **BIOTECHNOLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

To understand the potentials of microorganisms and utilizations of beneficial microorganisms

#### **Course Detail**

- Introduction to history of biotechnology.
  - Recombinant products expression and transgenic.
  - Design of sterilization systems.
  - Fermentation.
  - Product recovery, waste treatment and safety.
- 
- Biosensors: applications of biosensors, transducer technology, principles of biosensors.
  - Recombinant Protein Production, General aspects of heterologous protein expression.
  - Bacterial expression systems - *Escherichia coli* and *Bacillus subtilis*.
  - *Saccharomyces cerevisiae* as a system for expression of heterologous proteins.
  - Expression in non-*Saccharomyces* yeast species and filamentous fungi and microbial productions of: pharmaceuticals, diagnostic proteins, vaccines, microbial toxins and insecticides.

## **Practical**

1. Isolation and screening microorganism
2. Screening for microbial extracellular metabolites, enzymes and antimicrobial agents
3. Citric acid fermentation.
4. Field trip to an industry with a large scale fermentor.

## **Recommended Books**

1. Tourte, Y., and Tourte, C., 2005. Genetic Engineering and Biotechnology: Concepts, Methods, and Agronomic Applications. Science Publishers.
2. Alex. 2010. Principles of Biotechnology. ADP.
3. Baskar, C., Baskar, S., Dillon, R. S., 2012. Biomass Conversion: The Interface of Biotechnology, Chemistry and Materials Science .Publisher: Springer-Verlag, New York, LLC.
4. Thiemann, W.J., Palladino, M.A., 2012. Introduction to Biotechnology. 3rd Edition. Benjamin Cummings Publishers.
5. Aunger. 2013. Recent Advances in Bacterial Biotechnology, RDM.

## **5<sup>th</sup> Semester**

### **MEDICAL MICROBIOLOGY**

**Credit Hours 3(2+1)**

#### **OBJECTIVES**

- To understand pathogenesis of microorganisms
- To learn basic mechanism of infection and molecular mechanism of Pathogenesis.

#### **Course Detail**

- Introduction: Host-parasite interactions.
- Determination of pathogenicity and molecular mechanisms of pathogenesis.
- Chemotherapy and drug resistance.
- Study of bacterial infections with emphasis on mechanisms of pathogenesis of the following groups: *Streptococcus*, *Staphylococcus*, *Niesseria*, *Pseudomonas*, *Corynebacterium*, *Bordetella*, *Vibrio*, Enterobacteraceae, *Clostridium*, *Bacillus*, *Campylobacter*, *Aeromonas* and *Helicobacter*, *Legionella*, *Mycobacterium*, *Actinomycetes/ Nocardia*, *Chlamydia* and *Mycoplasma*.
- Zoonotic infections.
- Study of viral and rickettsial diseases including epidemic and endemic typhus, AIDS, Hepatitis. Poxviruses and Herpes viruses.
- Protozoan infections with emphasis on Leishmaniasis and Toxoplasmosis.
- Pathogenesis of mycotic infections with particular emphasis on mycetoma.
- Classical and newly emerging pathogens.

#### **Practical**

1. Collection and transportation & microscopic examination of clinical samples.
2. Infections of ear, nose, throat, eye, GIT, urogenital tract (swabs).
3. Isolation and identification of selected micro-organisms.



plasmids at cell division, regulation of plasmid copy number and amplification, incompatibility. Transposons and integrons.

#### **Practical**

- Isolation of Nucleic Acids
- Isolation of Plasmids
- Chromosome staining
- PCR
- Blotting techniques etc
- Mutation study by physical and chemical agents
- Beta galactosidase assays

#### **Books Recommended:**

- Jeremy W. D., S. F. Park (2010) Molecular Genetics of Bacteria, Publisher: Wiley; 5 edition.
- Snyder, L. W. Champness (2007) Molecular genetics of bacteria ASM Press.
- Birge, E. A. (2006) Bacterial and bacteriophage genetics. Birkhäuser.
- McGrath, S., D. V. Sinderen (2007) Bacteriophage: Genetics and Molecular Biology. Caister Academic Press.
- Dale, J., S. F. Park (2006) Molecular Genetics of Bacteria. John Willy and Sons.
- Streips, U. N., R. E. Yasbin (2002) Modern microbial genetics John Wiley and Sons.
- Higgins, P. N. (2004) The Bacterial Chromosome. ASM Press.

### **BIO-SAFETY AND RISK MANAGEMENT**

**Credit Hours 3(3+0)**

#### **OBJECTIVES**

- To learn safe practices for handling of microbes.
- To learn about risky and hazardous environment.
- To learn about the development of safe and healthy environment.

#### **Course Detail**

- Detailed concept of Risk and Hazardous Environment, Chemicals, Biological factors and Radiations.
- Risk assessment & Management: Preventions, Surveillance and Monitoring.
- Judicial rights / Penalties.
- Concepts of Biosafety Environment: Terrestrial, Marine, Atmosphere.
- Designing of labs based on Biosafety and Biological Containment



parameters.

- Details of Biological Containment: Plants, Animals, Microbes.
- Bioethical issues related to Biosafety.
- Biosafety levels.

#### **Recommended Books**

1. Fleming, D.O., and D.L. Hunt, D.L.2006. Biological Safety. Principles and Practices, 4th edition, ASM Press, Washington, D.C.
2. US Health Department. 2010. Biosafety in Microbiological and Biomedical Laboratories Edition 5. Books Express Publishing.US
3. Horst, K.N., 2011. Biosafety Cabinet .Dig Press.
4. Russell, J. Cohn, R., 2012. Biosafety. Bookvika Publisher.

