WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

HEC NEW UNDERGRADUATE POLICY
(Fall 2023)

04 YEARS BS
(8 Semesters)

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

Scheme of Studies

Semester-I				
Course Code	**Course Name**	**Credit Hours**	**General Education Course /Major/Interdisciplinary**	**Marks**
ISL-301	Islamic Studies	02	General Education Course	
PSY-302	Introduction to Psychology	02	General Education Course	
ENG-301	Functional English	03	General Education Course	
BOT-311	Diversity of Plants	03	General Education Course	
PSC-301	Civic and Community Engagement	02	General Education Course	
MIC-311	Fundamentals of Microbiology	03	Major Disciplinary Specific	
MIC-312	Cell-Biology	03	Interdisciplinary	
Semester Credit Hours		**17**		
Semester-II				
ISL-302	History of Islamic Civilization	02	General Education Course	
ENG-302	Expository Writing	03	General Education Course	
BBA-322	Entrepreneurship	02	General Education Course	
PSC-302	Ideology and Constitution of Pakistan	02	General Education Course	
MTH-433	(QR-I) Exploring Quantitative skills	03	General Education Course	
MIC-321	Microbial Diversity and Taxonomy	03	Major Disciplinary Specific	
Semester Credit Hours		**16**		
Semester-III				
MTH-444	(QR-II) Tools for Quantitative Reasoning	03	General Education Course	
CS-301	Application of Information and Communication Technologiesa	3 (2+1)	General Education Course	
MIC-411	Introductory Biochemistry	03	Interdisciplinary	
MIC-412	Microbial Physiology	03	Major Disciplinary Specific	
MIC-413	General Genetics	03	Interdisciplinary	
Semester Credit Hours		15		

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Semester-IV				
MIC-421	Basic Biotechnology	03	Interdisciplinary	
MIC-422	Biosafety and Risk Management	03	Major Disciplinary Specific	
MIC-423	Bacteriology	03	Major Disciplinary Specific	
MIC-424	Microbial Genetics	03	Major Disciplinary Specific	
MIC-425	Microbial Ecology	03	Major Disciplinary Specific	
Semester Credit Hours		**15**		
Semester-V				
MIC-511	Genetic Engineering	03	Interdisciplinary	
MIC-512	Techniques in Microbiology	03	Major Disciplinary Specific	
MIC-513	Virology	03	Major Disciplinary Specific	
MIC-514	Introduction to Medical Microbiology	03	Major Disciplinary Specific	
MIC-515	Molecular biology	03	Major Disciplinary Specific	
Semester Credit Hours		**15**		

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Semester-VI				
MIC-521	Introductory Immunology	03	Major Disciplinary Specific	
MIC-522	Veterinary Microbiology	03	Major Disciplinary Specific	
MIC-523	Parasitology	03	Major Disciplinary Specific	
MIC-524	Food Microbiology	03	Major Disciplinary Specific	
MIC-525	Mycology	03	Major Disciplinary Specific	
Semester Credit Hours		**15**		
Semester-VII				
MIC-611	Soil and Environmental Microbiology	03	Major Disciplinary Specific	
MIC-612	Epidemiology and Public Health	03	Major Disciplinary Specific	
MIC-613	Immuno-genetics	03	Major Disciplinary Specific	
MIC-614	Industrial Microbiology	03	Major Disciplinary Specific	
MIC-615	Field Experience	03		
Semester Credit Hours		**15**		
Semester-VIII				
MIC-621	DNA Damage, Repair and Carcinogenesis	03	Major Disciplinary Specific	
MIC-622	Microbial genomics and proteomics	03	Major Disciplinary Specific	
MIC-623	Pharmaceutical Microbiology	03	Major Disciplinary Specific	
MIC-624	Bioinformatics	03	Major Disciplinary Specific	
MIC-625	Capstone Project	03	Major	
Semester Credit Hours		**15**		
Major Courses		**72**		
General Education Courses		**30**		
Interdisciplinary		**15**		
Field work/internship and Capstone project		**03+03**		
Total Credit Hours		**123**		

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Course Contents for all semesters

Semester-I

Islamic Studies/ Ethics اخلاقیات/ اسلامیات

Program	**BS (04 Years) Islamic Studies**		
Course Title	**Islamic Studies/ Ethics اخلاقیات/ اسلامیات**		
Semester	1st	**Course Code**	ISL-301
Pre-Requisite	--	**Nature of Course**	General Education Course
No. of Credit Hours	02 C.H	**Total Teaching Weeks**	18

Objectives of the Course

This course is aimed at:

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

Course Contents

Introduction to Qur'anic Studies

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

Study of Selected Text of Holy Quran

1) Verses of Surah Al-Baqara 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 Ahkam (Verse No-152-154)

Study of Selected Text of Holy Quran

1) Verses of Surah Al-Ahzab 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 Tafakkur, Tadabbur (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

First Twenty Ahadith (Narrations of the Holy Prophet Muhammad peace be upon him) from the book "Al-Arbaeen Nawawi" by Imam Abu Zakaria Yahya bin Sharf Al-Deen Al-Nawawi

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 Khilaft-e-Rashida
2) Period of Umayyad's
3) Period of Abbasids

Social System of Islam

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

Reference Books:

1. Hameedullah Muhammad, "Emergence of Islam" , IRI, Islamabad
2. Hameedullah Muhammad, "Muslim Conduct of State"
3. Hameedullah Muhammad, 'Introduction to Islam
4. Maulana Muhammad Yousaf Islahi,"
5. Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.

6. Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
7. Mir Waliullah, "Muslim Jurisprudence and the Qur'anic 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)
10. Imam Yahya bin Sharf Al-Deen Al-Nawawi, "Arbaeen Nawawi" Maktaba Khuddam Al-Quran, 36-K, Model Town, Lahore (2nd Edition: 2008)

INTRODUCTION TO PSYCHOLOGY-I

PSY-302 **Credit Hours: 3**

AIMS AND OBJECTIVES

To ensure that the students are aware of the nature, origin, history and scope of Psychology as a modern discipline and its relationship with other sciences and to have a working knowledge of the application and the practice of psychology in real life.

