



**SHAHEED BENAZIR BHUTTO WOMEN
UNIVERSITY PESHAWAR**

**AGENDA FOR THE MEETING OF BOARD OF STUDIES
DEPARTMENT OF MICROBIOLOGY**

**Venue
Committee Room, Main Campus,
Shaheed Benazir Bhutto Women University,
Peshawar**

**Main Campus,
Landay Sarrak, Charsadda, Peshawar
Phone Number: 091-9224708**



THE REGISTRAR
SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

University Avenue Charsadda road, Larama, Peshawar
Email: academics@sbbwu.edu.pk, Phone .No: 091-9224708

No: ____/MB/BOS/ACAD-II/SBBWUP
Dated: Tuesday, 30th April, 2019

To

All Members,
Board of Studies, Department of Microbiology,
Shaheed Benazir Bhutto Women University, Peshawar

Subject: MEETING OF BOARD OF STUDIES, DEPARTMENT OF MICROBIOLOGY

Respectable Sir/Madam,

Reverentially, I am directed to intimate that the subject meeting will be held in the Committee Room, Main Campus, Shaheed Benazir Bhutto Women University Peshawar. The Agenda for the meeting is enclosed herewith for your kind perusal.

Your partaking in the meeting is solicited please.

With profound regards,

Yours Sincerely,

Registrar

Encl. (As Above)

No:_____/DEAN/SBBWUP

Copy to:

1. The Treasurer, SBBWUP.
2. The Administrative Officer, SBBWUP.
3. The RAD, SBBWUP.
4. The Assistant Registrar Academics, SBBWUP.
5. P.S. to Vice Chancellor.

Registrar



**AGENDA FOR MEETING OF BOARD OF STUDIES
DEPARTMENT OF MICROBIOLOGY**



**MEETING OF BOARD OF STUDIES
DEPARTMENT OF MICROBIOLOGY**

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SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

Vision and Mission Statement of University

Vision:

Shaheed Benazir Bhutto Women University aspires for excellence in learning, education, creativity, research and innovation.

Mission:

The mission of Shaheed Benazir Bhutto Women University is to contribute to the society through transformative power of education and research with a focus on diversity, linkages, entrepreneurship, creativity and innovation. We aim to prepare individuals with problem solving attitude, humanistic outlook, critical thinking and the ability to respond to socio-economic challenges.

Introduction to Department of Microbiology

Vision

The vision of the department is to provide high quality research based institute for female of KPK, according to International Standards that leads to discovery of novel principles and microbiological processes and its application in various fields of Microbiology.

Mission Statement of Department

The mission of Department of Microbiology is to prepare skilled and ethical professionals by providing the quality education, through diverse learning environment, by providing equipped laboratories and through Internship and Research Programs in renowned Research Institutes, under the supervision of highly qualified and experienced staff.

Mission Statement of Program

The primary mission of the Graduate Program in Microbiology is to equip work force with skills in the areas of basic and applied microbiology by providing research based teaching necessary to meet the needs of growing field of Microbiology. To meet this goal we give them research based teaching necessary to meet the needs of advancements in microbiology.



**SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR**

**ITEM # I: APPROVAL OF COURSE CODE POLICY ACCORDING
TO SBBWU**

SCHEME & COURSES OF STUDIES FOR BS IN MICROBIOLOGY



DEPARTMENT OF MICROBIOLOGY

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

All Codes for complete program are classified as:

S. No	Compulsory Courses	Symbol of Code	Alphabetical	Level of Study/Year	Semester
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			Code		
1.	English-I	Will be given by other Department	Will be given by other Department	3	1
2.	Pakistan Studies	Will be given by other Department	Will be given by other Department	3	2
3.	Mathematics	Will be given by other Department	Will be given by other Department	3	1
4.	English-II	Will be given by other Department	Will be given by other Department	3	2
5.	Islamic studies	Will be given by other Department	Will be given by other Department	3	2
6.	Intro. to computer sciences	Will be given by other Department	Will be given by other Department	3	2
7.	Biostatistics/ Mathematics II	Will be given by other Department	Will be given by other Department	4	3
8.	English-II	Will be given by other Department	Will be given by other Department	4	3

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR
EX-POST FACTO APPROVAL OF COURSE CODES
SCHEME OF STUDIES MICROBIOLOGY BS 4-YEAR PROGRAM (SESSION- 2016, 2017,
2018)

S.NO	SEMESTER	COURSE TITLE	COURSE CODE	Theory	Practical	CREDIT HOURS
1.	1 st	English-1	ENG-301	3	0	3
2.		Pakistan Studies	PST-323	2	0	2
3.		Fundamentals of Microbiology – I	MB-301	3	1	4
4.		Biodiversity of Animals	ZOL-302	2	1	3
5.		Mathematics – I (Basic Calculus)	MTH-307	3	0	3
6.		General Chemistry	CHM-3_ _	2	1	3
Total Credit Hours				15	3	18
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
7.	2 nd	English-II	ENG-302	3	0	3
8.		Islamic Studies	ISL-320	2	0	2
9.		Fundamentals of Microbiology – II	MB-302	3	1	4
10.		General Genetics	MB-303	2	1	3
11.		Integral Calculus	MTH-308	3	0	3
12.		Biochemistry	BCHM-321	2	1	3
Total Credit Hours				15	3	18
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
13.	3 rd	Biostatistics	STAT-401	2	1	3
14.		Sociology	SOC-4_ _	3	0	3
15.		Computer Applications	CSC-301	2	1	3
16.		Ecology & Ecosystem	MB-401	2	1	3
17.		Cell Biology	MB-402	2	1	3
18.		Microbial Taxonomy	MB-403	2	1	3
Total Credit Hours				13	5	18
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS

19.	4 th	Biodiversity of Plants	MB-404	2	1	3
20.		Environmental Current Issues	MB-405	2	1	3
21.		General Virology	MB-406	3	1	4
22.		Biotechnology	MB-407	2	1	3
24.		Mycology	MB-408	3	1	4
				12	5	17
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
	5 th	Microbial Metabolism	MB-501	2	1	3
		Biosafety & Risk Management	MB-502	3	0	3
		Microbial Genetics	MB-503	3	1	4
		Soil Microbiology	MB-504	2	1	3
		Medical Microbiology	MB-505	3	1	3
Total Credit Hours				12	4	16
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
	6 th	Research Methodology & Literature Review	MB-506	2	1	3
		Molecular Microbiology	MB-507	3	1	4
		Medical Virology	MB-508	2	1	3
		General Immunology	MB-509	2	1	3
		Microbial Physiology	MB-510	2	1	3
Total Credit Hours				11	5	16
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
	7 th	Food Microbiology	MB-601	2	1	3
		Clinical Bacteriology	MB-602	3	1	4
		Genetic Engineering	MB-603	3	0	3
		Cell & Tissue Culture Technology	MB-604	2	1	3
		Mini Research Project	MB-699	0	3	3
		OR Internship	/MB-698	0	3	3
Total Credit Hours				14	1	16
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
	8 th	Immunobiology	MB-605	2	1	3

		Epidemiology, Public Health & Bioethics	MB-606	2	1	3
		Bioinformatics	MB-607	2	1	3
		Environmental Microbiology	MB-608	3	1	4
		Veterinary Microbiology (Optional Subject With Internship)	MB-609	3	0	3
		Mini Research Project	MB-699	0	3	3
		Total Credit Hours		12	7	19
		Overall Credit Hours				135 Internship (100+35) Research (97+38)



**SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR**

**ITEM # II: Review and approval of 4 years BS Curriculum from 2019
and onward**



DEPARTMENT OF MICROBIOLOGY

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

- Total numbers of credit hours 132-138
- Duration 4 years
- Semester duration 16-18 weeks
- Semesters 8
- Course load per semester 15-18 Credit hours
- Number of courses per semester 4-6
- Number of courses per semester 4-6 (not more than 3 lab /Practical courses)

Enlightenment Through Knowledge

LAYOUT FOR BS (4 YEARS) IN MICROBIOLOGY

Compulsory Courses (student has no choice)		General and Foundation Courses (to be chosen from other Departments)		Discipline-specific Foundation Courses	
7 courses		7-8 courses		9-10 courses	
Subjects	Cr. hr	Subjects	Cr. hr	Subjects	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+2
4. Islamic studies/Ethics	2	4. Biochemistry-II	2+1	4. Gen. Immunology	2+1
5. Mathematics I	3	5. Sociology	3+0	5. Microbial Taxonomy	2+1
6. Mathematics II OR Biostatistics	3	6. Environ-mental Current Issues	3+0	6. Gen. Virology	2+1
7. Computer Applications	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 Management	2+1
		12. Biodiversity of plants	2+1		3+0
		13. Plant physiology	2+1		
		14. Ecology and Ecosystem	2+1		
		Note***			
	19		24		33

* University may recommend other General courses according to their available faculty and expertise.

** University may recommend any other course in lieu of Mathematics II.

*** University may recommend other courses according to their available faculty i.e. Zoology, Botany, Animal/Human/Plant Physiology, Chemistry/Biochemistry, Plant diversity and Genetics.

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	3+0
2. Microbial Anatomy & Physiology	2+1	Elective-II	3+0
3. Fresh Water Microbiology	2+1	Elective-III	3+0
4. Bacterial Genetics	2+2	Elective-IV	3+0
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		
Note****			
	42		12

**** 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.
- Food Preservation Technology.
- Molecular Immunology.
- Clinical Parasitology.
- Plasmids, Episomes and Insertion Sequences.
- Microbial Enzyme Technology.
- Advances in Soil Microbiology.
- Diagnostic Chemistry for Microbial Diseases.
- Mycotic infections
- DNA Damage, Repair and Carcinogenesis.
- Management of Infectious Waste.
- Epidemiology: Analytical and Experimental Approaches.
- Advances in Microscopy and image analysis
- Nanobiotechnology.
- Structural and computational Biology.
- Epigenetics

Epigenetics

Any other course(s) recommended by an Institution's Board of Studies.