## **MICROBIAL METABOLISM**

**Credit hours 3(2,1)**

### **Course Outline:**

Introduction to microbial growth and metabolism. Energy conversion in microorganisms. Microbial enzymes: classification, chemistry, mechanism of action and inhibition. Mechanisms for generating energy. Catabolism of Glucose; glycolysis, pentose sugar pathway, EmbdenDoudoroff pathway, transition reaction, citric acid (Krebs) Cycle, electron transport chain and chemiosmosis, theoretical ATP yield. Metabolism of carbohydrates other than glucose (disaccharides and polysaccharides). Anaerobic Respiration, fermentation (types, role and Significance). Metabolism of substances other than glucose including; protein, nucleic acid, lipid. Photosynthesis. Light dependent reaction. Light independent reaction (Calvin cycle). Factors that effects the rate of metabolism. Metabolism in stress conditions. Metabolic engineering.

Practical:

identification. Biochemical activities of bacteria. Extraceluar enzymatic activities of microorganisms. carbohydrate fermentation. triple sugar iron test. IMViC test (Indole, methyl red, VogesPrauskaur, and citrate utilization). Hydrogen sulfide test. Urease test. Nitrate reduction. Catalase test. Oxidase test. Utilization of amino acids. Decarboxylase test. Phenyl alanine deminase test.

### **Books Recommended:**

- Presscott/ Harley/Klein. Microbiology 8<sup>th</sup> Edition (2010) McGraw Hill Publisher.

- [McBrewster](#), J., [F. P. Miller](#), [A. F. Vandome](#) (2009) Microbial metabolism. Alphascript Publishing.
- [Gadd](#), J. M., [B. H. Kim](#) (2008) Bacterial Physiology and Metabolism, Cambridge Univ Press.
- Pelczar Jr. M. J., E. C. S.Chain, N. R. Krieg (2006) Microbiology: concepts and Applications. McGraw Hill, Inc. N.Y.
- Cossart, P., P. Boquet, S. Normark, R. Rappuoli (2000) Cellular Microbiology. ASM Press.

## **SOIL MICROBIOLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To understand the ecological interaction of microorganisms.
- To examine the major kinds of interactions of microorganisms.
- To examine the habitats where microorganisms can be found

### **Course Detail**

- Elements of soil formation and conservation.
- Soil microbial population and methods of study with their advantages and disadvantages.

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- Role of microorganisms in mineral transformations with special and detailed emphasis on Carbon and Nitrogen transformations. Brief introduction to Sulphur and Phosphorus.
- Introduction to soil ecology and rhizosphere. Plant-microbe interactions and microbe-microbe interactions and their impact on soil fertility and formation of compost and humus.
- Biotechnological potentials of soil microorganisms.
- Importance of the subject in the agricultural development of Pakistan.
- Problems of salinity and water logging and the methods of land reclamations.
- Microbial remediation: salt, heavy metals and pesticides.

### **• Biofertilizers**

### **• Mycorrhiza.**

### **Practical**

1. Role of microbes in soil formation.
2. Reduction of metallic salts by microbial activity.
3. Buried slide technique.
4. Symbiotic and antagonistic relationship of soil microflora.
5. Cellulolytic activity of soil microorganisms.
6. Isolation of antibiotic producing and pesticide degrading microbes.
7. Effects of biofertilizer on plant growth and health.

### **Recommended Books**

1. Diane Tice, D., 2005. Principles and Applications of Soil Microbiology. 2nd Edition. Oxford University Press.
2. Paul, E.A., 2007. Soil Microbiology, Ecology and Biochemistry .Elsevier Science. Varma, A., 2010. Advanced Techniques in Soil Microbiology: 1st Edition .Springer-Verlag New York, LLC.
3. Geoffrey R. Dixon, G.F., 2010. Soil Microbiology and Sustainable Crop

- Production: 1st Edition. Springer-Verlag New York, LLC
4. Paul, E.A., Study guide for Soil Microbiology, Ecology. Content Technologies, Inc. Publisher
  5. Vallabhaneni, S., 2012. Soil Microbiology- A Laboratory Manual. LAP Lambert Academic Publishing AG & Co. KG.
  6. Carrey. 2013. Recent Advances in Soil Microbiology and Soil Biotechnology. RDM.

## **6<sup>th</sup> Semester**

### **RESEARCH METHODOLOGY & LITERATURE REVIEW**

**Credit Hours 3(3+0)**

#### **OBJECTIVES**

- To introduce the methods involved in research
- To learn about the misconduct, copyright and patents law.

#### **Course Detail**

- Introduction: Research and professions.
- Understanding the research process.
- History and Principles of research ethics.
- Originality of Research.
- Conflicts of interest.
- Copyright and Patent Law.
- Aims of research, the research topic.
- Title and research problem.
- Literature review: Search, retrieve and manage information.
- Research design.
- Parametric, non-parametric and semi-parametric methods.
- Qualitative Methodologies and interpretation of results.
- Conclusions and its validity.
- Report writing and the research proposal.
- Community Research.
- Principles of presentation.
- Communication-oral, posters.
- Abstract and manuscript preparation.
- Communicating your own credentials.
- Communicating own work-CV.

#### **Recommended Books**

1. Ann Bowling, A. and Ebrahim S., 2005. Handbook of Health Research Methods. Open University Press, Two Penn Plaza, New York, NY.
2. Baumgartner, T. and Hensley, L. 2006. Conducting and Reading Research in Health and Human Performance 4th ed. McGraw-Hill, New York.
3. Kumar, R., 2010. Research Methodology: A Step-by-Step Guide for Beginners. 3rd edition. SAGE Publications, London
4. Flick, U., 2011. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project SAGE Publications London
5. Chilisa, B., 2011. Indigenous Research Methodologies SAGE Publications, London.

## **GENERAL IMMUNOLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To understand basis of immunity and cells and organs involved in acquired immunity.
- To understand the role of antibodies and induction of antibody response to antigens.
- To understand the role of vaccines in controlling diseases.