Introduction to Psychology:

- Nature and Application of Psychology with special reference to Pakistan.
- Historical Background and Schools of Psychology (A Brief Survey)

Methods of Psychology:

- Observation
- Case History Method
- Experimental Method
- Survey Method
- Interviewing Techniques

Biological Basis of Behavior:

- Neuron: Structure and Functions
- Central Nervous System and Peripheral Nervous System
- Endocrine Glands

Sensation, Perception, and Attention

Sensation:

- Characteristics and Major Functions of Different Sensations
- Vision: Structure and functions of the Eye.

- Audition: Structure and functions of the Ear

Perception:

- Nature of Perception
- Factors of Perception: Subjective, Objective and Social
- Kinds of Perception
    - Spatial Perception (Perception of Depth and Distance)
    - Temporal Perception
    - Auditory Perception

Attention:

- Factors
    - Subjective
    - Objective
- Span of Attention
- Fluctuation of Attention
- Distraction of Attention (Causes and Control)

SUGGESTED READINGS:

- Atkinson R. C., & Smith E. E. (2000). *Introduction to psychology* (13th ed.). Harcourt Brace College Publishers.
- Fernald, L. D., & Fernald, P. S. (2005). *Introduction to psychology*. USA: WMC Brown Publishers.
- Glassman, W. E. (2000). *Approaches to psychology*. Open University Press.
- Hayes, N. (2000). *Foundation of psychology* (3rd ed.). Thomson Learning.
- Lahey, B. B. (2004). *Psychology: An introduction* (8th ed.). McGraw-Hill Companies, Inc.
- Leahey, T. H. (1992). *A history of psychology: Main currents in psychologicalthought*. New Jersey: Prentice-Hall International, Inc.
- Myers, D. G. (1992). *Psychology* (3rd ed.). New York: Wadsworth Publishers.
- Ormord, J. E. (1995). *Educational psychology*: *Developing learners*. PrenticeHall, Inc

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ENG-301 **FUNCTIONAL ENGLISH** **Credit Hours: 3(3+0)**

AIMS AND OBJECTIVES

The aim of the course is to develop the ability to communicate effectively. To enable students to read effectively and independently any intermediate level text. To make the students able to use grammar and language structure in context.

- Parts of speech
- Sentence structure
- Analysis of phrase and clause
- Use of articles
- Active and passive voice
- Transitive and intransitive verbs
- Punctuation and spelling
- Practice in unified sentence
- Comprehension
- Discussion: General topics and everyday conversation
- Paragraph writing

SUGGESTED READINGS:

- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises (3rd ed.). Oxford University Press 1997. ISBN O 194313506

PSC-301 **Civic and Community Engagement** **Cr.Hrs.: 02**

Learning Outcomes:

- Understand, critically think about, and reflect upon the history of democracy and civic engagement in the Pakistan.
- Identify and utilize - civic/community engagement skills such as: (advocacy, organizing, communications) and knowledge- (working in groups and teams, leadership, diversity, how systems work)
- Create civic sense and establish importance of civic and community engagement.
- Identify and explain the values and ethics for community engagement.
- Carry out a civic engagement activity incorporating some of their new knowledge and skills of civic engagement and reflect on their learning about the community, the issue addressed, and about themselves.

Course Contents-

Divided into categories for in-depth comprehension-

Category A: General

1. The historical background of civic and community engagement
2. Conceptual understanding of Human Rights and Minority Rights

3. Dimensions of Citizens engagement in Community: Political, Social, Economic
4. Rights and duties of Citizens in Community
5. Organizations (National & International) and Groups
    - Role of non-governmental organizations and their contributions
    - NGOs: Nature and Scope
    - International Commission for Red Cross (ICRC)
    - Amnesty International
    - Asia Watch

Category B: Pakistan's context

6. Role of Citizens in Governance of Pakistan
7. Democratic Accountability and Civic Engagement
8. Enhancement of leadership skills among women and youth of Pakistan through civic community engagement programs

Suggested Books

- Hoefer, R. (2012). Advocacy
- for Practice. 3rd Edition. Chicago, IL: Lyceum Books, Inc. (ISBN-13: 978-1935871828)
- Putnam, R. and Feldstein, L (2003). Better Together. New York, NY: Simon and Schuster. (ISBN-13: 978-0743235471)
- Civic Engagement—What Is It and Why Is It Important? Kerry J. Kennedy
- Universal Human Rights in Theory and Practice by Jack Donnelly
- Adamantia Pollis and Peter Schwab, Human Rights Cultural and Ideological Perspectives. Preager Publishers, Preager Publishers, London, 1980.
- Promoting and Protecting Minority Rights- A Guide for Advocates by United Nations.
- Human Rights in International Law, Council of Europe press, 1992.
- United Nations, Human Rights Status of International Instruments, United Nations, Baltimore, New York, 1987.

MIC-311 FUNDAMENTALS OF MICROBIOLOGY Credit Hours 3(3+1)

<u>Aims and Objectives</u>

The course is designed to enable the students

- To learn how to work with microorganisms.
- To distinguish basic groups of microbes.
- To compare gram positive and negative bacteria and draw their basic membrane structure.
- To learn and understand the yield of catabolic pathways at the energetic level.
- To understand the need for energy source in the microbial world.