SCHEME OF STUDIES MICROBIOLOGY BS 4-YEAR PROGRAM 2019-2023
& ONWARD

S.NO	SEMESTER	COURSE TITLE	COURSE CODE	Theory	Practical	CREDIT HOURS
1.	1 st	English-I	ENG-301	3	0	3
2.		Islamic Studies	ISL-301	2	0	2
3.		Basic Calculus	MTH-307	3	0	3
4.		Introduction to Microbiology	MB-301	2	1	3
5.		Biodiversity of Animal Life	ZOL-302	2	1	3
6.		General Chemistry	CHM-	2	1	3
Total Credit Hours				14	3	17
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
7.	2 nd	English-II	ENG-302	3	0	3
8.		Pak Studies	PST-323	2	0	2
9.		Fundamentals of Microbiology	MB-302	3	1	4
10.		Human Physiology	MB-303	3	0	3
11.		Introduction to Information & Communication Technologies	CSC-301	2	1	3
12.		Biochemistry	BCHM-321	2	1	3
Total Credit Hours				15	3	18
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
13.	3 rd	Ecology & Ecosystem	MB-401	2	1	3
14.		English III	ENG-410	3	0	3
15.		Biostatistics	STAT-404	2	1	3
16.		Cell Biology	MB-402	2	1	3
17.		Microbial Taxonomy	MB-403	2	1	3
18.		Biodiversity of Plants	MB-404	2	1	3
Total Credit Hours				13	5	18
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
19.	4 th	Biosafety, bioethics & Risk Management	MB-405	3	0	3
20.		General Virology	MB-406	3	1	4
21.		Biotechnology	MB-407	2	1	3
22.		Mycology	MB-408	3	1	4
24.		Molecular Biology	MB-409	2	1	3
Total Credit Hours				13	4	17
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
25.	5 th	Microbial Metabolism	MB-501	2	1	3
26.		Food Microbiology	MB-502	2	1	3
27.		General Immunology	MB-503	3	1	4
28.		Soil Microbiology	MB-504	2	1	3

29.		Clinical Bacteriology	MB-505	2	1	3
Total Credit Hours				11	5	16
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
30.	6 th	Bioinformatics	MB-506	2	1	3
31.		Microbial Genetics	MB-507	3	0	3
32.		Medical Microbiology	MB-508	2	1	3
33.		Microbial Physiology	MB-509	2	1	3
34.		Genetic Engineering	MB-510	2	1	3
Total Credit Hours				11	4	15
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
36.	7 th	Research Methodology	MB-601	2	1	3
37.		Industrial microbiology	MB-602	2	1	3
38.		Molecular Mechanism of Antimicrobial Drugs	MB-603	3	0	3
39.		Elective I	MB-604	2	1	3
40.		Environmental Microbiology & Public Health	MB-605	2	1	3
		Elective II	MB-606	2	1	3
Total Credit Hours				13	5	18
S.NO	SEMESTER	COURSE TITLE	COURSE CODE			CREDIT HOURS
41.	8 th	Veterinary Microbiology	MB-607	2	1	3
42.		Elective III	MB-608	2	1	3
43.		Elective IV	MB-609	2	1	3
44.		Research/Internship+ 1 course of 3 credit hours each	MB-699/ MB-698/*	0	6	6
Total Credit Hours				6	3	15
Total				111	22	134

*Course code will be selected from the list of Elective courses within the major.



SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – I

Course Name: English – I	Course Code: ENG-301
Course Structure: Lectures: 3	Credit Hours: 3
Prerequisites: None	
Objectives: Enhance language skills and develop critical thinking.	
Course Contents <ul style="list-style-type: none">• 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 <ul style="list-style-type: none">• Answers to questions on a given text.	
Discussion <ul style="list-style-type: none">• 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 <ul style="list-style-type: none">• Topics to be chosen at the discretion of the teacher	
Presentation skills <ul style="list-style-type: none">• Introduction	
<i>Note: Extensive reading is required for vocabulary building</i>	
Recommended Books: <ol style="list-style-type: none">1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. 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 01943135063. Writing. Intermediate by marie-Christine Boutin, Suzaanne Brinand and Francoise Grellet. Oxford supplementary skills Fourth Impression 1993. ISBN 0 19 435405-27 and 7-41Pages.35 204. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.	

Course Name: Islamic Studies

Course Code: ISL-301

Course Structure: Lectures: 2	Credit Hours: 2
Prerequisites: None	
Objectives: This course is aimed at: 1 To provide Basic information about Islamic Studies 2 To enhance understanding of the students regarding Islamic Civilization 3 To improve Students skill to perform prayers and other worships 4 To enhance the skill of the students for understanding of issues related to faith and religious life.	
Detail of Courses	
Introduction to Quranic Studies	
1) Basic Concepts of Quran 2) History of Quran 3) Uloom-ul -Quran	
Study of Selected Text of Holly Quran	
1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286) 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18) 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11) 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77) 5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)	
Study of Selected Text of Holly Quran	
1) Verses of Surah Al-Ihزاب 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

Recommended 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 Jrisprudence 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).

Course Name: Basic Calculus

Course Code: MTH-307

Course Structure: Lectures:3	Credit Hours: 3
Prerequisites:	
OBJECTIVES	
<p>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.</p>	
Course Detail	
<ul style="list-style-type: none"> • Limits and continuity. • Derivative of a function and its applications. • 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:	
<ol style="list-style-type: none"> 1. Anton H, <i>Calculus: A New Horizon</i> (6th edition), 1999. John Wiley, New York. 2. Stewart J, <i>Calculus</i> (3rd edition), 1995, Brooks/Cole (suggested text) 3. Thomas G. B, Finney A. R., <i>Calculus</i> (10th edition), 2002. Addison- Wesley, Reading, Ma, U.S.A. 4. Anton, H., 1999. <i>Calculus: A New Horizon</i>, 6th Edition, John Wiley, New York. 5. Stewart J, 1995. <i>Calculus</i>, 3rd Edition, Brooks/Cole 6. Thomas, G. B. and Finney, A. R, 2002. <i>Calculus</i> 10th Edition, Addison-Wesley, Reading, Ma, U.S.A. 	

Course Name: Introduction to Microbiology	Course Code: MB-301
Course Structure: Lectures: 3	Credit Hours: 3(2+1)
Prerequisites: None	
OBJECTIVES	
<ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • Introduction to microbiology. • Microorganisms and their respective place in the living world. • Historical development of Microbiology and its scope. • Microscopy: An outline of the principles and applications of light and electron microscope. • Growth, nutrition (physical and nutritional requirement and nutritional types; sources of energy, C, N, H, O, S, P, H₂O, trace elements, growth factors) and reproduction. • General methods of studying microorganisms: cultivation, isolation, purification and characterization. • Control of microorganisms by physical and chemical methods. • Basic properties of fungi, protozoa and algae. • Application of microbiology in different fields (Health, Industry, Food, 	

biotechnology, environment and agriculture).

Practical

1. Laboratory safety: Containment and decontamination.
2. An introduction to microscopy.
3. Preparation and sterilization of bacteriological media and glassware.
4. Inoculation techniques. Study of colony characteristics of microorganisms.
5. Study visits.

Recommended Books

1. Baker, S., Khan, N., Nicklin, J. and Killington, R., 2011. Instant Notes in Microbiology, 4th Ed edition, Taylor and Francis.
2. Black, J. G. 2015. Microbiology: Principles & Explorations, 6th edition, John Wiley and Sons, N.Y.
3. Talaro, K. P. 2018. 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.

Course Name: Biodiversity of Animal life	Course Code: ZOL-302
Course Structure: Lectures: 2+1	Credit Hours: 3 (2+1)
Prerequisites: None	
OBJECTIVES:	
<ul style="list-style-type: none">• To provide the knowledge of evolutionary/phylogenetic relationship (from simple to the complex organisms).• To impart the basic taxonomic characteristics and classification of all the invertebrate phyla.• To provide understanding of body organization, Feeding and Digestive system; Other Organ System.	
COURSE CONTENTS:	
<ul style="list-style-type: none">• Classification of animal kingdom, Definition of classification, Major division invertebrates and vertebrates; Classification of invertebrates• Phylum protozoa including general features, classification of Ameoba, Paramecium, Volvox and chlamydomonas• Phylum Porifera; some general features, classification including important species; Sycon, Spongilla, Euplectella, Spongia.• Phylum Coelentrates; some general features, Classification including important species; Hydra, Obelia, Physalia, Aurilaaurita, Metridium.• Phylum Platyhelminthes; some general features, classification including Planaria, Liver fluke and tapeworm.• Phylum Aschelminthes; some general features, classification upto orders. Classes; 1. Gastrotricha, 2. Rotifera, 3.Nematoda with examples.• Phylum Annelida; general features, classification: Class Polychaeta, Class	

Oligochaeta, Class Hirudinea.

- Phylum Mollusca; general features, classification: classes; 1. Amphineura, 2.gastropoda, 3. Pelecypoda,4.Scaphopoda, 5. Cephalopoda.
- Phylum Arthropoda: some general features, classification: Class Crustaceans, Class Insecta, Class Chilopoda, Class Diplopoda, Class Arachnids with examples.
- Phylum Echinodermata (General features; classification)

Practicals:

- A study Visit to animal museum
- Body design and taxonomy of the Animalia
- Study of Ameoba, Paramecium, Volvox and chlamydomonas
- Study of representatives of classes of Phylum Porifera.
- Study of principal representatives of classes of Phylum Coelenterate.
- Study of principal representatives of classes of Phylum Platyhelminthes.
- Study of representatives of phylum Rotifer, Phylum Nematode.
- Study of principal representatives of classes of Phylum Mollusca.
- Study of principal representatives of classes of Phylum Annelida.
- Study of principal representatives of classes of groups of Phylum Arthropoda
- Study of representatives of classes of phylum Echinodermta.
- Histology: animal cells and tissues
- Comparison of radial and bilateral invertebrates

BOOKS RECOMMENDED:

1. Miller, A.S. and Harley, J.B. ; 1999 , 2002., 2007, 2009, 2012 & 2016 Zoology, 4th , 5th , 6th , 7th , 8th , 9th& 10th Edition (International), Singapore : McGraw Hill.
2. Additional Readings:
3. Hickman, C.P., Roberts, L.C/, AND Larson, A., 2018. INTEGRATED PRINCIPLES OF ZOOLOGY, 15th Edition (International), Singapore: McGRAW Hill.
4. Hickman, C.P., Roberts, L.C/, AND Larson, A., 2007. INTEGRATED PRINCIPLES OF ZOOLOGY, 12th& 13th Edition (International). Singapore: McGraw Hill.
5. Pechenik, J.A., 2015. BIOLOGY OF INVERTEBRATES, 7th Edition, (International), Singapore: McGraw Hill.
6. Kent, G. C. and Miller, S., 2001. COMPARATIVE ANATOMY OF VERTEBRATES New York: McGraw Hill.
7. Campbell, N.A., 2002; BIOLOGY Sixth Edition, Menlo Park, California; Benjamin Cummings Publishing Company, Inc.
BOOKS FOR PRACTICAL
8. Miller, S.A., 2002. GENERAL ZOOLOGY LABORATORY MANUAL. 5th Edition (International), Singapore : McGraw Hill.