### **Course Detail**

- Introduction: chronological development and scope of immunology.
- Immunity and immune responses: Definitions and types (specific and non-specific). Humoral and cellular immunity.
- Introduction to complement system.
- Cells and tissues of immune system.
- The antigens: structure (simple and complex molecules, proteins and polysaccharides) and immunogenicity.
- Tissue antigens: the Allo- and heterophile antigens. The ABO and Rh blood group systems, their chemical basis, inheritance & clinical significance.
- Immunoglobulin: structure and function; classes, subclasses, types and subtypes; immunoglobulin genetics.
- Immune response to an antigen.
- Introduction to antigen-antibody reactions: methods for detecting antigens and antibodies (agglutination, precipitation, complement fixation, EIA, etc.).
- Introduction to HLA & MHC and its role in immune response, disease and its significance in tissue transplantation.
- Immune-regulation and tolerance.
- Introduction to Cancer immunology.
- Introduction to immunopathology: hypersensitivity reactions, autoimmune diseases and immunodeficiencies.
- Immunization (methods of immunization, vaccines and adjuvants).

### **Practical**

1. Differential leukocyte count.
2. Blood grouping (ABO & Rh).
3. Immuno-diagnostic Methods.
4. Agglutination test (Widal test).
5. Precipitation tests.
6. Gel diffusion test.
7. ICT Test.

### **Recommended Books**

1. Chen, E. R. and Kasturi, S. 2006. Deja Review: Microbiology and Immunology, McGraw-Hill Companies, N.Y.
2. Van Emon, V. M. 2006. Immunoassay and Other Bioanalytical Techniques, CRC Press, F.L...
3. Abbas, A. K., Lichtman, A. H. and Pillai, S. 2007. Cellular and Molecular Immunology, Elsevier Health Sciences, N.Y.

4. Johnson, A. G. G., Ziegler, R. J., Lukasewycz, O. A. and Lukasewycz, O. A. 2007. Microbiology and Immunology: Board Review Series, Lippincot Williams and Wilkins, M.D.
5. Lichtman, A. H. 2007. Basic Immunology. Elsevier Health Sciences, N.Y.
6. Murphy, K., 2011. Janeway's Immunobiology (Immunobiology: The Immune System, 8th Edition. Garland Science Publishers.

## **MOLECULAR MICROBIOLOGY**

**Credit Hours 4(3+1)**

### **Course Outline**

DNA topology. Different forms of DNA; RNA types and secondary structures. Protein chemistry. Replication machinery; Primase, Polymerase, Helicases, Topoisomerases 1, II, Reverse Transcriptase, Gyrase & Telomerase. Role of nucleoid proteins in Gene regulation and transcription. RNA maturation; posttranscriptional modifications and degradation pathways. Posttranslational modifications; Chaperon system in *E. coli* and Yeast. Bacteriophages: control of host gene expression. Ribosomal and non-ribosomal peptide synthesis. Molecular basis of microbial communication and community networking. Techniques in molecular biology; PCR, Gel electrophoresis and blotting techniques. Recombinant DNA technology and molecular cloning; DNA cutting and joining reactions

### **Practical**

1. Plasmid extraction.
2. Nucleic acid extraction (DNA & RNA).
3. PCR
4. Gel Electrophoresis
5. DNA Sequencing

### **Books Recommended:**

- Virology: Molecular Biology and Pathogenesis (2010) American Society Microbiology ISBN-10: 1555814530, USA
- Kevin V. Morris (2008) RNA and the Regulation of Gene Expression: A Hidden Layer of Complexity, Caister Academic Press ISBN: 978-1-904455-25-7 USA
- Gerald Karp (2007) Cell and Molecular Biology, 5<sup>th</sup> Edition, John Wiley & Sons Inc ISBN-13: 9780470042175
- Darnell Jr. J., Lodisch, H. and Baltimore, D., (2007). Molecular Cell Biology, 6<sup>th</sup> Edition, W.H. Freeman & Co. USA
- Lehninger, A.L., Nelson, D.L. and Co. N.M., (2000). Principles of Biochemistry. Worth Publishers, N.Y.
- Daphne C. Elli (2005) Biochemistry And Molecular Biology Oxford University Press UK ISBN: 0199271992

## **MICROBIAL PHYSIOLOGY**

**Credit hours 3(2,1)**

### **Course Outline:**

Introduction to microbial physiology and its implications in genomic era; genomic proteomics and traditional tools. Cell structure and function; eukaryotic nucleus, bacterial nucleoids, cytoskeleton microbial cell surfaces, capsules, organ of locomotion, pili and fimbriae. Cytoplasmic membranes, periplasmic spaces, permeability and transport . ATPase complexes in bacterial membranes: Architecture and Mechanics. Cell signaling. Microbial cell division. Factors effecting growth of microorganisms. Microbial stress responses: osmotic, oxidative, pH, thermal and nutrient stress. osmoregulation, aerobic and anaerobic regulation, acid tolerance, heat shock and starvation responses. Metabolic channeling. Gene regulation under stress condition. Quorum sensing and biofilm formation. Microbial cell differentiation: sporulation, endospore formation, activation, germination and outgrowth of microbial spores. Molecular basis of sporulation.

### **Practical:**

Environmental factors affecting growth of microorganisms. pH. Temperature. osmotic pressure. Oxygen. Qualitative and quantitative analysis microbial enzymes: , protease, amylase, lipase.

### **BOOKS RECOMMENDED**

- Prescott/Harley/Klein (2010) Microbiology, 8<sup>th</sup> Edition, McGraw Hill Publisher.
- Moat, A. G., J. W. Foster, M. P. Spector (2009) Microbial Physiology, 4<sup>th</sup> Edition, John Wiley & Sons, Inc.
- Poole, R. K. (2009) Advances in Microbial Physiology Publisher: Academic Press.
- Gerday, C., N. Glansdorff (2007) Physiology and Biochemistry of Extremophiles. ASM Press.
- White, D. (2006) Physiology and Biochemistry of Prokaryotes, 3<sup>rd</sup> Edition, Oxford University Press.