<u>Course outline</u>

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- **Introduction to Microbiology**
  - ✓ Definition of Microbiology
  - ✓ History of Microbiology
  - ✓ Discovery of Microorganisms
- **Classification of Microbiology**
  - ✓ Basic Microbiology (Epidemiology, Etiology, Immunology)
  - ✓ Applied Microbiology (Disease Diagnostics)
- **Bacteriology**
  - ✓ Difference between Prokaryotes and Eukaryotes
  - ✓ Morphology of Bacteria
  - ✓ Arrangement, Shape and size of Bacteria
- **Ultra-structure of Bacteria**
  - ✓ Cell Wall Composition
  - ✓ Cell Membrane, Lysosomes
  - ✓ Spore formation
  - ✓ Flagella
- **Extracellular Structure of Bacteria**
  - ✓ Capsule
  - ✓ Outer Membrane in Gram Negative bacteria
  - ✓ Porins
- **Microbial Classification**
  - ✓ Nomenclature of Microorganism
  - ✓ Types of Microorganism
- **Types of Bacteria**
  - ✓ Gram Negative and Gram Positive Bacteria
  - ✓ Identification of Bacteria
- **Cultivation of Bacteria**
  - ✓ Preparation of Cultural Media
  - ✓ Preparation of Enrichment Media
- **Bacterial Isolation**
  - ✓ Streaking
  - ✓ Spreading
  - ✓ Tube Dilution Method
- **Methods of Microbiology**
  - ✓ Microscopy
  - ✓ Light Microscope
  - ✓ Electron Microscope
  - ✓ Pure culture Techniques
  - ✓ Biochemical identification of Bacteria

- **Diseases caused by Microorganisms**
  - ✓ Fungal diseases in Humans (Ring worm, *Aspergillosis, Candiasis*)
  - ✓ Bacterial Diseases
  - ✓ Viral Diseases in Humans (Flu, AIDS)
- **Treatment of Diseases**
  - ✓ Chemotherapy
  - ✓ Antibiotics
  - ✓ Radiotherapy
- **Growth of Bacteria**
  - ✓ Generation time
  - ✓ Incubation
  - ✓ Lag, Log, Stationary, Decline phases
  - ✓ Factors affecting growth
- **Reproduction**
  - ✓ Asexual Reproduction
  - ✓ Binary Fission
  - ✓ Budding
- **Bacterial Nutrition**
  - ✓ Growth Factors
  - ✓ Essential Metabolites
- **Classification of bacteria on Nutritional basis**
  - ✓ Autotrophic Bacteria, Heterotrophic Bacteria
  - ✓ Photoautotrophic Bacteria, Chemosynthetic Bacteria
  - ✓ Parasitic Bacteria
- **Bacterial Counting**
  - ✓ Manual Counting
  - ✓ Image Analysis
  - ✓ Spectrometry
- **Control of bacterial diseases**
  - ✓ Antibiotic
  - ✓ Physical control of bacteria
- **An introduction to viruses**
  - ✓ Naming of viruses
  - ✓ Classification of viruses
  - ✓ Reproduction of viruses

Practicals

- A laboratory studies of properties of bacteria and other microorganisms
- Biosafety guidelines

- Use and care of Microscope
- Techniques of culturing
- Morphological identification of bacteria
- Transforming techniques of bacteria
- Biochemical identification of bacteria
- Method of culture preservation and maintenance.

Recommended Books

1. Pelczar, Jr. M.J., Chan, E.C.S. and Krieg, N.R. (2005). Microbiology. Concepts and applications. MacGraw Hill Inc. N. Y.
2. Stuart, H. (2005) Essential Microbiology. John Wiley & Sons Inc.
3. Tortora. (2006). Microbiology An Introduction. 8th edition. Wiley & Sons Inc.
4. Aleamos, I. (2009). Fundamentals of Microbiology. Wiley & Sons Inc.
5. Sridhar, S, (2009). Methods of Microbiology.

MIC-312 CELL BIOLOGY Credit Hours 3(2+1)

Aims and Objectives

The aim of course is

- To learn about the cell and its organization of architecture and the unified role it plays for the ultimate sustainability of the organisms.
- To learn the various ultra-structural, molecular and functional aspects of the cells.

Course outline

- Introduction to cell biology
- Ultra structure, chemical composition and function:
- Cell wall and Cell membrane,
- Cell organelles
- Cytoskeleton
- Cell cycle and apoptosis
- Cell reproduction and chromosomal aberration
- Signal Transduction
- Animal cloning

Practical

- Study different types of prokaryotic and eukaryotic cell
- Study of different cell organelles
- Identification of DNA

- Study of chromosome morphology
- Study of variation in chromosome number

Recommended books

1. Stephen R. Bolsover, Elizabeth A. Shephard, Hugh A. White, Jeremy S. Hyams. (2011) Cell Biology: A Short Course, 3rd ed.
2. S. C. Rastogi. (2012) Cell Biology 3rd ed.
3. Lodish, H., (2011). Solutions Manual for Molecular Cell Biology.7th Edition. W.H. Freeman & Company
4. Lodish, H., Berk, A., Kaiser, C. A., M Krieger; Bretscher, A., Ploegh,H; Amon,A., Scott, M., 2012. Molecular Cell Biology.7th Edition. W. H. Freeman Company.
5. James, D. W. 2013. Molecular Biology of Gene Benjamin Cumming.

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Semester-II

ENG-302 **Expository Writing** **Credit Hours 3(3-0)**

AIMS AND OBJECTIVES:

The course is designed for the students to fulfill their practical life communication skill and needs.

Paragraph writing:

- Practice in writing a good
- Unified and coherent paragraph

Essay writing:

- Introduction and Practice
- Essay types: descriptive, narrative, discursive, argumentative.

CV and job application:

- Translation skills
- Urdu to English
- English to Urdu

Study skills:

- Skimming and scanning
- Intensive and extensive and speed reading
- Summary and précis writing
- Comprehension

Academic skills:

- Letter and memo writing
- Minutes of meetings
- Use of library and internet

Presentation skills:

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

SUGGESTED READINGS:

- Boutin, M.,&Brinand,S.,&Grellet, F. (1993). Oxford Supplementary Skills. Fourth Impression. Pages 45-53.
- Nolasco, R. (1992). Oxford Supplementary Skills (3rd ed.). Fourth Impression.
- Thomson, A. J., & Martinet, A.V. (1986). Practical English Grammar (3rd ed.). Oxford University Press.
- Tomlinson, B., & Ellis,R. (1991). Oxford Supplementary Skills. Third Impression.
- Reading and Study Skills by John Langan
- Study Skills by Riachard Yorky