9. Hickman, C.P. and Kats, H.L., 2000. Laboratory Studies in integrated principal of zoology. Singapore : McGraw Hill.

Course Name: General Chemistry	Course Code: CHM-
Course Structure: 2+1	Credit Hours: 3
Prerequisites: None	
OBJECTIVE	
<ul style="list-style-type: none"> • 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:	
<ul style="list-style-type: none"> • 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:	
<ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • 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. 	



DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – II

Course Name: English – II	Course Code: ENG-302
Course Structure: Lectures: 3	Credit Hours: 3
Prerequisites: None	
Objectives: Enable the students to meet their real life communication needs.	
Course Contents	
Paragraph writing Practice in writing a good, unified and coherent paragraph	
Essay writing Introduction	
CV and job application Translation skills Urdu to English	
Study skills Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension	
Academic skills Letter/memo writing, minutes of meetings, use of library and internet	
Presentation skills Personality development (emphasis on content, style and pronunciation)	
<i>Note: documentaries to be shown for discussion and review</i>	
Recommended Books:	
Communication Skills	
a) Grammar	
1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.	
b) Writing	
1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).	
2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).	
c) Reading	
1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.	
2. Reading and Study Skills by John Langan	
3. Study Skills by Richard York.	

Course Name: Pakistan Studies

Course Code: 323

Course Structure: Lectures: 2	Credit Hours: 2
Prerequisites: None	
Introduction/Objectives	
<ul style="list-style-type: none"> • Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan. • Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. • To make students understand the dynamics of population characteristics; relationship between man, environment and resources. To highlight the importance of demographic data in planning and decision-making. 	
Course Outline	
1) Historical Perspective	
<ul style="list-style-type: none"> 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	
a). Objective Resolution	
b). Salient features of the constitutions of	
Constitutions of 1956	
Constitutions of 1962	
Constitutions of 1973	
3) Contemporary Pakistan	
a. Economic institutions and issues	
b. Foreign policy of Pakistan and challenges	
4) Population Dynamics in Pakistan	
Introduction, Population Characteristics: Physical, Social and economic.	
Population dynamics: Patterns of fecundity and fertility, morbidity and mortality	
Population growth and change through pyramids, population policies, current population situation, family planning and islam.	
Recommended Books:	
1) Burki, Shahid Javed. <i>State & Society in Pakistan</i> , The Macmillan Press Ltd 1980.	
2) Akbar, S. Zaidi. <i>Issue in Pakistan's Economy</i> . Karachi: Oxford University Press, 2000.	
3) S.M. Burke and Lawrence Ziring. <i>Pakistan's Foreign policy: An Historical analysis</i> . Karachi: Oxford University Press, 1993.	
4) Mehmood, Safdar. <i>Pakistan Political Roots & Development</i> . Lahore, 1994.	
5) Wilcox, Wayne. <i>The Emergence of Banglades.</i> , Washington: American Enterprise, Institute of Public Policy Research, 1972.	
6) Mehmood, Safdar. <i>Pakistan Kayyun Toota</i> , Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.	
7) Amin, Tahir. <i>Ethno - National Movement in Pakistan</i> , 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.

Course Name: Fundamentals of Microbiology	Course Code: MB-302
Course Structure: 3+1	Credit Hours: 4
Prerequisites: None	
Credit Hours 4(3+1)	
OBJECTIVES	
<ul style="list-style-type: none">• 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	
<ul style="list-style-type: none">• Cell Morphology• 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.• Growth and Nutrition• Microbiology of water and wastewaters. Water as a source of infection and methods of water purification. Methods of sewage treatment and disposal.• Methods of food preservation.• Differentiation between food intoxication and food-infection.• Microbiology of soil with particular reference to nitrogen cycle.• Microbiology of air.	
Practical	
<ol style="list-style-type: none">1. Enumeration of bacteria in drinking water, milk, soil and air.2. Staining Methods3. Growth media4. Pure culture study of (on the basis of morphological, cultural and biochemical characteristics): <i>E. coli</i>, <i>Salmonella sp</i>, <i>Shigella sp</i>, <i>Staphylococcus aureus</i>, <i>S. epidermidis</i> and <i>S. fecalis</i>, <i>Corynebacterium</i>.5. Microscopic study of <i>Leishmania</i>, <i>Entamoeba</i>, <i>Plasmodium</i> and <i>Giardia</i>.	
Recommended Books	
<ol style="list-style-type: none">1. Black, J. G. 2005. <i>Microbiology: Principles & Explorations</i>, 6th edition, John Wiley and Sons, N.Y.2. Talaro, K. P. 2018. <i>Foundations in Microbiology: Basic Principles</i>, McGraw-Hill Companies, N.Y.3. Tortora, G. J., Funke, B. R. and Case, C. L. 2019. <i>Microbiology: an introduction</i>	

13th 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.

Course Name: Human Physiology	Course Code: MB-303
Course Structure: 3	Credit Hours: 3
Prerequisites: None	
COURSE OBJECTIVES	
This course is designed to provide a holistic overview of the various aspects of human physiology	
COURSE OUTLINE:	
<ul style="list-style-type: none"> • DIGESTION AND ABSORPTION OF MACROMOLECULES: Digestion, absorption and transport of carbohydrate, lipid and Protein. • HORMONES: Introduction, classification, chemical nature, general mechanism of action, regulation, secretion, mode of action and biological functions of thyroid, <i>parathyroid</i>, pituitary, adrenal, gonadal and <i>pancreatic hormones</i>. • BLOOD: General composition, characteristics and functions; <i>hemoglobin</i>: chemistry, properties, synthesis, degradation, functions and derivatives. <i>Blood coagulation</i> and <i>blood clotting factors</i>; blood pressure, groups and buffers. • RESPIRATION: Structure and functions of lungs; transport of oxygen and carbon dioxide in blood; acid base balance. • SPECIALIZED TISSUES: Structure and functions of muscle. Kidney; structure and functions, <i>acid base balance</i>, water and electrolyte balance. Structure and <i>functions of liver</i>; with special reference to detoxification functions. 	
RECOMMENDED BOOKS:	
<ol style="list-style-type: none"> 1. Guyton and Hall textbook of medical physiology (2016) 13th Edition by John E. Hall, W. B Saunders Company. 2. Fundamentals of Biochemistry (2016) 5TH Edition by D. Voet, J. G. Voet, & C. W. Pratt, John Wiley and Sons, New York. 3. Human Physiology, (2019) 15th Edition by Stuart Ira Fox, McGraw-Hill Company 4. Principles of Biochemistry (2008), 5th Edition by A.L. Lehninger, D.L. Nelson and M. M. Cox, Worth Publishers, New York 	

Course Name: Introduction to Information & Communication Technologies	Course Code: CSC-301
Course Structure: 2+1	Credit Hours: 3(2+1)
Prerequisites: None	
Introduction/Objectives	
The course focuses on introducing computing environment, general application software,	

basic computing hardware, operating systems, desktop publishing, internet, software applications and tools and computer usage concept.

COURSE OUTLINE:

Introduction to computer and Uses of computer in different disciplines. History of computer. Generations of computer. First Generation. Second generation. Third generation. Fourth generation. Fifth generation Computer Hardware: Introduction to hardware, Parts of computer and their functions (CPU, monitor, keyboard, mouse etc).computer types and classification. Types of .computer (digital and analogue).classification. Minicomputer. Micro computer. Mainframe computer. Super computerOperating System: Introduction. Windows 98/2000. Computer software .Introduction to software. Types of software. System software and application software. Internet Access. Internet Access. Different databases on Internet. Word Processing.Introduction.MS-Word. MS-Word Applications. Spread Sheets. Introduction. MS-Excel. MS-Excel Applications

PRACTICAL:

Other Software related Practical

Text Books:

1. Introduction to computer science, P.K Sinha.
2. Computer science- An Overview, Glenn Books.

A text book of computer B.com part-I

Course Name: Biochemistry	Course Code: BCHM-321
Course Structure: 3(2 +1)	Credit Hours: 3
Prerequisites: None	
OBJECTIVES	
<ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • 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., 2016. 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.

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – III

Course Name: Ecology & Ecosystem	Course Code: MB-401
Course Structure: 3(2+1)	Credit Hours: 3
Prerequisites: None	
OBJECTIVE To learn about different ecosystems To learn about food dependency of organisms in an ecosystems.	
Course Detail <ul style="list-style-type: none">• 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 <ol style="list-style-type: none">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 <ol style="list-style-type: none">1. Prakash, 2008. Molecular Biology of Ecology. DPH2. Joanne W. and Kathleen M Sandman; Dorothy H Wood. 2020 Prescott's Microbiology 11TH edition. 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.	