## **MEDICAL VIROLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To understand different systems used for classification of viruses.

- To learn viral multiplication, pathogenesis and viral oncogenesis.

### **Course Detail**

- Classification and structure of medically important viruses.
- Host cells for viral multiplication, productive infections.
- Introduction to the replication of viral genome.
- Maturation and release of viruses.
- Special features of molecular biology, biochemistry and genetics of the following viruses: Picornaviruses, Poxviruses, Myxoviruses, Paramyxoviruses, Rubella viruses, Rhabdoviruses, Reoviruses, Herpes viruses, Hepatitis viruses, Retroviruses and Tumor viruses (DNA & RNA), Adenoviruses, Coronaviruses.
- Viruses of Zoonotic significance.
- Virus-host interactions.
- Genetics of viruses shift and drift.
- Diagnostic procedure for viral infections including isolation identification and serology.
- Antiviral agents, viral prophylaxis.
- Interferon and chemotherapeutic agents.

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- Emerging viral infection.

### **Practical**

1. Chick embryo inoculation.
2. Enzyme Linked Immunosorbent Assay (ELISA).
3. Haemagglutination Inhibition (HI).
4. Haemagglutination (HA).
5. Precipitation.
6. Cytopathic effects.
7. Animal inoculation.
8. Fluorescent Antibody Test (FAT).
9. Polymerase Chain Reaction (PCR).

### **Recommended Books**

1. Strauss, J. H., Ellen G. Strauss, E.G., 2007. Viruses and Human Disease. Elsevier Science.
2. Mettenleiter, T.C., and Francisco Sobrino, F., 2008. Animal Viruses: Molecular Biology. Caister Academic Press
3. Shi, P.Y., 2012. Molecular Virology and Control of Flaviviruses. Caister Academic Press
4. Stent, G.S., and Dohm, J.L., 2012. Molecular Biology Of Bacterial Viruses. Literary Licensing, LLC.
5. Maramorosch, K., and Frederick A. Murphy, F.A., 2013. Advances in Virus Research Elsevier Science.

## **7<sup>th</sup> Semester**

### **FOOD MICROBIOLOGY**

**Credit Hours 3(2+1)**

#### **OBJECTIVES**

- To learn about the relevance of microbes with food industries

- To learn about food related microorganism.
- To learn about microbial food spoilage and its control.

### **Course Detail**

- Introduction and scope of food microbiology
- Food related microorganisms their classification, genetics and biochemistry.
- Sources of microorganism in food.
- Microbial interaction, attachment and growth.
- Factors influencing microbial growth in food environment.
- Lactic acid producing bacteria (LAB) in food and their important metabolites: bacteriocins, lantibiotics, probiotics and enzymes.
- Applications of LAB in food technology.
- Traditional fermented food; microbiology of fermented foods
- Microbial food spoilages; Factors and microbial metabolites.
- Food borne pathogens, infection, toxification and indicators of food borne pathogens.
- Control of microbes in food by physical, chemical and biological methods.
- Introduction to hurdle technology.
- HASSAP.

### **Practical**

1. Detection of food borne pathogens.
2. Total viable count.
3. Detection of mycotoxins and toxins.
4. Application of hurdle technology.
5. Visits to food industries: Brewery, Fisheries and food factories.

### **Recommended Books**

1. Ray, B. 2007, Fundamental Food Microbiology, 4th edition, CRS Press New York.
2. Montville, T. J. & K. R. Matthews. 2008. Food Microbiology: An Introduction, 2nd Edition ASM Press, USA.
3. Weidmann M. and W. Zhang. 2011 Genomic of food borne bacterial pathogens (Food Microbiology and food Safety) 1st Edition. Springer, ISBN-13: 978-14419765857.
4. El Mansi, E. M. T. et al. 2011. Fermentation, Microbiology and Biotechnology. CRC Press.
5. Michael, P. D. and Robert, L. B. 2012, Food Microbiology: Fundamentals and Frontiers. ASM Press.
6. Thomas, J. M., Matthew, K. R. and Kniel, K. E. 2012, Food Microbiology: An Introduction. ASM Press.

## **GENETIC ENGINEERING**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To learn basic techniques used in recombinant DNA technology.
- To understand the potential problems related to genetic engineering.

### **Course Detail**

- Introduction and scope.



- Restriction and modification system.
- Properties of restriction endonucleases, their occurrence and recognition sequences. Assay procedures for restriction endonucleases and slab gel electrophoresis. Practical uses of endonucleases. Role in genetic engineering.
- Construction of cloning vector by  $\lambda$ -phage.
- *In vitro* genetic engineering; cloning vehicles: plasmids, cosmids and phagemids, YAC and BAC etc.
- Principles of nucleic acid isolation (DNA & RNA).
- Cloning strategies: construction of chimeric plasmids.
- Methods of introducing exogenous DNA.
- Methods for screening the clones.
- DNA sequencing.
- PCR: its application and primer designing.
- Prokaryotes and Eukaryotes Expression systems.
- Labeling methods of probes.
- Construction of genomic libraries.

#### **Practical**

1. Methods of nucleic acid isolation (DNA & RNA).
2. Slab gel electrophoresis.
3. Restriction enzyme digestion of DNA.
4. Transformation.
5. Southern blotting.
6. Electro blotting.

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#### **Recommended Books**

1. Meyers, R.A., 2006. Genomics and Genetics . John-Wiley and Son Limited.
2. Primrose, S.B., and Twyman, R.M. 2006. Gene Manipulation and Genomics 6th edition. Blackwell Publishing.
3. Snustad, D.P., and Simmons . M.J., 2012. Genetics, 6th Edition. John Wiley and Sons.
4. Snustad, D.P., and Simmons . M.J., 2011. Principles of Genetics, 6th edition. John Wiley and Sons.
5. James, D. W. 2013 Molecular Biology of Gene. Benjamin Cumming

## **CELL & TISSUE CULTURE TECHNOLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To understand the process of tissue culture technology.
- To study the nutritional and physical requirements of primary cell culture and established cell lines.
- To use as viable media for the cultivation of viruses; and in diagnosis
- To understand the cellular differentiation.