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ISL-302 HISTORY OF ISLAMIC CIVILIZATION (Cr. Hrs. 02)

تاریخ تہذیب اسلامی

Title	**Description**
Semester	5th
Nature of Course	(GEAH)
No. of C.Hrs	02
Total Teaching Weeks	16
Course code	AH 102
Objectives of the Course	1. Definition of Islamic Culture & Civilization 2. Analysis of the Rise and Fall of Islamic Culture in various parts of the World 3. A Critical Study of the Effect and benefits of Islamic Civilization on other Cultures

Course Description

	Title	**Description**
1	Introduction to civilization- 1	• Introduction of Civilization • Foundation of Civilization • Elements of Civilization
2	Important Civilization in the Pre-Islamic Era	• Greek Civilization • Roman Civilization
3	Important Civilization in the Pre-Islamic Era	• Egypt Civilization • Hindu Civilization
4	Principles of Islamic Civilization	• Pillars of Culture & Civilization
5	Foundations of Islamic Civilization in the Era of the Prophet (SAW) and the Caliphates	• Reasons for the evolution of Islamic Civilization in the Era of the Prophet (SAW)
6		• Islamic Civilization in the Era of the Caliphates •

7		• Elements of Islamic Civilization in the era of Caliphates
8	Islamic Civilization in the era of Banu Ummayads- 1	• Introduction of Banu Ummayads • Intellectual development among the Banu Ummayads • Educational Centers for the Banu Ummayads
MID TERM		
9	Islamic Civilization in the era of Banu Ummayads- 2	• Social developments of the Banu Ummayads • Causes of the civilization development of the Banu Ummayads • Results of the civilization development of the Banu Ummayads
10	Islamic Civilization in the era of Banu Ummayads- 3	• Religious Movements in the era of Ummayads • Internal Disputes in Ummayads era • Reasons for the decline of the Ummayads
11	Islamic Civilization in the era of Abbasids- 1	• Beginning of Abbasid civilization • Educational movements of the Abbasid period
12	Islamic Civilization in the era of Abbasids- 2	• Cultural development in the Abbasid period • Social development in the Abbasid period • A Comparative study of the Islamic Culture of Abbasids with other Civilization
13	Islamic Civilization in the era of Abbasids- 3	• Battles of Crusades • Battlers of Tartarians • The Causes of the Fall of the Abbasids and its Effects on Islamic Civilization
14	Islamic Civilization in Spain	• Causes of the spread of Islamic civilization in Spain • Manifestations of Islamic civilization in Spain • Influence of Islamic civilization in Spain on European civilization
15	Islamic Culture and Civilization in the Sub-Continent	• Islamic civilization achievements in the Sub-Continent • Reasons for the spread of Islamic

		cultural in Sub-Content
16.		• The effects of the publication of Islamic civilization in the Sub-content on other civilization

Recommended Books

1. Muslim History and Civilization by Ehsan ul Karim
2. Islamic Religion History and Civilization, Seyyed Hossein Nasr
3. Tareekh-e-Islam Shah Nadvu Moin-ud-din
4. Islamic History by Dr. Kabeer Ali
5. An Atlas of Islamic History, H.W.Hazard
6. A Short History of Islam, S.F.Mehmood
7. تاریخ تمدن اسلامی، شاہ معین الدین ندوی

BBA-322 Entrepreneurship Cr. Hrs. 03

COURSE OBJECTIVE

With more than half of the new jobs being created in the world economy by small businesses, the particular problems and experiences encountered in starting and developing new enterprises are clearly worth studying. This course of Entrepreneurship has been designed to provide the participants with an overall understanding of the concept of entrepreneurship and small business management. Participants will be prepared to start, survive, and succeed in their own businesses.

COURSE CONTENT

Week 1	Entrepreneurship: an evolving concept Entrepreneurship – a perspective
Week 2	The Role of Entrepreneurship Kinds of Entrepreneurs Role and Functions of Entrepreneurs
Week 3	Understanding strategic issues in business plan development
Week 4	Pitfalls in selecting new ventures

Week 5	Innovation: the creative pursuit of ideas Opportunity identification: the search for new ideas
Week 6	Reason for failures of new ventures
Week 7	Legal challenges for entrepreneurial ventures
Week 8	Sources of capital for entrepreneurial ventures
Week 9	**Mid-Term Examination**
Week 10	Assessment of entrepreneurial plan
Week 11	Marketing challenges for entrepreneurial ventures
Week 12	Developing an effective business plan
Week 13	Strategic entrepreneurial growth
Week 14	Problems Faced by Newly Established Company Post and Field Problems Faced by a New Enterprise
Week 15	Franchising and the Entrepreneur
Week 16	**Final-Term Examination**

Reference Books:

- Small Business Management:Entrepreneurship and Beyond, Timothy S. Hatten.South-Western, Cengage Learning
- Norman M. Scarborough., Essentials of Entrepreneurship and Small Business Management.Pearson Education
- Donald F. Koratko , Entrepreneurship –Theory Process Practice (10th Edition), South Western -Cengage Learning.
- David L. Kurtz& Louis E. Boone, Contemporary Business (latest edition).
- Philip Kotler &Gary Armstrong, Principles of marketing (latest edition).

- Any Other Resources such as: Internet and Resource Notes and Modules

Local and international newspapers and financial journals

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PSC-302Ideology and Constitutional Development of Pakistan Cr. Hrs. 02

Learning Objectives

- To develop critical thinking for understanding Constitutional development in Pakistan;
- To develop understanding of the legal and constitutional structure of the state;
- To develop comprehension of the interconnectivity between the Constitutional provisions and political practice;
- To develop the understanding of students regarding ideological basis of Pakistan as well as role of ideology in building national character.

Contents of the Course:

Course is divided into two sections to cover the maximum portion of the course. Section A: Ideological understanding and development of Pakistan

1. Basis of Ideology of Pakistan and Two Nations Theory
2. Ideology of Pakistan: Vision of Quaide e Azam and Allama Iqbal
3. Role of ideology in building national character
4. Democratic system of Pakistan (Issues)
5. Major causes of the Imposition of martial Law (1958, 1969, 1977&1999).