Course Name: English – III	Course Code: BC – 431
Course Structure: Lectures: 3	Credit Hours: 3
Prerequisites: English I & II	
Objectives: Enhance language skills and develop critical thinking	
Course Contents: <ul style="list-style-type: none">• Presentation skills• Essay writing: Descriptive, narrative, discursive, argumentative• Academic writing: How to write a proposal for research paper/term paper, How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)• Technical Report writing• Progress report writing	

Note: Extensive reading is required for vocabulary building

Recommended Books:

Technical Writing and Presentation Skills

a) Essay Writing and Academic Writing

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

b) Presentation Skills

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

Course Name: Biostatistics	Course Code: STAT-401
Course Structure: Lectures: (3,0)	Credit Hours: 3
Prerequisites: None	
Course Objectives	
The course aims at enabling the students to understand the basic statistical tools for research and economic models development.	
Course Outline	
<ul style="list-style-type: none"> - Introduction and scope of Biostatistics. Definition of Statistics, Population, sample Descriptive and inferential Statistics, Observations, Data, Discrete and continuous variables. - Descriptive Measures. The Mean, Median and mode, Variance and Standard Deviation - Introduction to probability and its basic concepts. Event and types of event. Mutually Exclusive and Exhaustive events. - Simple linear Regression, Assumptions of simple linear regression model, fitting of linear regression model, Co-efficient of determination. Correlation, Co-ficient of Correlation, Introduction to categorical data. Concept of Logistic Regression. - Inferential Statistics Hypothesis. Testing, Statistical problem, null and alternative hypothesis, Type-I and Type-II errors, Level of significance, Test statistics, acceptance and rejection regions, Testing of hypothesis about mean, Chi-Square test of Association - Experimental Design. Introduction to experimental design, basic Principles of experimental design, CRD and RCBD. 	
Recommended Books	
<ol style="list-style-type: none"> 1. Choudhry, Sher Muhammad, (2006), Introduction to Statistical Theory, part – I, part – II, Lahore: ilmi Kutab Khana. 2. Spiegel, M.R., (2002) Theory and Problems of Statistics, (Schaum's Outline Series), New Delhi: McGraw-Hill 3. Allan G. Bluman, (3rd ed.) (2003) Elementary Statistics A step by step 	

approach, New Delhi: McGraw Hill Book co.

4. Walpole, Raynold E., (latest ed) Introduction to Statistics (Maxwell, McMillan Int, Ed).
5. Walpole, R. E. (1982). Introduction to Statistics, 3rd Ed., Macmillan Publishing Co., Inc. New York.
6. Muhammad, F. (2005). Statistical Methods and Data Analysis, KitabMarkaz, Bhawana Bazar Faisalabad.

Course Name: Cell Biology	Course Code: MB-402
Course Structure: Lectures: 3(2+1)	Credit Hours: 3
Prerequisites: None	
Course Detail	
<ul style="list-style-type: none"> • 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. • Mitosis • Meiosis • Cell cycle and apoptosis. • Cell reproduction. • Signal transduction. • Cell culture 	
Practicals:	
<ol style="list-style-type: none"> 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	
<ol style="list-style-type: none"> 1. Nalini Chandar; Susan Viselli. 2019. 2nd edition. Cell and Molecular Biology. 8th Edition. Lippincott, Philadelphia: Wolters Kluwer. 2. Gilmartin, P. M. and Bowler, C. 2002. Molecular Plant Biology. Vol 1 and 2. Oxford University Press. UK. 3. Weaver, R. F. 2005. Molecular Biology. McGraw Hill, St. Louis. 4. Lodish, H., 2016. Molecular Cell Biology. W. H. Freeman Company. 5. Walker, D., 2010. Cells and Life Processes. London : Evans. 6. Alberts. B., 2007. Molecular Biology of the Cell Taylor and Francis, Inc. 7. Pollard, T. D., Lippincott-Schwartz, J., Earnshaw, W. C., 2007. Cell Biology: Saunders W. B. Co. 8. Karp, G., 2007. Cell and Molecular Biology, Study Guide: Concepts and Experiments. 5th Edition, Wiley, John and Sons Incorporated. 	

Course Name: Microbial Taxonomy	Course Code: MB-403
Course Structure: 3(2+1)	Credit Hours: 3
Prerequisites: None	
OBJECTIVES	
<ul style="list-style-type: none"> • 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.
- Recent tools in Microbial taxonomy.

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. 2010. Bergey's Manual of Systematic Bacteriology: The Proteobacteria. Springer Verlag.
2. Jon C Herron; Scott Freeman; Jason A Hodin; Brooks Erin Miner; Christian A Sidor., 2015. Evolutionary Analysis. 5th edition. Benjamin Cumming.
3. Roberto K. and Stanley M. 2012. Microbes and Evolution: The World That Darwin Never Saw. ASM. Press.
4. David L. K. 2018. 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

Course Name: Biodiversity of Plants	Course Code: MB-404
Course Structure: Lectures: 3(2+1)	Credit Hours: 3
Prerequisites: None	
Course Detail:	
OBJECTIVE	
To learn about the phylogenetic relation between plants and fungi.	
To learn about the evolutionary history and of fungi and plant.	
Course Detail	
<ul style="list-style-type: none"> • 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 • Medicinal plants, • Endangered species • 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. Dordrecht : Springer
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.



SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – IV

Course Name: Bio-safety, Bioethics & Risk Management	Course Code: MB-405
Course Structure: Lectures: 3+0	Credit Hours: 3
Prerequisites: None	
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	
<ul style="list-style-type: none"> • Detailed concept of Risk and Hazardous Environment, Chemicals, Biological factors and Radiations. • Risk assessment & Management: Preventions, Surveillance and Monitoring. • Biosafety levels. • 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. • Pathogenicity data sheet (Safety data sheets) 	
Recommended Books	
1. Fleming, D.O., and D.L. Hunt, D.L. 2014. Biological Safety. Principles and practices, 5th 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.	

Course Name: General Virology	Course Code: MB-406
Course Structure: 4(3+1)	Credit Hours: 4
Prerequisites: None	
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	
<ul style="list-style-type: none"> • Principles of electron microscopy. • Origin and evolution of viruses. • Nature of animal and plant viruses. • Classification: structural and functional groups. • Cultivation of Virus; 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 viroid.

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
2. Cann, A. J., 2016. Principles of Molecular Virology. 6th Edition. Amsterdam: Elsevier: 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 cademic Press. USA.

Course Name: Biotechnology	Course Code: MB-407
Course Structure: 3(2+1)	Credit Hours: 3
Prerequisites: None	
OBJECTIVES	
To understand the potentials of microorganisms and utilizations of beneficial microorganisms	
Course Detail	
<ul style="list-style-type: none"> • Introduction to history of biotechnology. • Scope and applications of biotechnology • Classification of biotechnology (White Biotechnology, Green biotechnology, red biotechnology, yellow biotechnology and blue biotechnology) • Recombinant products expression and transgenic. • Fermentation; types, modes of operation • Product recovery, waste treatment and safety. • Biosensors: construction and types, applications of biosensors, transducer technology, principles of biosensors. • Recombinant Protein Production, General aspects of heterologous protein expression. • Bacterial, filamentous fungal and yeast expression systems. • Microbial productions of: pharmaceuticals, diagnostic proteins, vaccines, microbial toxins and insecticides. 	
Practical	
<ul style="list-style-type: none"> • Isolation and screening microorganism 	

- Screening for microbial extracellular metabolites, enzymes and antimicrobial agents
- Citric acid fermentation.
- Field trip to an industry with a large scale fermentor.

Recommended Books

- Tourte, Y., 2018. Genetic Engineering and Biotechnology: Concepts, Methods, and Agronomic Applications. CRC Press.
- Alex. 2010. Principles of Biotechnology. ADP.
- Baskar, C., Baskar, S., Dillon, R. S., 2012. Biomass Conversion: The Interface of Biotechnology, Chemistry and Materials Science. Publisher: Springer-Verlag, New York, LLC.
- Thiemann, W.J., Palladino, M.A., 2019. Introduction to Biotechnology. 4th Edition. NY, NY: Pearson.
- Aunger. 2013. Recent Advances in Bacterial Biotechnology, RDM.

Course Name: Mycology	Course Code: MB-408
Course Structure: 4(3+1)	Credit Hours: 4
Prerequisites: None	
Credit Hours	
OBJECTIVES	
<ul style="list-style-type: none"> • To learn characteristics of fungi for classification. • Examine fungal metabolism. • To learn about pathogenic fungi and their infections in plant and animal. 	
Course Detail	
<ul style="list-style-type: none"> • Introduction to mycology. • Fundamentals of fungal classification. • Structure, physiology, characteristics, life cycles, examples of Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota, Glomeromycota, Deuteromycota. • 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. Lichens and its economic importance Mycorrhiza, VAM. • Use of fungi in biotechnology. • Economic impact of fungi on health, environment and agriculture • Edible fungi and its importance. 	
Practical	
<ol style="list-style-type: none"> 1. Isolation and identification of fungi from: 2. Environment 3. Rhizosphere 4. Clinical, food and vegetables samples. 5. Effect of physical and chemical factors on growth of fungi. 6. Determination of antifungal activity of (nystatin, actidion, amphotericin B etc.) 7. Propagation of edible mushroom. 	

Recommended Books

1. Hocking, A.D., 2011. *Advances in Food Mycology*, new York London 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.

Course Name: Molecular Biology	Course Code: MB-409
Course Structure: 3(2+1)	Credit Hours: 3
Prerequisites: None	
Course Outline <ul style="list-style-type: none">• Introduction to molecular biology and history• DNA topology. Different forms of DNA;• RNA types and secondary structures.• DNA replication in prokaryotes and eukaryotes (Replication machinery; Primase, Polymerase, Helicases, Topoisomerases I, II, Reverse Transcriptase, Gyrase & Telomerase.• Transcription in prokaryotes and eukaryotes; post transcriptional processing (e.g., RNA splicing, alternative splicing, editing); RNA maturation; posttranscriptional modifications and degradation pathways.• Chaperon system in <i>E. coli</i> and Yeast.• Genetic code; translation, posttranslational processing in prokaryotes and eukaryotes; protein folding, targeting and turnover;• DNA damage, mutation and repair, recombination and transposable elements.• Signaling and control of gene regulation in prokaryotes and eukaryotes.• Role of nucleoid proteins in Gene regulation and transcription.• DNA sequencing	
Practical <ol style="list-style-type: none">1. Plasmid extraction.2. Nucleic acid extraction (DNA & RNA).3. PCR4. Gel Electrophoresis	
RECOMMENDED BOOKS: <ol style="list-style-type: none">1. Nelson D and Cox MM, 2009. <i>Lehninger Principles of Biochemistry</i>. 5th Edition; WH Freeman, New York.2. Lodish et al., 2016. <i>Molecular Cell Biology</i>. 8th Edition; WH Freeman, New York3. Berg et al., 2006. <i>Biochemistry</i>. 6th Edition; WH Freeman, New York.4. Alberts et al., 2007. <i>Molecular Biology of the Cell</i>. 5th Edition; Garland Science.	