### **Course Detail**

- History and application of cell culture.
- The eukaryotic cell: general structure and function, cell cycle, chromosomes, polyploidy, polytene and karyotypes.
- Nutritional requirements, growth and metabolism of cells, and growth

control, topoinhibition, source substitutes, pH regulation.

- Outlines of methodology of plant, insect and animal cell and tissue culture.
- Cell culture, cell types and morphology of cells in culture.
- Primary and secondary culture, cell strains and established cell lines.
- Establishment of cell lines.
- Establishment of clones of plant and animal cells.
- Lymphoid cells culture.
- Transformed cells: growth control of mouse fibroblasts and malignancy, the normality of 3T3 fibroblasts cell lines from tumors.
- Genetics of cells in culture. Origin of mutant cell lines. Negative selection: heterokaryons, malignancy of hybrids.
- Differentiated, serum dependent normal cells. Role of cyclic nucleotides.
- Selective cell line and their specialized uses (HeLA, Vero, 3T3 fibroblast, WEHI, etc.)
- Tissue culture and virology (CPE, Plaque Assay).
- Applications of plant tissue culture.
- Stem cell technology.

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### **Practical**

1. Starting a primary culture (tissue digestion, cell count and cell culture).
2. Maintenance of a cell line.
3. Cryopreservation of cell line.
4. Plant cell culture.
5. Vital staining.
6. Organ culture

### **Recommended Books**

1. Halford, N., 2006. Plant Biotechnology: Current and Future Applications of Genetically Modified Crops .John Wiley and Sons Limited.
2. Vunjak-Novakovic, G., Freshney, R.I., 2006.Culture of Cells for Tissue Engineering.1st Edition Wiley, John & Sons
3. 2013. Principles of Tissue Engineering. Elsevier Science
4. Freshney, R.I., 2006. Culture of Animal Cells: A Manual of Basic Technique. 5th Edition. Wiley, John & Sons.
5. Neumann, K-H., Kumar,A., Imani, J., 2009. Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application .1st Edition. Springer-Verlag New York, LLC.
6. Abbot. 2013. Recent Advances

## **CLINICAL BACTERIOLOGY**

**Credit Hours 4(3+1)**

### **OBJECTIVES**

- To explore the general nature of relationship between human and microorganisms
- To identify the major factors determining virulence and their genetic basis

### **Course Detail**

- An introduction to clinical bacteriology.
- Hazards in clinical microbiology laboratory.
- Role and importance of normal flora in different parts of body.
- Respiratory tract infections.
- Infections of eye ear and skin.
- Fluids from infected joints, CSF, pleural and peritoneal fluids.

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- Differential diagnosis of selective systemic bacterial infections of GIT, genito-urinary, cardiovascular and central nervous system.
- Nosocomial infections: community acquired infection, prevention and control.
- Principles of conventional, rapid and molecular diagnostic procedures.

### **Practical**

1. Good laboratory practices.
2. Collection and processing of different clinical specimen for isolation and identification of pathogens.
3. Antibiotic sensitivity test by various techniques.
4. Conventional, rapid and molecular diagnostic methods.

### **Recommended Books**

1. Murray, P. R., Rosenthal, K. S., Pfaller, M. A., Tenover, K. C., Tenover, K. S., 2005, Medical Microbiology: Elsevier Health Science.
2. Hawkey, P.M., Gillespie, S.H., Hawkey, P., 2006. Principles & Practice of Clinical Bacteriology. 2nd Edition. Wiley, John & Sons.
3. Woodford, N. Johnson, A.P., 2010. Genomics, Proteomics, and Clinical Bacteriology: Methods and Reviews. 1st Edition. Springer-Verlag New York, LLC.
4. Versalovic, J., 2011. Manual of Clinical Microbiology, 10th Edition. ASM Press
5. Vinay, K., 2011. Robbin's and Ctran Pathologic Basis of Disease Saunder.

## **8<sup>th</sup> Semester**

### **EPIDEMIOLOGY, PUBLIC HEALTH AND BIOETHICS**

**Credit Hours 3(2+1)**

#### **OBJECTIVES**

- To develop the understanding of epidemiology.
- To use different mathematical tools of epidemiology.
- To learn and examine the descriptive and analytical epidemiology.

#### **Course Detail**

- Introduction to epidemiology: Types of epidemiology, clinical, occupational, experimental, interrelation of factors.
- Epidemiological methods, incidence, prevalence, rate, susceptibility etc.
- Types of studies, cross sectional, cohort, case control.
- Epidemiologic consideration in disease process.
- Cyclicity of diseases: Chicken Pox, Measles.

- Health information and biostatistics.
- Sampling methodology: procedure, sample size, cluster sampling, sampling error, bias, risk, data collection of infectious disease cases, antibiotic resistance profile of infectious agents.
- Screening tests, accuracy of screening tests, predictive value, reliability.
- Epidemiological polarization.
- Disease pattern in community & Social diversity
- Flu, common cold and prevailing pandemics and epidemics.
- Surveillance, prevention, control and eradication of disease.
- Status of health services in Pakistan: comparison with other countries.
- Predisposing factors of epidemics in developed countries and a comparison with the existing factors in Pakistan.
- Bioethics.

### **Practical**

- Questioner based survey to determine the current infections and prevailing infections.
- Application of statistical tools for data analysis.