Section B: Constitutional Development of Pakistan

6. Pakistan's Constitutional Development from 1947 onward.
7. An Overview of the Constitution of Pakistan (Features of 1973 Constitution).
8. Basic Concepts—Federalism and the 1973 Constitution.
9. Islam and the Constitution of Pakistan -1973.
10. Constitutional Amendments and Reforms- 1973.

Recommended Books:

Students are advised to take notes during lectures. Certain books have been recommended for reference and quality of analysis.

- Constitution of Pakistan
- The Constitutional History of Pakistan—1947-2012, Malik Muhammad Owais Khalid, 2012
- Constitutional History and Political Development, Hamid Khan, 2005
- Constitutional Development in Pakistan, G.W. Chaudhary
- Constitution Making in Pakistan 1947-85, Dr. Baz Muhammad
- Allen Gledhill, Pakistan: The Development of its Laws and Constitution
- "Military, State and Society in Pakistan" by Hasan Askari Rizvi, 2000.
- Kazmi, Raza, Pakistan Studies, Karachi Oxford University Press.
- Qureshi, I. H., A Short History of Pakistan, University of Karachi Press.
- Qureshi, I. H., Struggle for Pakistan, University of Karachi Press.
- Sayeed, K. B., Pakistan Formative Phase, National Book Service
- Ziring, Lawrance, Pakistan in Twentieth Century: A Political History, London; Oxford University Press

- Government and politics in Pakistan by Mushtaq Ahmad.
- Ideology and Dynamics of Politics in Pakistan by Muhammad Asif Malik

MIC-321 MICROBIAL DIVERSITY AND TAXONOMY Credit Hours: 3(2+1)

Objectives

- Identify the objectives of classification.
- Identify traits used to classify microorganisms.
- Locate microorganisms in the realm of living world.

Course outlines

- Basic concepts and aims of classification.
- Classical and molecular basis of classification of prokaryotes and eukaryotes.
- Bacterial nomenclature.
- Diversity of organisms found in microbial world
- Metabolic diversity of microorganisms
- Major groups of bacteria
- Bacterial taxonomy rules
- Introduction to current concept and methods in microbial evolution/phylogeny
- Evolution of eubacteria
- Archeabaceria
- Eukaryotic microorganisms
- Classification of *Enterobacteriaceae, spore formers, Actinomycetes (Mycobacterium* &Nocardia), Spirochetes (Treponema & Leptospira).
- Detailed classification of viruses, fungi, protozoa and Algae.
- A brief introduction of Rickettsia, Chlamydia and Mycoplasma.
- An introduction to Prions and Viroids.

Practical

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

Recommended Books

1. Garrity, G. M., Krieg, N. R., Brenner, D. J., 2006. Bergey's Manual of Systematic Bacteriology: The Proteobacteria, Vol.
2. Williams and Wilkins Co, Baltimore. 2. Scott F. and Jon c. H., 2007. Evolutionary Analysais. Benjamin Cumming.

3. Roberto K. and Stanley M. 2012. Microbes and Evolution: The World T\that Darwin Never Saw. ASM.Press.
4. David L. K. 2012. Process in Microbial Ecology.Oxford University Press.
5. Ralf G. Dietzgen, R.F., and Ivan V. Kuzmin, I.V., 2012. Rhabdoviruses: Molecular Taxonomy, Evolution, Genomics, Ecology, Host-Vector Interactions, Cytopathology and Control Caister Academic Press. USA.

Semester-III

MTH-444 QR-II----Tools for Quantitative Reasoning Credit Hours: 03

Specific Objectives of the Course:

Introduce students to variables, sampling data and statistical approach in decision making.

Course Outline:

- Investigating relationships between variables
- Exploring tools to find relationship between variables
- Population and samples,
- Exploring and summarizing data
- Finding a representative value in a data
- Measure and spread of a data,measuring degree of relationship among variables
- Measure of central tendency, dispersion, data interpretation
- Basic probability theory
- Basics of estimation and confidence interval
- Testing hypothesis
- Statistical inferences in decision making
- Survey sampling

Recommended Books:

- Heumann, Christian, and Schomaker, Michael. Introduction to Statistics and Data Analysis: With Exercises, Solutions and Applications in

R. Switzerland, Springer International Publishing, 2023.

- James, Gareth, et al. An Introduction to Statistical Learning: With Applications in R. Germany, Springer New York, 2013.
- Reid, Howard M.. Introduction to Statistics: Fundamental Concepts and Procedures of Data Analysis. United States, SAGE Publications, 2013.

CS-301 APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES Credit Hours 3(2-1)

This is an introductory course in Computer Science designed for beginners. Apart from leading the participants through a whirlwind history of computing, the course also develops a feel for web programming through a series of lectures that help the students develop their own web page. Main objective of the course is to build an appreciation for the fundamental concepts in computing and to become familiar with popular PC productivity software.

CLO No. Course Learning Outcomes Bloom Taxonomy

CLO-1 Understand basics of computing technology C1 (Knowledge)

CLO-2 Do number systems conversions and arithmetic C2(Understand)

CLO-3 Have knowledge of types of software C2(Understand)

CLO-4 Have knowledge of computing related technologies C3 (Apply)

Course Outline:

Brief history of Computer, Four Stages of History, Computer Elements, Processor, Memory, Hardware, Software, Application Software its uses and Limitations, System Software its Importance and its Types, Types of Computer (Super, Mainframe, Mini and Micro Computer), Introduction to CBIS (Computer Based Information System), Methods of Input and Processing, Class2. Organizing Computer Facility, Centralized Computing Facility, Distributed Computing Facility, Decentralized Computing Facility, Input Devices. Keyboard and its Types, Terminal (Dump, Smart, Intelligent), Dedicated Data Entry, SDA (Source Data Automation), Pointing Devices, Voice Input, Output Devices. Soft- Hard Copies, Monitors and its Types, Printers and its Types, Plotters, Computer Virus and its Forms, Storage Units, Primary and Secondary Memories, RAM and its Types, Cache, Hard

Disks, Working of Hard Disk, Diskettes, RAID, Optical Disk Storages (DVD, CD ROM), Magnetic Types, Backup System, Data Communications, Data Communication Model, Data Transmission, Digital and Analog Transmission, Modems, Asynchronous and Synchronous Transmission, Simplex. Half Duplex, Full Duplex Transmission, Communications, Medias (Cables, Wireless), Protocols, Network Topologies (Star, Bus, Ring), LAN, LAN, Internet, A Brief History, Birthplace of ARPA Net, Web Link, Browser, Internet Services provider and Online Services Providers, Function and Features of Browser, Search Engines, Some Common Services available on Internet.