5. Weaver R, 2011. Molecular Biology. 5th Edition; McGraw-Hill



**SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR**

DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – V

Course Name: Microbial Metabolism	Course Code: MB-501
Course Structure: Lectures: 3(2+1)	Credit Hours: 3

Prerequisites: None

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, Embedden Doudoroff 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.

Practicals:

1. Identification: Biochemical activities of bacteria.
2. Extraceluar enzymatic activities of microorganisms.
3. Carbohydrate fermentation.
4. Triple sugar iron (TSI) test.
5. IMViC test (Indole, methyl red, VogesPrauskaur, and citrate utilization).
6. Hydrogen sulfide test
7. Urease test
8. Nitrate reduction
9. Catalase test
10. Oxidase test
11. Utilization of amino acids
12. Decarboxylase test
13. Phenyl alanine deminase test

Books Recommended:

1. Prescott/ Harley/Klein. Microbiology 8th Edition (2010) McGraw Hill Publisher.
2. McBrewster, J., F. P. Miller, A. F. Vandome (2009) Microbial metabolism. Alphascript Publishing.
3. Byung Hong Kim; Geoffrey M Gadd (2013) Bacterial Physiology and Metabolism, Cambridge Univ Press.
4. Pelczar Jr. M. J., E. C. S.Chain, N. R. Krieg (2006) Microbiology: concepts and Applications. McGraw Hill, Inc. N.Y.
5. Cossart, P., P. Boquet, S. Normark, R. Rappuoli (2000) Cellular Microbiology. ASM Press.

Course Name: Food Microbiology	Course Code: MB-502
Course Structure: 3+1	Credit Hours: 4
Prerequisites: None	
Credit Hours (2+1)	
OBJECTIVES	
<ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • 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	
<ol style="list-style-type: none"> 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	
<ol style="list-style-type: none"> 1. Ray, B. 2014, Fundamental Food Microbiology, 4th edition, CRS Press New York. 2. Karl R Matthews; Kalmia E Kniel; Thomas J Montville. 2017. Food Microbiology: An Introduction, 4th Edition Washington, D.C ASM Press. 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. 2019, Food Microbiology: Fundamentals and Frontiers. 5th edition, ASM Press. 6. Thomas, J. M., Matthew, K. R. and Kniel, K. E. 2017, Food Microbiology: An Introduction. 4th edition, Washington, D.C ASM Press. 	

Course name: General Immunology	Course Code: MB-503
Course Structure: 4(3+1)	Credit Hours: 4
Prerequisites: None	

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.
- 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.
- Autoimmune diseases and immunodeficiencies, immunization.

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. 2019. 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. 2019. Cellular and Molecular Immunology, 9th edition, Elsevier Health Sciences, N.Y.
4. Johnson, A. G. G., Ziegler, R. J., Lukasewycz, O. A. and Lukasewycz, O. A. 6th edition, 2014. Microbiology and Immunology: Board Review Series, Lippincot Williams and Wilkins, M.D.
5. Lichtman, A. H. 2019. Basic Immunology Function and disorders of the immune system. Elsevier Health Sciences, N.Y.
6. Kenneth M Murphy; Casey Weaver; Allan Mowat; Leslie Berg; David Chaplin; Charles A Janeway; Paul Travers; Mark Walport 2017. Janeway's Immunobiology (Immunobiology: The Immune System, 9th Edition. Garland Science Publishers.

Course Name: Soil Microbiology

Course Code: MB-504

Course Structure: 3(2+1)

Credit Hours: 3

Prerequisites: None

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.
- Role of microorganisms in mineral transformations with emphasis on Carbon, Nitrogen, 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.

Practical

1. Role of microbes in soil formation and soil analysis
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.

Recommended Books

1. Diane Tice, D., 2005. Principles and Applications of Soil Microbiology. 2nd Edition. Oxford University Press.
2. Paul, E.A., 2017. 4th edition, Soil Microbiology, Ecology and Biochemistry. Elsevier Science.
3. Varma, A., 2010. Advanced Techniques in Soil Microbiology: 1st Edition .Springer-Verlag New York, LLC.
- 4 Geoffrey R. Dixon,G.F.,2010. Soil Microbiology and Sustainable Crop Production: 1st Edition. Springer-Verlag New York, LLC
5. Paul, E.A., Study guide for Soil Microbiology, Ecology. Content Technologies, Inc. Publisher
6. Vallabhaneni, S., 2012. Soil Microbiology- A Laboratory Manual. LAP Lambert Academic Publishing AG & Co. KG.
7. Carrey.2013. Recent Advances in Soil Microbiology and Soil Biotechnology. RDM.

Course Name: Clinical Bacteriology	Course Code: MB-505
Course Structure: 3(2+1)	Credit Hours: 3
Prerequisites: None	
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.
- Differential diagnosis of selective 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.

Practicals:

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., Rosenthal, 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.



SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM) SEMESTER – VI

Course Name: Bioinformatics and protein structure	Course Code: MB-506
Course Structure: Lectures: 3(2+1)	Credit Hours: 3
Prerequisites: None	
<p>Objectives:</p> <ul style="list-style-type: none"> • 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. <p>Course Contents</p> <ul style="list-style-type: none"> • Introduction to Bioinformatics • Protein structure classification and super folds. • Mechanisms of protein folding and folding pathways. • Alignment • 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 analysis tools. • Protein, protein docking. • Experimental methods for determining protein structure. • Protein domains. <p>Practical</p> <ol style="list-style-type: none"> 1. Demonstration of the use of Web based tools for Bioinformatics analysis. 2. BLAST, SWISSPROT etc. 3. Phylogenetic tree 	
<u>Recommended Books:</u>	
<ol style="list-style-type: none"> 1. Bujnicki, J.B., 2009. Prediction of Protein Structures, Functions, and Interactions. Wiley, John & Sons, Incorporated 2. Lucio Comai; Jonathan Katz; Parag Mallick, 2017. 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. Bioinformatics Approaches to Structure and Function of Protein LAP Lambert Academic Publishing AG & Co. 	
Course Name: Microbial Genetics	Course Code: MB-507
Course Structure: 3+0	Credit Hours: 3
Prerequisites: None	
<p>Course Outline:</p> <ul style="list-style-type: none"> • Chromosomes, genes, and proteins: prokaryotes vs eukaryotes, genome size, chromosome organization, super coiling, protein structure. 	

- DNA replication, origin of replication, events that occur at the replication fork, structure and function of DNA polymerases, replication strategies.
- Control of DNA replication, dichotomous replication in prokaryotes.
- Gene expression: transcriptional initiation and termination, control, polycistrons, operon, catabolic repression, attenuation control
- Protein synthesis- mRNA translation: genetic code, non-universality, codon exchange, events on ribosome, ribosome structure-function relationship.
- DNA damage and repair: DNA damage mechanisms, DNA repair mechanism, Mutations: types of mutations, effect on the DNA sequence: point mutations, insertions, deletions, and rearrangements, isolation of mutants: mutator genes. Selections, screens, and enrichments, uses of mutants. Reversion and suppression.
- Genetic analysis of mutants, complementation, in vitro complementation: cross-feeding, in vivo complementation: dominance and *cis/trans* tests.
- Genetic recombination, mechanisms of recombination.
- Genetic exchange: mechanisms of genetic exchange: transformation, conjugation, and transduction
- Plasmids: properties of some bacterial plasmids, plasmid replication, origin of replication and replication proteins, partitioning of plasmids at cell division, regulation of plasmid copy number and amplification, incompatibility.
- Transposons and integrons.

Practical

1. Isolation of Nucleic Acids
2. Isolation of Plasmids
3. Chromosome staining
4. PCR
5. Blotting techniques etc
6. Mutation study by physical and chemical agents
7. Beta galactosidase assays

Books Recommended:

1. Jeremy W. D., S. F. Park (2010) Molecular Genetics of Bacteria, Publisher: Wiley; 5 edition.
2. Snyder, L. W. Champness (2007) Molecular genetics of bacteria ASM Press.
3. Birge, E. A. (2006) Bacterial and bacteriophage genetics. Birkhäuser.
4. McGrath, S., D. V. Sinderen (2007) Bacteriophage: Genetics and Molecular Biology. Caister Academic Press.
5. Larry Snyder (2013) 4th edition, Molecular Genetics of Bacteria. Washington DC ASM press.
6. Streips, U. N., R. E. Yasbin (2002) Modern microbial genetics John Wiley and Sons.
7. Higgins, P. N. (2004) The Bacterial Chromosome. ASM Press.

Course Name: Medical Microbiology	Course Code: MB 508
Course Structure: Lectures: 3	Credit Hours: 3 (2+1)

Course Name: Microbial Physiology	Course Code: MB- 509
Course Structure: Lectures: 3	Credit Hours: 3(2+1)
Prerequisites: None	
<p>OBJECTIVES</p> <p>To identify the basic components of cells. To distinguish the features of procaryotic cells and eucaryoatic cells. To learn the use and characteristics of microscope.</p> <p>Course Detail</p> <ul style="list-style-type: none"> • Detailed organization of microbial cells. • Organelles structural and functional relationship. • Chemical composition and biosynthesis of macromolecules in microbial cells. • Regulation of gene expression under stress condition.. • Uptake and secretion of molecules. • Stress responses; homeostatis, Physical and chemical factors. • Microbial physiology and its implications in genomic era; genomic, proteomic and traditional tools. <p>Practical</p> <ol style="list-style-type: none"> 1. Isolation of polysaccharides from bacteria. 2. Isolation of lipids from bacteria. 3. Estimation of total protein from bacterial cell. 4. Isolation and purification of a bacterial enzyme. 5. Effect of temperature, pH, oxygen, chemicals on microbial growth. 	
<p>Recommended Books</p> <ol style="list-style-type: none"> 1. Seckbach, J., 2013. Journey to Diverse Microbial Worlds Adaptation to Exotic Environments .Publisher: Dordrecht : Springer Netherlands. 2. David L. N. and Michael M. C. L., 2008. Principles of Biochemistry. W. H. Freeman. 3. Rathi. 2009. Microbial Physiology genetics and Ecology. MPDI. 4. Moat , A. G., Foster, J.W., Spector, M.P., 2009. Microbial Physiology 4th Edition. Wiley, John & Sons 5. Poole, R.K., 2019. Advances in microbial Physiology .Book series. Elsevier Ltd. 6. Allison. 2013. Recent Advances in Applied Microbiology. . RDM. 	