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### **Recommended Books**

1. Ziegler, A., and Koenig, I. R., 2006. A Statistical Approach to Genetic Epidemiology: Concepts and Applications. John-Wiley and Son Limited. Khardori, N., 2006. Bioterrorism Preparedness: Medicine - Public Health Policy. John Wiley and Sons limited.
2. Fos, P.J., 2010. Epidemiology Foundations: The Science of Public Health: 1st Edition. Wiley, John & Sons, Incorporate
3. Friis, R.H., 2010. Epidemiology for Public Health Practice: 4th Edition .Publisher: Jones & Bartlett Learning.
4. Baily, S., 2012. Introduction to Epidemiologic Research Methods In Public Health Practice. Jones & Bartlett Learning.
5. Rothman, K.J., 2012. Epidemiology: An Introduction: 2nd Edition .Oxford University Press.

## **IMMUNOBIOLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To understand body defense mechanism against infections.
- To learn cells and tissues involved in antibody production.
- To learn surface markers for identification of cells of immune system.

### **Course Detail**

- The immune system: organs constituting the immune system, their location in the human body and basic architecture.
- The immunocompetant cells: their origin, surface markers, population and sub-populations. Immunological characterization and functions.

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- Antibody induction and production: antigen and antibody metabolism. Cells involved in cellular sequence of events. Kinetics of antibody synthesis.
- The role of T-cells and immunoglobulins in the immune response.

- Immunologic memory: positive and negative. Phenomenon of natural tolerance.
- Manifestations of antigen-antibody reactions including precipitation, agglutination, complement fixation and neutralization.
- Cellular immune response and its characterization.
- Basics and applications of ELISA, RIA, immunofluorescence and immunoblotting. Lab work pertaining to above course.
- Immuno suppression a need, agents.
- Animal handling practices.

#### **Practical**

1. Culture of immune cells.
2. Phagocytosis specific and non-specific.
3. Detection of B-cells.
4. Hemolytic plaque assays.
5. Immunization of animal with soluble and particulate antigens.
6. Latex agglutination
7. Immunochromatography
8. C reactive proteins

#### **Recommended Books**

1. Paul, W., 2006. Fundamental Immunology. Fifth Edition. Lippincott Williams and Wilkins.
2. Lichtman., A. H., 2007. Basic Immunology. Elsevier Health Sciences.
3. Abbas, A. K., Lichtman, A. H., and Pillai., S., 2007. Cellular and Molecular Immunology: Elsevier Health Sciences.
4. Murphy, K., 2011. Janeway's Immunobiology (Immunobiology: The Immune System .8th Edition. Garland Science Publishers.
5. Kenneth Murphy, K., Travers, P., Walport , M., 2011. Janeway's Immunobiology. 8th Edition, Taylor & Francis.

## **BIOINFORMATICS**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To learn the details of proteins structure and their bioactive configuration.
- To learn about computational analysis of proteins structure and functions
- To learn about computational tools for protein and nucleic acid analysis.

### **Course Detail**

- Amino acids and their properties.
- Protein structure classification and super folds.
- Mechanisms of protein folding and folding pathways.
- Role of chaperones in protein folding.
- Experimental techniques for characterizing membrane protein structure and function.
- A case study: proteases - function and mechanisms.
- Simple sequence analysis - use of hydropathy plots.

- Introduction to sequence databases.
- Comparing sequences against sequence databases.
- Predicting protein coding regions.
- Prediction of protein structure from sequence data.
- Genome sequencing projects.
- Bioinformatics and genome analysis.

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- Protein, protein docking.
- Experimental methods for determining protein structure.
- Protein domains.

#### **Practical**

1. Demonstration of the use of Web based tools for Bioinformatics analysis.
2. BLAST, SWISSPROT etc.

#### **Recommended Books**

1. Bujnicki, J.B., 2009. Prediction of Protein Structures, Functions, and Interactions. Wiley, John & Sons, Incorporated
2. Peirce, M.J., and Wait, R., 2010. Membrane Proteomics: Methods and Protocols. 1st Edition.. Springer-Verlag New York, LLC
3. Rigden, D.J., 2010. From Protein Structure to Function with Bioinformatics. 1st Edition. Springer-Verlag New York, LLC
4. Jeremy W. D., Malcolm V. S. and Nicholas P. 2011. From Gene to Genome. Wiley.
5. Kanwal, S., Nishat, S., Khan, I.M., 2012. Bioinformatic Approaches to Structure and Function of Protein LAP Lambert Academic Publishing AG & Co. KG.

## **ENVIRONMENTAL MICROBIOLOGY**

**Credit hours 4(3,1)**

#### **Course Outline:**

Introduction, scope and applications of environmental microbiology. Microorganisms as a component of ecosystem. Role of microorganisms in nutrients recycling. An introduction to environmental pollutants and their impact. Bioremediation: types and Applications. Biodegradation of hazardous organics. Microbial transformation. Bioleaching. Biological control. Microbiology of Natural water, Drinking water and Waste water. Wastewater Treatment: Integrated Approach. Microbial indicators: quality monitoring aspects. Biosensors as environmental monitors. Communicating environmental health risks. Biological aerosols as a hazardous source for humans.

#### **Practical:**

Soil and water analysis (BOD, COD, EC, TDS, TSS, TOC, nitrates, sulfate, phosphates). Techniques in microbial ecology :

### **Books Recommended:**

- Mitchell, R., Ji-D. Gu (2010) Environmental Microbiology. 2<sup>nd</sup> Edition, Wiley & Sons, Inc., Hoboken, New Jersey.
- Madsen, E. L. (2008) Environmental Microbiology, Blackwell Publishing, 350 Main Street, MA 02148-5020, USA.
- Pradipta K., I. K. Mohapatra (2008) Textbook of Environmental Microbiology, International House Pvt. Ltd..
- Hurst, C. J. R. L. Crawford (2001) Manual of Environmental Microbiology, ASM Press.
- Verman, A. H, Evans, M. G. (2000) Environmental Microbiology. ASM Press.

## **VETERINARY MICROBIOLOGY**

**Credit Hours 3(2+1)**

### **OBJECTIVES**

- To learn about viral and bacterial infections of animals and birds.
- To learn about common pathogens of human and animals.
- To get know how of symptoms, diagnosis, epidemiology and control of veterinary infections.