Reference Materials:

1. Charles S. Parker, Understanding Computers: Today and Tomorrow, Course Technology, 25 Thomson Place, Boston, Massachusetts 02210, USA
2. Livesley, Robert Kenneth. An introduction to automatic digital computers. Cambridge University Press, 2017.
3. Zawacki-Richter, Olaf, and Colin Latchem. "Exploring four decades of research in Computers & Education." Computers & Education 122 (2018): 136-152.
4. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications, 2010.
5. Goel, Anita. Computer fundamentals. Pearson Education India, 2010

MIC-411 INTRODUCTORY BIOCHEMISTRY Credit Hours 3(2+1)

Aims and Objectives

The course is aimed

- To help the students to understand the essentials of biomolecules in human life.
- To understand the principles of biochemistry.
- To understand the function and deficiency disorders related to biomolecules.

Course outline

- **Introduction to biochemistry**
  - ✓ Biomolecules
- **Carbohydrates**
  - ✓ General characteristics

- ✓ Classification
- **Lipids**
  - ✓ General characteristics
  - ✓ Classification
- **Amino acids**
  - ✓ General characteristics
  - ✓ Classification
- **Proteins**
  - ✓ General characteristics
  - ✓ Structure of proteins
  - ✓ Properties of proteins
  - ✓ Denaturation
- **Nucleic Acids**
  - ✓ Introduction
  - ✓ Components of Nucleic acid
- **Enzymes**
  - ✓ Introduction
  - ✓ Classification
- **Vitamins**
  - ✓ Nomenclature
  - ✓ Classification
- **Alkaloids**
  - ✓ Classification
  - ✓ Properties
- **Terpeniods**
  - ✓ Structure
  - ✓ Function
- **Metabolism**
  - ✓ Metabolism of Proteins
  - ✓ Metabolism of Carbohydrates
  - ✓ Metabolism of lipids
  - ✓ Metabolism of Nucleic acids
  - ✓ Integration of various metabolic processes

Practicals

- Identification of proteins
- Identification of carbohydrates
- Identification of nucleic acid
- Identification of lipids

- Identification of enzymes
- Identification of alkaloids and vitamins
- Lab techniques for analysis of biochemical materials including biological activity assay
- Chromatographic and electro phoretic separation of macromolecules

Recommended Books

1. Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil. (2015).Harper's Illustrated Biochemistry, 30ed.
2. Denise R. Ferrier. (2013) Lippincott illustrated biochemistry 6th Edition.
3. Chatterjee. (2012) Medical biochemistry 8th Edition
4. Voet D, pratt. (1998). Fundamentals of biochemistry 5th Edition.

MIC-412 MICROBIAL PHYSIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- Identify the basic components of cells.
- Distinguish the features of procaryotic cells and eukaryotic cells.
- Learn the use and characteristics of microscope.

Course Outline:

- Detailed organization of microbial cells.
- Structure & Function relationship.
- Chemical composition and biosynthesis of macromolecules in microbial cells.
- Genomic organization of prokaryotes.
- Regulation of gene expression under stress condition.
- Uptake and secretion of molecules.
- Aerobic and anaerobic respiration and fermentation
- Cell metabolism: protein, nucleic acid and fat
- Microbial enzymes and metabolites.
- Classifications, chemistry, mechanism of action and inhibition.
- Stress responses.
- Microbial physiology and its implications in genomic era; genomic, proteomic and traditional tools.

Practical:

- Isolation of polysaccharides from bacteria.
- Isolation of lipids from bacteria.
- Estimation of total protein from bacterial cell.

- Isolation and purification of a bacterial enzyme.
- Growth curve under variable conditions.

Recommended Books:

- Seckbach, J., 2007. Journey to Diverse Microbial Worlds Adaptation to Exotic Environments .Publisher: Springer-Verlag New York.
- David L. N. and Michael M. C. L., 2008. Principles of Biochemistry. W. H. Freeman.
- Rathi. 2009. Microbial Physiology genetics and Ecology. MPDI.
- Moat , A. G., Foster, J.W., Spector, M.P., 2009. Microbial Physiology 4th Edition. Wiley, John & Sons
- Poole, R.K., 2012. Advances in microbial Physiology .Book series. Elsevier Ltd.
- Allison. 2013. Recent Advances in Applied Microbiology. RDM.

MIC-413 GENERAL GENETICS Credit Hours 3(2+1)

Aims and Objectives

The course is aimed

- To understand structure and function of chromosomes.
- To understand basic concept of Mutation.
- To learn about the genetics.
- To understand the mechanism of heredity.

Course outline

- Introduction to genetics
- Cell division
- Mendalism
- Gene interaction
- Gene and environment
- Linkage and crossing over
- Multiple alleles
- Sex linkage
- Cytogenetics
- Population genetics

Practicals

- Numerical problems of gene interaction
- Numerical problems of Multiple alleles
- Numerical problems of population genetics

- Numerical problems of sex linkage
- Blood groups
- Rh factor
- Culturing of Drosophila
- Culturing of yeast

Recommended books

1. Maria Alvarez. (2011) Genetic Transformation.
2. Leland, H., Leroy, H. (2010). Genetics: From Gene to Genome. McGraw Hill Sciences.
3. Asche, 2013. Recent Advances in Cloning Genetics and Stem Cell Technology. RDM.
4. Robert J. Booker. (2008) Genetics:Analysis and Principals 3rd ed.
5. Stanley Fields, Mark Johnston. (2010). Genetic Twist of Fate.