Course Name: Genetic Engineering	Course Code: MB- 510
Course Structure: Lectures: 3	Credit Hours: 3(2+1)
Prerequisites: None	
<p>OBJECTIVES</p> <ul style="list-style-type: none"> • To learn basic techniques used in recombinant DNA technology. • To understand the potential problems related to genetic engineering <p>Course Detail</p> <ul style="list-style-type: none"> • 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 λ -phage.
- *In vitro* genetic engineering; cloning vehicles: plasmids, cosmids and phagemids, YAC and BAC etc.
- Cloning strategies: construction of chimeric plasmids.
- Methods of introducing exogenous DNA.
- Methods for screening the clones.
- Prokaryotes and Eukaryotes Expression systems.
- Labeling methods of probes.
- Construction of genomic libraries.

Practical

1. Restriction enzyme digestion of DNA.
2. Transformation.
3. Southern blotting.
4. Electro blotting.
5. Cloning

Recommended Books

1. Meyers, R.A., 2006. Genomics and Genetics . John-Wiley and Son Limited.
2. Primrose, S.B., and Twyman, R.M. 2014. Principals of Gene Manipulation and Genomics 7th 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



SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DETAILED COURSE OUTLINE MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – 7th

Course Name: Research Methodology

Course Code: MB- 601

Course Structure: Lectures: 3	Credit Hours: 3 (2+1)
Prerequisites: None	
Objectives:	
<ul style="list-style-type: none"> • To introduce the methods involved in research • To learn about the misconduct, copyright and patents law. 	
Course Contents	
<ul style="list-style-type: none"> • 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. • Plagiarism 	
Practicals:	
<ul style="list-style-type: none"> • Communication-oral, • Posters. • Abstract and manuscript preparation. • Communicating your own credentials. • Communicating own work-CV. 	
Recommended Books:	
<ol style="list-style-type: none"> 1. Ann Bowling, A. and Ebrahim S., 2010. 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. 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. 	
Course Name: Industrial Microbiology	Course Code: MB-602
Course Structure: Lectures: 3	Credit Hours: 3 (2+1)
Prerequisites: None	
OBJECTIVES	
<ul style="list-style-type: none"> • To understand the beneficial role of industrially important microorganisms. • To learn about the commercial utilization of microbes for the production of 	

organic acids, organic solvents and fermentable products.

Course Detail

- Screening and Properties of biotechnologically important microorganisms
- Large-scale microbial fermentation, the principles and problems.
- An introduction to downstream processing.
- Culture technique: Strain Development spectrum of microbes by Continuous culture technique, principles and means of rational strain development.
- Empirical and Semiempirical strain development, mutagenesis, screening and selection.
- Microbial fermentations: Organic acids (Citric, lactic and acetic acid); Organic solvents (Acetone, butanol and ethanol), enzymes; Amino acids: Lysine and glutamic acid, Quorm (r) myco-protein,
- Use of auxotroph and analogue resistant mutants in strain development.
- Growth and Development of Microorganisms in Bioreactors.
- Scope of fermentation biotechnology In Pakistan
- The food processing, food manufacture and preservation.
- Industrially novel microorganism.

Practicals:

1. Isolation and identification of industrially important microorganisms.
2. Citric Acid, Ethanol and Lactic Acid production.
3. Estimation of Microbial cell mass.
4. Strain development (Mutagenesis).
5. Field trips to the relevant industries.

Recommended Books:

1. Prescott S. C., 2007. Industrial Microbiology, Agrobios Indiad
2. Naduka Okafor. 2007 Modern Industrial Microbiology and Biotechnology. Science Publisher.
3. El-Mansi E. M. T. et al., 2019. Fermentation Microbiology and Biotechnology 4th edition. Boca Raton : Taylor & Francis, CRC Press.
4. Pauline M. D., 2012. Bioprocessing Engineering Principles. Academic Press.
5. Ricardo Melendez-Ortiz , R., and Sánchez , V., 2005. Trading in Genes: Development Perspectives on Biotechnology, Trade and Sustainability. Earthscan/James and James.
6. Carlos A. Guzmán, Giora Z. Feuerstein., 2010. Pharmaceutical Biotechnology. Springer New York.
7. Doelle, H. W., and C.G. Heden, C.G., 2007. Applied Microbiology. 1st Edition. Springer-Verlag New York, LLC
8. Cirino, Z., 2011. Metabolic Control Analysis. Civ Publishers.
9. Capasso, V., and Bakstein, D., 2012. An Introduction to Continuous-Time Stochastic Processes: Theory, Models, and Applications to Finance, Biology, and Medicine. Birkhauser Verlag.

Course Name: Molecular Mechanism of Antimicrobial Drugs	Course Code: MB-603
Course Structure: Lectures: 3+0	Credit Hours: 3
Prerequisites: None	
Objectives:	

OBJECTIVES

To understand the mechanisms of chemotherapy.
 To develop general understanding of microbial control.
 To examine various factors that influence microbial control.

Course Detail

- Nature and historical background of chemotherapy.
- Basic strategies for drug discovery: empirical screening, molecular targets and developing models.
- Range of antimicrobial targets.
- Chemical structure and biological activity.
- Molecular basis for selective action against the prokaryotes.
- Antimicrobial agents affecting: Cell wall synthesis, Protein Synthesis, DNA/RNA synthesis and others.
- Antifungal drugs affecting cell membrane and cell wall biosynthesis in fungi.
- Mechanism of action of antiviral drugs, antimitotic agents, benzimidazole carbamates, alkaloids and taxol.
- Antiparasitic agents.
- Resistance mechanisms.
- Antimicrobial resistance.
- New approaches in Therapy: By the use of Blockers for: selective microbial enzymes, substrates, and receptors.
- Blockers for biochemical processes.
- Action of antibiotics on biofilms,
- Emerging antimicrobial technology.

Recommended Books:

1. Hauser, A. R., 2007. Antibiotic Basics for Clinicians. Wolters Kluwer Health.
2. Greenwood, D., Finch ,R., Davey, P., Wilcox ,M., 2007. Antimicrobial Chemotherapy. Oxford University Press; 5Rev Ed edition.
3. Franklin, T.J., Snow , G.A.,2010. Biochemistry and Molecular Biology of Antimicrobial Drug Action. 6th Edition. Springer-Verlag New York, LL.
4. Amyes, S., 2010 Antibacterial Chemotherapy: Theory Problems, and Practice. Publisher: Oxford University Press, USA.
5. Finch, R., Davey, P .,Wilcox,, M. H., Irving , W., 2012. Antimicrobial Chemotherapy. Oxford University Press.

Course Name: Cell & Tissue Culture Technology	Course Code: MB-604
Course Structure: Lectures: 3	Credit Hours: 3 (3+1)
Prerequisites: None	
Objectives:	
<ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • 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.

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

Course Name: Environmental Microbiology & Public Health	Course Code: MB-605
Course Structure: Lectures: 3 (2+1)	Credit Hours: 3
Prerequisites: None	
Objectives: To learn about diversified environmental implications on public health. To get brief idea about epidemiology and community acquired ailments. To learn about waste water health hazards and its management.	
Course Detail <ul style="list-style-type: none"> • An introduction to environmental pollutants and their impact. • Aeromicrobiology. • Microbiology of water including water pollution. Detection and elimination of 	

polluting bacteria from waters.

- Water purification by various means.
- Microbiology of wastewater including disposal and treatment.
- Microbiology of food and milk pertaining to public health.
- Prevention and control of epidemic diseases.
- Prophylactic measures and vaccines
- Bioremediation and biodegradation.
- Environmental pollution: an introduction to environmental diseases.
- Nosocomial and community acquired infection biomonitoring.
- National and international standards for monitoring the environment.
- Biosensors and bioindicators.
- Surveillance of epidemics through GIS.
- Environmental Laws and Regulations.

Practical

1. Detection of water, air and soil pollutants.
2. Isolation of microbes from air samples.
3. Designing of schemes as flow diagram for waste water treatment/management.
4. BOD and COD detection.
5. MPN technique.
6. Case study for different epidemics.

Recommended Books:

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

Course Name: NanoBiotechnology	Course Code: MB-606
Course Structure: Lectures: 3(2+1)	Credit Hours: 3
Prerequisites: None	
Objectives: To understand about nanoparticles produce by microorganisms. To learn about the application of nanoparticles in various fields. To learn about the use of nanoparticles in medical sciences.	
Course Detail <ul style="list-style-type: none">• Biomaterials : 1st generation, 2nd generation , 3rd generation biomaterials: their historical overview and current directions• Nanobiotechnology and nanoscience ; top down and bottom up approaches to analyze nanoscopic properties;	

- Nanoparticles and nanoscale materials.
- Cellular nano- and microstructures.
- Nanocarbon tubes and abalone shells.
- Nanomanipulation via different types of micromanipulators.
- Nanoprobes and probe array.
- DNA nanotechnology and DNA-modified surfaces
- Applications of nanobiotechnology in living systems.

Practical

1. Construction of silver nanoparticles.
2. Construction of Zinc quantum dots. Study of bactericidal activity of nanoparticles.
3. Biofilm formation and bioluminous determination.
4. Quorum sensing in biofilms in the presence of nanoparticles

Recommended Books:

1. Prasad. 2008. Advanced Nanotechnology. DPH.
2. Thomas M. M. 2009. Nanobiotechnology: Synthetic Biology and RNAi Marquette University Law School.
3. Vedpriya A. and Kumar R. 2011. Nanobiotechnology: Biological Synthesis of Silver nanoparticles in Brassica Juncea. LAP LAMBERT Academic Publishing.
4. Sandra J. R. and David W. W. 2013. Nano-biotechnology protocol, Humana.



SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DETAILED COURSE OUTLINE OF MICROBIOLOGY (4 YEARS PROGRAM)

SEMESTER – 8th

Course Name: Veterinary Microbiology	Course Code: MB- 607
Course Structure: Lectures: 3	Credit Hours: 3 (2+1)

Prerequisites: None
OBJECTIVES <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 Zoonotic diseases. • Quarantine and international control of animal livestock farming. Practical <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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.

Course Name: Microbial Enzyme Technology	Course Code: MB-608
Course Structure: Lectures: 3	Credit Hours: 3 (2+1)
Prerequisites: None	
OBJECTIVES Course Detail <ul style="list-style-type: none"> • Introduction to enzymes: Nature, structure & function, Biological role of enzymes, their sources and biosynthesis, Enzyme turnover. • Multi-enzyme complexes. • Kinetics of enzyme reaction. 	

- Mechanisms of enzyme reaction, Reversible and irreversible changes.
- Regulatory enzymes and the control of metabolic pathways- feedback inhibition.
- Allosteric enzymes. Industrial enzymes: Types, their sources, uses and applications, Fermentative production of industrial enzymes, A brief outline to the methods of purification.
- Enzyme immobilization: methods of immobilization and kinetics; properties of immobilized enzymes, Uses of free and immobilized enzymes in industries.
- Analytical application of enzymes: enzymes as biosensors, Clinical and therapeutic application of enzymes.

Practicals:

1. Assays for microbial enzyme detection i.e. cellulose, lipase, amylase, proteases & nucleases.
2. Isolation of proteolytic, lipolytic and amylolytic organism from different sources.
3. Production of industrially important enzymes from microbes.
4. Enzyme immobilization.
5. Isolation of microbial enzymes.

Recommended Books:

1. Ray, R. C., 2005. Microbial Biotechnology in Agriculture and Aquaculture. NBN International.
2. Kreuzer, H. and Massey, A., 2005. Biology and Biotechnology Science, Applications, and Issues American Society for Microbiology.
3. Harding, S. E., 2004. Biotechnology and Genetic Engineering Reviews: Volume 21 Intercept Ltd.
4. Parekh, R., 2004. The GMO Handbook: Genetically Modified Animals, Microbes and Plants in Biotechnology Humana Press.

Course Name: Plant Microbiology	Course Code: MB-609
Course Structure: Lectures: 3	Credit Hours: 3 (2+1)
Prerequisites: None	
OBJECTIVES	
Course Detail	
<ul style="list-style-type: none"> • Introduction to enzymes: Nature, structure & function, Biological role of enzymes, their sources and biosynthesis, Enzyme turnover. • Multi-enzyme complexes. • Kinetics of enzyme reaction. • Mechanisms of enzyme reaction, Reversible and irreversible changes. • Regulatory enzymes and the control of metabolic pathways- feedback inhibition. • Allosteric enzymes. Industrial enzymes: Types, their sources, uses and applications, Fermentative production of industrial enzymes, A brief outline to the methods of purification. • Enzyme immobilization: methods of immobilization and kinetics; properties of immobilized enzymes, Uses of free and immobilized enzymes in industries. • Analytical application of enzymes: enzymes as biosensors, Clinical and therapeutic application of enzymes. 	
Practical	
1. Sample collection and identification of plant pathogen (farms, orchards, nurseries etc.).	

2. Field trips.

Recommended Books:

1. Hull, R., 2001. Matthews' Plant virology. Academic Press.
2. Prell, H. H., Day, P. R., 2001. Plant-fungal pathogen interactions: A classical and molecular view. Springer Verlag.
3. Skinner, F.A., Rhodes-Roberts, M. E., 1982. Bacteria and plants. Academic Press Inc.
4. Zadoks, J. C., Schein, R. D., 1979. Epidemiology and plant disease management. Oxford University Press.
5. Agrios, G. N., 1997. Plant Pathology. Morgan Kaufmann Publishers
6. Lucas, J. A., Dickinson, C. H., 1998. Plant Pathology and Plant Pathogens. Blackwell Science Inc.
7. Vedhaysekaran, P., 1997. Fungal Pathogenesis in Plants and crops: Molecular biology and host defence mechanisms. Marcell Dekker.
8. Ingram, D. S., 1985. Advances in plant Pathology. Academic Press Inc.
9. Maloy, O. C., Murray, T. D., 2000. Encyclopedia of plant pathology. Wiley, Johns and Sons.

Course Name: Research/Internship	Course Code: MB – 699/698
Course Structure: 6 Cr. hrs. research/ 3 Cr. Hrs. internship+3 Cr.Hrs Course)/(2 electives Cr. Hrs 3+3)	Credit Hours: 6

LIST OF ELECTIVE COURSES

- 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

Note: *University may opt any other course(s) depending upon the facilities and expertise of faculty available subjected to the approval of concerned academic forum.*



**SHAHEED BENAZIR BHUTTO WOMEN
UNIVERSITY PESHAWAR**

**Item # III: Approval of 2 Years MS/M. Phil Curriculum (Session
2019 onwards)**



**SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR**

MS/M.Phil APPROVAL

Agenda Items:

- i) Eligibility Criteria**
- ii) Curriculum**
- iii) Course Codes**

ELIGIBILITY CRITERIA

Minimum Criteria for Admission in MS/M.Phil and Ph.D Programmes

This is for the information of all concerned that the degrees awarded by the Universities/Degree Awarding Institutions must meet the following minimum criteria for recognition by the HEC.

MS/M.Phil Programme:

1. Sixteen years of schooling or 4 year education (124 credit hours) after HSSC/F.A. /F.Sc/Grade 12 equivalent will be required for admission in the M.Phil/MS.
2. The GAT-General (www.nts.org.pk/gat/gat.asp) conducted by the National Testing Service with a minimum 50% cumulative score will be required at the time of admission to M.Phil/M.S. The GAT-General test is valid for a period of two years.
3. For award of M.Phil/M.S/Equivalent degree, candidates will either need to complete 30 credit hours of course work or complete 24 credit hours of course work along with a minimum of 6 credit hours for research work/thesis.
4. There should be at least 2 relevant full time Ph.D. Faculty members in a department to launch the M.Phil/MS programs.

List of Majors:

1. Proteomics and Genomics
2. Molecular Pathogenesis
3. Plant Viral Diseases
4. Molecular Virology
5. Tissue Culture and techniques
6. Advanced Molecular Diagnostics
7. Advances in Molecular Biology & Biotechnology

8. Advanced Bioinformatics
9. Application of Techniques to Biomolecules
10. DNA Techniques and Clinical Applications
11. Signal Transduction
12. Nutrition for health promotion and disease prevention
13. Research Methods in Microbiology
14. Regulation of Gene Expression
15. Molecular Evolution
16. Pathogens and Pathogenicity
17. Advances in Molecular biology and Biotechnology
18. Advances in cell biology
19. Advances in Immunology
20. Current trends

List of Minors:

1. Protein Structure, Function and Engineering
2. Graduate Seminar-I
3. Graduate Seminar with Special Problems-II
4. Instrumentation and analytical techniques
5. Computational Biology
6. Recombinant DNA Technology
7. Biological safety and Risk Management
8. Renewable bioenergy Resources
9. Advanced Microbial Techniques

Note: In addition to the above, the university can offer any other which they feel necessary subject to the availability of resources.



**SHAHEED BENAZIR BHUTTO WOMEN
UNIVERSITY PESHAWAR**

The structure of M.Phil/MS Microbiology Program will be as follows:

1st Semester

S.NO	SEMESTER	COURSE TITLE	COURSE CODE	THEORY	PRACTICALS	CREDIT HOURS
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1.	1st	Advances in Microbiology	MB-710	3	0	3
2.		Medical Virology	MB-711	2	1	3
3.		Elective I	MB-712	3	0	3
4.		Elective II	MB-713	3	0	3
Total Credit Hours				11	1	12

2nd Semester

S.N O	SEMESTER	COURSE TITLE	COURSE CODE	THEORY	PRACTICALS	CREDIT HOURS
1.	2nd	Advances in Molecular Biology & Biotechnology	MB-714	3	0	3
2.		Research Methodology	MB-715	2	1	3
3.		Elective III	MB-716	3	0	3
4.		Elective IV	MB-717	3	0	3
Total Credit Hours						12

***3rd and 4th semester will comprise of Research Project and Thesis of 06 credit hours with course code MB899.**

Advances in Immunology

3+0

Course Objectives:

The objective of this course is to enable the students to learn the intricacies of the defense system prevailing amongst the vertebrates. The students will learn activation of immune response, elimination of invading organisms, production of polyclonal & monoclonal antibodies and use of antibodies as diagnostic as well as therapeutic agent.

Course Contents:

An over view of fundamentals of immunology Genetics and structure/function relationships of antibodies; T-Cell receptors; MHC antigens; Accessory molecules; Lymphocyte differentiation and activation; Molecular and cellular regulation of immune responses: Hybridoma technology; Humanized, bifunctional antibodies; Edible vaccines; vaccines of immune in diseases, diagnosis and hypersensitivity reactions and allergic diseases; Tumors of immune response; Immune response to tumors; Cancer immunotherapy; Experimental animal models; Immunological techniques; significance of cytokines (interleukins, interferons, growth/stimulating factors, etc.) in regulatory pathways. Classic problems and emerging areas in immunobiology

Recommended Books:

1. Immunology, Goldsby R A, Kindth J.T, Osborne B. A., 5th edition W.H. Freeman and Company.
2. Immunology, Ivan Roitt, Jonathan Brostoff, David Male, 6th (2001) Mosby, Inc.
3. Roitt's Essential Immunology. Peter J. Delves, Seamus J. Martin, Dennis R. Burton (2011). John Wiley & Sons.
4. Immunology: Understanding the immune system. Klaus D. Elgert (2009). Wiley Blackwell.