### **Course Detail**

- Study of major animal diseases in Pakistan. Etiology, Symptomatology, Immunology, Epidemiology, diagnosis, and prevention.
- Tuberculosis, Anthrax, Brucellosis, Johne's Disease, Bovine Mastitis, tick fever, Salmonellosis (including Pullorum).
- Rabies, Foot and Mouth Disease. New castle Disease, Infectious laryngotracheitis, Fowl pox, Sore Mouth of sheep and goats, avian influenza, infectious bursal disease (Gumboro), hydropericardium syndrome (Angara).
- Importance of Zoonoses in Pakistan.
- Quarantine and international control of animal livestock farming.

### **Practical**

1. Isolation of etiological agents of infections in animals.
2. Isolation of etiological agents of infections in poultry.
3. Mode of immunization of birds and animals.
4. Field trips.

### **Recommended Books**

1. Martin E., Jones, H., William T. and Hubbert, V. H., 2005. Zoonoses: Recognition, Control and Prevention, Blackwell Publishing.
2. Mettenleiter, T. C and F. Sobrino, F., 2008. Animal Viruses: Molecular Biology Caister Academic Press.
3. Songer, J. G., and Post, K., 2009. Veterinary Microbiology: Bacterial and Fungal Agents of Animal Disease. 1st Edition. Wiley, John & Sons, Incorporated.
4. Quinn, P.J., Markey, B.K., Leonard, F.C., Hartigan, P., Fanning,

S.,2012.Veterinary Microbiology and Microbial Disease. Wiley, John & Sons, Incorporated.



# M.phil APPROVAL

## ITEM # 2: APPROVAL OF CURRICULUM OF M.phil MICROBIOLOGY PROGRAM

The curricula for M.phil Microbiology program and Eligibility criteria was decided according to HEC and course codes were designed according to SBBWU,Peshawar rules. It was then presented before the Board of Studies Members for their consideration and further recommendation by academic council.

**Decision:** The board after having detailed discussion expressed their satisfaction over the M.phil Microbiology program curriculum, Eligibility criteria and course codes.

### Eligibility Criteria:

1. Candidate with 2.5 CGPA, after 16 years of Education in Biological field is eligible to apply for M.phil Program.
2. The GAT-General with minimum 50% cumulative score OR In House/ Departmental test with minimum of 60% score will be required for admission in M.phil.
3. For award of M.phil Degree, candidate will need to complete Course work of 24 credit hours with research work/thesis of 06 Credit hours.

### Curriculum:

Course topics in each area are defined below and the board of studies at each institution will decide contents.

Each student must successfully complete at least 80% of course prior to starting his / her research project. One whole year shall be devoted to research will be novel and regional at the beginning of the research a thesis / research committee consisting of three senior Professor and the supervisor will be appointed and this committee will overseas the research proposal and progress. The conclusion of the research the thesis will be examined by and external examined from outside the university pointed by the board of study

#### 1<sup>st</sup> Year

##### Core courses

- |                               |               |
|-------------------------------|---------------|
| 1. Proteomics & Genomics      | 3 Credit Hrs. |
| 2. Instrumentation techniques | 3 Credit Hrs. |

## CORE COURSES

### PROTEOMIC AND GENOMIC

1. Introduction to Proteomics and Genomics
2. Genome Diversity and Evolution
3. Gene to Genome (Comparison of Pro and Eukaryotic Systems)
4. Data base search in genomic, retrieval and analysis
5. Gene to protein
6. Posttranslational modification.
7. Folding and 3D Structures
8. Computer Modeling of Biological Molecular
9. Data Base search in proteomic
10. X-Ray Crystallography, Principle and Interpretations.
11. Principle and Application of Gene and Protein Arrays.

### Recommended Books

1. Barnes, M.R. and Gray, I.C., 2005. Bioinformatics for Geneticists John Wiley & Sons limited.
2. Barnes, M.R. and Gray, I.C., 2005. Bioinformatics for Geneticists John Wiley & Sons limited.
3. Campbell, A.M., and Heyer, L.J., 2002. Genomics, Proteomics and Bioinformatics. Benjamin Cumming,
4. Dardel, F., Képès, F. and Hardy, N., 2006. (Bioinformatics: Genomics and Post-Genomics). John Wiley & Sons limited.
5. Dardel, F., Képès, F. and Hardy, N., 2006. (Bioinformatics: Genomics and Post-Genomics). John Wiley & Sons limited.
6. Kinter ,M., and Sherman , N.E., 2000. Protein Sequencing and Identification Using Tandem Mass Spectrometry. John Wiley and Sons Limited.
7. Liebler, D.C., 2001. Introduction to Proteomics, Tools for the New Biology. Humana Press.
8. Meksem, K., and Kahl, G., 2005. The Handbook of Plant Genome Mapping: Genetic and Physical Mapping. John Wiley and Sons Limited.
9. Mount, D.W., 2001. Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press.
10. Mount, D.W., 2001. Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press.
11. Nakamura, H., and Arisaka, F., 2005. Architecture and Physical Properties of Proteins, Biophysical Society of Japan.
12. Nakamura, H., and Arisaka, F., 2005. Architecture and Physical Properties of Proteins, Biophysical Society of Japan.
13. Nelson, P., 2003. Biological Physics: Energy, Information, Life, W. H. Freeman.
14. Nelson, P., 2003. Biological Physics: Energy, Information, Life, W. H. Freeman.
15. Pannington, S. and Dunn, M.J., 2001. Proteomics: From protein sequence to function Springer- Verlag.
16. Schomburg, D., and Lessel, U., 1995. Bioinformatics: From Nucleic Acids and Proteins to Cell Metabolism. Wiley. John & Sons.
17. Schomburg, D., and Lessel, U., 1995. Bioinformatics: From Nucleic Acids and Proteins to Cell Metabolism. Wiley. John & Sons.
18. Sensen, C.W., 2005. Handbook of Genome Research: Genomics, Proteomics, Metabolomics, Bioinformatics, Ethical and Legal Issues, John Wiley and Sons Limited.