Semester-IV

MIC-421 BASIC BIOTECHNOLOGY Credit Hours: 3(3+0)

Aims and Objectives

- To acquaint students with the basic concepts and significance of biotechnology as it stands today.

Course Outline

- Biotechnology- definition and history
- foundations of biotechnology and interdisciplinary pursuit
- branches and/or applications of biotechnology in medicine, agriculture (food, livestock,
- fisheries, algae, fungi, etc.)
- protection of biotechnological products
- safety in biotechnology
- public perception of biotechnology
- biotechnology and ethics
- biotechnology and the developing world

Recommended books:

1. Daugherty E, 2012. Biotechnology: Science for the New Millennium. 1st Edition, Revised; Paradigm Publication.
2. Smith JE, 2009. Biotechnology. 5th Edition; Cambridge University Press.
3. Purohit SS, 2005. Biotechnology Fundamentals & Application. 4th Edition; Agro Bios, India.
4. Ratlegde C and Kristiansen B, 2006. Basic Biotechnology. 2nd Edition; Cambridge University Press, UK.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

MIC-422 BIO-SAFETY AND RISK MANAGEMENT Credit Hours: 3(2-1)

Aims and 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 Outline:

- Detailed concept of Risk and Hazardous Environment, Chemicals, Biological factors and Radiations.
- Risk assessment & Management: Preventions, Surveillance and Monitoring.
- Judicial rights / Penalties.
- Concepts of Biosafety Environment: Terrestrial, Marine, Atmosphere.
- Designing of labs based on Biosafety and Biological Containment parameters.
- Details of Biological Containment: Plants, Animals, Microbes.
- Bioethical issues related to Biosafety.
- Biosafety levels.

Recommended Books:

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

MIC-423 BACTERIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

To understand the morphology, structure and economic importance of Bacteria

Course Outline:

- History, characteristics and classification.
- Evolutionary tendencies in Monera (Bacteria, actinomycetes and cyanobacteria)
- Morphology, genetic recombination, locomotion and reproduction in bacteria
- Bacterial metabolism (respiration, fermentation, photosynthesis and nitrogen fixation)
- Importance of bacteria with special reference to application in various modern sciences specially agriculture, biotechnology and genetic engineering.
- Symptoms and control of major bacterial diseases in Pakistan

Practical:

- Isolation and identification of bacteria from:
  - Environment
  - Rhizosphere
  - Clinical samples.
- Effect of temperature on growth of bacteria.

Recommended Books:

1. Black, J. G. 2005 Microbiology - Principles and Exploration, John Wiley and Sons, Inc.
2. Prescott, L. M., Harley, J. P. and Klein, D. A. 2005. Microbiology McGraw-Hill Companies, Inc.
3. Arora, D. R. 2004. Textbook of Microbiology, CBS Publishers and Distributors, New Delhi.
4. Ross F. C. 1995. Fundamentals of Microbiology. John Willey & Sons, New York.

MIC-424 MICROBIAL GENETICS Credit Hours: 3(2+1)

Aims and Objectives:

- Understand about the continuity of the life from one generation to other generation on the basic mechanisms involving nucleus, chromosomes and genes etc.
- Understand the process of continuity and transfers of traits of the parents, that imparts variations render the generations sustainable in changing environment.

Course Outline:

- Nucleic acids structure and functions.
- DNA replication: replicon origins, events that occur at the replication fork, the structure and functions of DNA polymerases, and replication strategies.
- Control of DNA replication: dichotomous replication in prokaryotes.
- Control of gene expression in prokaryote: polycistrons, transcriptional initiation and termination, the operon, catabolite repression and attenuation control.
- Protein synthesis - mRNA translation: Genetic code - non universality, codon usage. Events on ribosomes (c.f. prokaryotes), ribosome structure-function relationships, organelle and archaebacterial systems.
- Plasmids, episomes and transposons.
- DNA mutagenesis and mutagenic agents, repair and mutation suppression.
- Genetic recombination: generalized recombination, site specific recombination and illegitimate recombination.
- Gene transfer mechanisms and their role in evolution.

- Transformation, transduction, conjugation and cross-phylogenic transfer.
- Gene mapping by conjugation and transduction.
- Circular chromosomal maps of bacteria.
- Introduction to genetic rearrangements.

Recommended Books:

1. Brooker, R.J., 2011. Genetics: Analysis and Principles 4th Edition. McGraw-Hill Science. Harlt,
2. D., L., and Ruvolo, M.,2011. Genetics. 8th Edition. Snustad, D.P and Simmons . M.J., 2011. Principles of Genetics, 6th edition. John Wiley and Sons.
3. Snustad, D.P. and Simmons . M.J., 2012. Genetics, 6th Edition.
4. John Wiley and Sons. Strickberger,M.V.,. 2012 Genetics .Macmillan Publishing Company. New York.
5. Larry Snyder, Joesph E. Peters, Tina M. Henkin and Wendy Champness. 2013. Molecular Genetics of Bacteria. 4th Edition.

MIC-425 MICROBIAL ECOLOGY Credit Hours 3(2+1)

Aims and Objectives:

- To understand basic concepts within the field of microbial ecology and environmental microbiology.
- To interpret the various ecological and evolutionary principles that impact microbes.
- To analyse and design experimental approaches used in the field of microbial ecology.