Advances in Molecular Biology & Biotechnology

3+0

Course Objectives:

This course will enable the students to know and understand the advances in molecular biology and biotechnology research and its applications.

Course Contents:

- **Methodology for Preparation and Purification of Genetic Material**
Electrophoresis, Growth of bacterial cultures, harvesting and lysis of bacteria, yeast, plant and animal cells. Methods for extraction and purification of genomic and vector DNA.
- **Strategies for Cloning**
Restriction endonucleases digestion of genomic and vector DNA; strategies for ligation, genomic DNA library, hosts for cloning, preparation and transformation of competent cells, identification of transformed bacterial colonies, analysis and cloning of eukaryotic genomic DNA, preparation of labeled DNA and NA probes, synthesis of oligonucleotide probes, screening and expression of libraries with oligonucleotides.
- **DNA and Amino Acid Sequencing**
DNA sequencing, Sanger's method, Maxim and Gilberts method, random sequencing, direct sequencing, dye terminators, automated DNA sequencing and capillary electrophoresis, electropherograms of DNA sequences, RNA sequencing and amino acid sequencing of proteins.
- **Site Directed Mutagenesis and PCR Technology**
Generation of deletion and insertion- Linker insertion mutagenesis, linker scanning mutagenesis, nested sets of deletion mutants, oligo nucleotide mediated mutagenesis preparation of single stranded target DNA, polymerase chain reaction technology (PCR technology).
- **Expression of Cloned Genes**

Expression vectors for mammalian cells, yeast cells, plant cells and bacterial cells introduction of recombinant vectors into the expression hosts cloned gene product expressed as fusion proteins expressed from cloned genes - production of antibodies, purification of antibodies, purification technology.

- **Enzymology & Recombinant DNA- Technology**

Sources of Enzymes, Enzyme Engineering, Extraction and Purification of Enzymes, Enzyme Kinetics, Immobilization of Enzymes, Biocatalyst Stabilization, Recent advances in Enzymology.

Recommended Books:

1. Tropp, B. E. (2012). *Molecular biology: Genes to proteins*. Sudbury, Mass: Jones & Bartlett Learning.
2. Meyers, R. A. (2012). *Epigenetic regulation and epigenomics: Advances in molecular biology and medicine*. Weinheim: Wiley-Blackwell.
3. In Jeon, K. W. (2013). *International review of cell and molecular biology: Volume three hundred and one*.
4. Schultz, W. A. (2005). *Molecular biology of human cancers: An advanced student's textbook*. Berlin: Springer Science.
5. Walker, J. M., Rapley, R., & Royal Society of Chemistry (Great Britain). (2009). *Molecular biology and biotechnology*. Cambridge: Royal Society of Chemistry Clark, D. P., & Pazdernik,
6. N. J. (2013). *Molecular biology*. Waltham, MA: Academic Press. Wink, M. (2013). *An Introduction to Molecular Biotechnology: Fundamentals, Methods and Applications*. Hoboken: Wiley.

Tissue Culture and Techniques

Course Objectives:

This course is designed to help students understand workings of the cell structure and function at cellular and molecular level that various viruses utilize in their life cycles. In this course molecular basis of cell structure and function will be discussed. Different methods of animal and plant cell cultures will also be discussed.

Course Contents:

- a) **Animal Culture:** Media requirements and sterilization techniques, primary and established cell lines. Culture methods: hanging drop, monolayer and suspension. Scale up methods. Roux tubes roller bottles. Stem cells: adult and embryonic, applications to tissue engineering. Applications of animal cells.
- b) **Plant Tissue Culture:** Cell and callus culture, another culture. Micropropagation, somatic cell hybridization, protoplast fusion, cybrids, artificial seeds, Agrobacterium mediated gene transfer and use of Ti plasmid. Applications of plant tissue culture engineering, pathogen resistance (BT gene), herbicide tolerance, salt tolerance, production of secondary metabolites and transgenic plants.

Recommended Books:

- Freshney, R. I., & Wiley InterScience (Online service). (2010). *Culture of animal cells: A manual*

- of basic technique and specialized applications. Hoboken, N.J: Wiley-Blackwell.
- Freshney, R. I. (2010). Culture of animal cells: A manual of basic technique and specialized applications. Hoboken, N.J: Wiley-Blackwell.
 - Smith, R. H. (2013). Plant tissue culture: Techniques and experiments. London: Academic Press.
 - Sharma, A. K. (2012). Recent advances in animal cell and tissue culture. Delhi: Globus Press.
 - Freshney IR.
 - Tourte Y and Catherine TC, 2005. Genetic Engineering and Biotechnology: Concepts, Methods, and Agronomic Applications. Science Publishers.
 - Houdebine LM, 2003. Animal Transgenesis and Cloning. 1st Edition; John Wiley and Sons.

Advances in Cell Biology

Course Objectives:

Aim of this course is to let the students flourish their knowledge about the structure and integrity of the cell in developing the cells and tissues. This would enable them to explore the key concept about cell to cell interaction and molecular paradigms of eukaryotic cell structure and function.

Course Contents:

Overview of cytoskeleton, microfilaments, cell motility and control of cell shape. Actin, microtubules and intermediate filaments. Self assembly and dynamics of cytoskeleton filaments, tread milling and dynamic instability, regulation of filament properties by accessory proteins. Multicellularity, cell-cell and cell-matrix interactions. Cell-cell adhesion, cell junction, tissue patterning and development. Extracellular matrix of connective tissues, primary components and functions, glycosaminoglycans and hydrated gels, cell surface glycosaminoglycans, collagen as major protein of extracellular matrix, post translational modifications of collagen, role of hyaluronan during tissue morphogenesis and repair, proteoglycans and regulation of secretory protein activities.

Transporters and active membrane transport; ion selectivity and ion channels. ATP driven pumps, P-type Ca^{+2} pump, Na^{+} - K^{+} pump, ABC transporters. Aquaporins, voltage gated cation channels, their role in generation of action potential in electrically excitable cells.

Regulation of eukaryotic cell cycle; experimental cycles in cell cycle research, molecular control mechanisms in mitosis, inhibitory proteins, biochemical switches, condensin role in configuration of chromosomal duplication, cell cycle check points. Stem cells: types and applications.

Reference Books

1. Molecular Biology of the Cell, Bruce Albert et al., 5th edition (2008), Garland Science.
2. Molecular Cell Biology, Lodish H, Berk A, Zipursky S L, Matsudaira P, Baltimore D, Darnell J, 6th edition (2008), W.H Freeman and Company.
3. Cell Biology, Thomas D. Pollard, William C. Earnshaw (2002), W. B. Saunders.
4. Essentials of Cell Biology, Bruce Albert et al., 3rd edition (2010), Garland Science, Taylor and Francis group.

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.

Item No: 1V ONE MEMBER FROM EACH BOARD OF STUDIES; WITHIN THE FACULTY TO BE NOMINATED BY BOARD OF STUDIES CONCERNED ON BOARD OF FACULTIES

1. Under the provision of section 3(1)(iv) of “SBBWUP Constitution, Functions and Powers of Authorities of the University Statutes-2016”, the Board of Faculties inter alia consists of:

“3. Board of Faculties

(1) There shall be a Board of each Faculty, which shall consist of the following:

- (iv) *One member from each Board of Studies; within the Faculty to be nominated by Board of Studies concerned”.*

2. The case is placed before the members of Board of Studies for nomination.

Item # V: STANDING LIST OF SUBJECT EXPERTS, RECOMMENDED BY THE RELEVANT BOARD OF STUDIES FOR SELECTION BOARD

1. Under the provision of section 7(2) & 7(7) of “SBBWUP Constitution, Functions and Powers of Authorities of the University Statutes-2016”, the Selection Board inter alia consists of:

“7. Selection Board

(2) *In selecting candidates for the posts of Lecturers, Assistant Professors, Associate Professors and Professors, the Selection Board shall co-opt or consult up to three subjects experts to be nominated by the Vice Chancellor from the standing list of subject experts, recommended by the relevant Board of Studies.*

(7). *In selecting candidates for the posts of Professors and Associate*

Professors, the Selection Board shall consider reports from three reviewers in the subject concerned, to be nominated by the Vice Chancellor from a standing list of experts, recommended by the relevant Board of Studies, and revised from time to time".

2. The case is placed before the members of Board of Studies for nomination.

Item # VI: A PANEL RECOMMENDED BY THE CONCERNED BOARD OF STUDIES FOR SCRUTINY AND QUANTIFICATION COMMITTEE

1. Under the provision of section 3(1(r) of "SBBWUP Teachers Appointment and Scales of Pay Statutes- 2016" , the Method of Appointment shall consist of the following:

"3. Method of Appointment

- (1) (r). *There shall be a scrutiny and quantification committee comprising of concerned Dean of the faculty, concerned Chairperson/HOD, Director/ Principal, two subject experts to be nominated by the Vice Chancellor from a panel recommended by the concerned Board of*

Studies and Deputy or Assistant Registrar meetings will be secretary of the committee”.

2. The case is placed before the members of Board of Studies for nomination.

ITEM #VII: ONE SUBJECT EXPERT TO BE NOMINATED BY THE VICE CHANCELLOR FROM THE PROPOSED LIST OF EXPERTS APPROVED BY THE BOARD OF STUDIES OF THE CONCERNED DEPARTMENT/INSTITUTE

1. Under the provision of Annexure-E, sub-Section 5(1)(4) appended to Section 3(1)(g) of “SBBWUP Teachers Appointment and Scales of Pay Statutes-2016” , the Screening Test and Demonstration Committee shall consist of the following:

“5. Screening Test and Demonstration

- (1). *Screening test and demonstration shall be conducted for appointments in BPS-18 (Lecturer) by the Screening Test & Demonstration Committee or through some other organization (to conduct only test) as approved by the Competent Authority (Vice Chancellor). The Screening & Demonstration Committee shall consist of the following:*

4. One subject expert to be nominated by the Vice Chancellor from the proposed list of experts approved by the Board of Studies of the concerned Department/Institute”.

2. The case is placed before the members of Board of Studies for nomination, please