## **INSTRUMENTATION AND ANALYTICAL TECHNIQUES**

Principles and Applications of various techniques in Biology

Confocal Microscopy

Ultracentrifugation

Spectroscopy

Isoelectric Focusing

Chromatography (TLC, GC, CLS, HPLC, Affinity and Ion Exchange)

Photographic techniques (simple and microphotography)

Amplification of DNA

Use of computer for genetic analysis

DNA and Amino acid sequencing

Kinetics of molecular Hybridization

Southern, Western, Northern blotting and FISH

Labeling Techniques of Probes (Isotopes, Fluorescence,  
Chemiluminescence, and other Chromogenic substances)

Tests for Chemical Carcinogens

Microarray Chips

Flow Cytometry

Electroporation and Microinjection

### **Recommended Books**

1. Louise, O'C., 2006. [Diagnostic Bacteriology Protocols, Second Edition](#), Humana Press, Inc. Scientific and Medical Publishers, 999 Riverview Dr, Ste 208, Totowa, NJ 07512
2. Hydar, A. and Haribabu, B., 2006. [Transmembrane Signaling Protocols, Second Edition](#), Humana Press Inc. Scientific and Medical Publishers. 999 Riverview Dr, Ste 208 Totowa, NJ 07512
3. Vaughn, P. 2000. DNA Repair Protocols: Prokaryotic Systems, Methods in Molecular Biology, Volume 152, Clifton, New Jersey.
4. Stanley. R., 1990. Experimental Techniques in Bacterial Genetics, Jones and Bartlett series in Biology, Jones and Bartlett, Boston.
5. Griffin, H G., and Griffin, A. M., 2000. DNA Sequencing Protocols Methods in Molecular Biology, Volume 23, Humana Press, Inc. Scientific and Medical Publishers, 999 Riverview Dr, Ste 208 Totowa, NJ 07512.
6. Isaac, P. G., 1994. Protocols for Nucleic Acid Analysis by Nonradioactive Probes, Methods in Molecular Biology, Number 28, Humana Press, Inc. Scientific and Medical Publishers, 999 Riverview Dr, Ste 208 Totowa, NJ 07512.

## OPTIONAL COURSES

Following area of specialization are recommended student would take six courses in any area of specialization four credit Hors each course.

### 1. Health & Medical Microbiology

- a. Molecular Pathogenesis
- b. Epidemiology: Analytical & expedited Approaches.
- c. Molecular Virology.
- d. Molecular Cancer Biology
- e. Gene and Gene Activity
- f. Advance Molecular Diagnostic
- g. Molecular Mechanism of Anti microbial drugs.

### 2. Agriculture

- a. Microbial Techniques in Horticulture
- b. Plant viral Diseases
- c. Pathogenic of Plant Diseases
- d. Microbiology of Soil and Bioremediation
- e. Current development in Diagnosis of Plant Diseases.
- f. Advance Veterinary Microbiology
- g. Control of Plant Microbial Disease.

### 3. Industry

- a. Fermentations and its industrial application
- b. Microbial Strain development for Industry
- c. Bioreactors & Bioprocess
- d. Microbial Enzyme Technology
- e. Vaccine Development
- f. Biopolymers & Microbial Pharmaceutics
- g. Microbial Pollution and Waste Management.

### 4. Food and Dairy

- a. Food Borne Diseases
- b. Pathogens of Aquatic Animals
- c. Advances in Dairy Microbiology
- d. Microbes & Poultry
- e. Current Advances in Food Preservation and Packaging
- f. Innovations in Microbial Fermentation Technology.

The structure of M.Phil Microbiology Program will be as follow:

1<sup>st</sup> Semester

| S.No | Subject                 | Course code | Credit hours |
|------|-------------------------|-------------|--------------|
| 1    | Proteomics and Genomics | MB-711      | 3            |
| 2    | Molecular Pathogenesis  | MB-712      | 3            |
| 3    | Advanced Immunology     | MB-713      | 3            |

|                           |                      |        |           |
|---------------------------|----------------------|--------|-----------|
| 4                         | Plant Viral Diseases | MB-714 | 3         |
| <b>TOTAL CREDIT HOURS</b> |                      |        | <b>12</b> |

2<sup>nd</sup> Semester

| S.No                               | Subject  | Course code | Credit hours |
|------------------------------------|--|-------------|--------------|
| 1                                  | Instrumentation and analytical techniques  | MB-721      | 3            |
| 2                                  | Advanced Molecular Diagnostics   | MB-722      | 3            |
| 3                                  | Fermentation and its industrial applications   | MB-723      | 3            |
| 4                                  | Biopolymers and microbial pharmaceuticals  | MB-724      | 3            |
| <b>TOTAL CREDIT HOURS</b>          |  |             | <b>12</b>    |
| 5                                  | <b>*3<sup>rd</sup> and 4<sup>th</sup> semester will comprise of Research Project and Thesis with course code MB-831.</b> |             | <b>06</b>    |
| <b>Grand Total of Credit Hours</b> |  |             | <b>30</b>    |

### Research Project:

1. Duration of the research project will be at least one full year. An independent research topic chosen by the student and supervised by a full-time faculty member of the department is required for all students in M.Phil Microbiology.
2. The research work of each student will be reviewed periodically by the supervisor/head of department to ensure the objectives laid down for study are being met.
3. All students must present and defend their research work before the panel of examiners as per the rules of the university.

In the end, the honorable members were thanked for their valuable guidance and support.

\_\_\_\_\_  
Incharge,  
Department of Microbiology

\_\_\_\_\_  
Registrar

\_\_\_\_\_  
Dean, Faculty of Social