Course Outline:

- Introduction to microbial ecology: overview, motivation, history, applications etc.
- Concepts of microbial ecology
- Ecology of macro- and microorganisms: definitions, terminology, concepts
- Communities: colonization, succession, diversity, structure
- Microbial functions in ecosystems and global cycles
- Habitat characterization
- Characterization of microbial communities: culture-based methods, biomarkers, cell stains
- Interactions of microorganisms with their physical and chemical environment
- Microbial guilds and biogeochemical cycles I
- Microbial guilds and biogeochemical cycles II
- Interactions with the biotic environment: symbiosis, competition, parasitism, predation
- Interactions within microbial communities: quorum sensing, syntrophy, antibiotics

- Interactions of microorganisms with algae and plants
- Interactions of microorganisms with animals and humans
- Extreme environments: deserts, hot springs, glaciers, deep subsurface, mine drainage

Practicals:

- Isolation of bacteria from soil
- Isolation of fungi from soil
- Biochemical characterization of soil bacteria

Recommended Books:

- Brock Biology of Microorganisms, 13th Edition Michael T. Madigan, John M. Martinko, David A. Stahl, and David P. Clark.

Semester-V:

MIC-511 GENETIC ENGINEERING Credit Hours 3(2+1)

Aims and Objectives:

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

Course Outline:

- 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.
- Principles of nucleic acid isolation (DNA & RNA).
- Cloning strategies: construction of chimeric plasmids.
- Methods of introducing exogenous DNA.
- Methods for screening the clones.
- DNA sequencing.
- PCR: its application and primer designing.
- Prokaryotes and Eukaryotes Expression systems.
- Labeling methods of probes.
- Construction of genomic libraries.

Practical:

- Methods of nucleic acid isolation (DNA & RNA).
- Slab gel electrophoresis.
- Restriction enzyme digestion of DNA.
- Transformation.
- Southern blotting.
- Electro blotting.

Recommended Books:

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

MIC-512 TECHNIQUES IN MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

The course is designed to impart the knowledge of different techniques of Microbiology such as Polymerase chain reaction, Autoclave, Spectrophotometer, ELISA etc

Course Outline:

- The working principles, uses and applications of different techniques in Microbiology:
- Microscopy
- Culture Techniques
- Autoclave
- Laminar Flow Hood
- Spectrophotometer
- PCR
- ELISA
- Chromatography
- HPLC
- Blotting
- Centrifugation
- Gel Electrophoresis

- **Practical:**
- Isolation of bacteria from soil
- Staining techniques
- Observing different slides under microscopes
- Obtaining pure culture and culture preservation
- DNA isolation by Gel electrophoresis
- Amplification of DNA by PCR
- Sterilization by using Autoclave
- Purification of bacterial metabolites by Chromatography
- Separation of metabolites by Centrifugation

Recommended Books:

1. John M. Lammert. 2007. Techniques in Microbiology: A Student Handbook 1st Edition.
2. Tang, Yi-Wei, Stratton, Charles W. 2006.Advanced Techniques in Diagnostic Microbiology
3. Kanika Sharma. 2005. Manual of Microbiology: Tools & Techniques.

MIC-513 VIROLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- 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 Outline:

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

- Origin of life and Evolution.
- Classification and structure of medically important viruses.
- Introduction to the replication of viral genome.
- Maturation and release of viruses.
- Special features of molecular biology, biochemistry and genetics of the following viruses: Picornaviruses, Poxviruses, Myxoviruses, Paramyxoviruses, Rubella viruses, Rhabdoviruses, Reoviruses, Herpes viruses, Hepatitis viruses, Retroviruses and Tumor viruses (DNA & RNA), Adenoviruses, Coronaviruses.Emerging viral infection

Practical

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

Recommended Books:

1. Shi, P.Y.,2012. Molecular Virology and Control of Flaviviruses .Caister Academic Press 4. Stent,G.S., and Dohm, J.L., 2012.Molecular Biology Of Bacterial Viruses .Literary Licensing, LLC. 5. Maramorosch,K., and Frederick A. Murphy, F.A., 2013.Advances in Virus Research Elsevier Science.
2. Mahy, B.W.J.,& Van Regenmortel, M.H.V., 2008. Encyclopedia of Virology 3rd. Edition. Elservier
3. Cann, A. J., 2011. Principles of Molecular Virology.5th Edition. Academic Press.
4. Robert, W. Molecular Biology. 2011. McGraw-Hill Sciences
5. Ralf G. Dietzgen, R.F., and Ivan V. Kuzmin, I.V.,2012. Rhabdoviruses: Molecular Taxonomy, Evolution, Genomics,
6. Caister. 2012. Ecology, Host-Vector Interactions, Cytopathology and Control Academic Press. USA.

MIC-514 INTRODUCTION TO MEDICAL MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

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

Course Outline:

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

Practical:

- Collection and transportation & microscopic examination of clinical samples.
- Infections of ear, nose, throat, eye, GIT, urogenital tract (swabs).
- Isolation and identification of selected micro-organisms.
- Antibiotic assays by disc diffusion methods and dilution method.
- Determination of MIC and MBC.
- Antibacterial activity of serum.
- Agglutination test (Widal test).
- Precipitation tests.
- Urine analysis (physical, chemical and microbiological)

Recommended Books:

1. Cowan, S. T., Steel, K. J., Barrow, G. I and Feltham, R. K. A. 2004. Cowan and Steel's Manual for the Identification of Medical Bacteria, 3rd Edition, Cambridge University Press, U.S.A.
2. Hawkey, P and Lewis, D. 2004. Medical Bacteriology: A Practical Approach. 2nd Edition, Oxford University Press, U.K.
3. Mims, C., Dockrell, H., Goering, R., Roitt, I Wakelin, D. and Zuckerman, M. 2007. Medical Microbiology. 3rd Edition .Mosby Co., M.O.
4. Murray, P. R., Rosenthal, K. S., Pfaller, M. A. and Rosenthal, K. S. 2005. Medical Microbiology, Elsevier Health Science, N.Y.
5. Murray, Baron, Pfaller, Tenover, Yolken. 2011. Manual of Clinical Microbiology by 10thEd . ASM Press USA.
6. Brooks, G., Carroll, K.C., Butel, J., Morse , S., 2013. JawetzMelnick&Adelbergs Medical Microbiology 26th Edition McGraw-Hill Companies. North America.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

MIC-515 MOLECULAR BIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- To understand the ionic, hydrophobic, and hydrogen bonding interactions determine the structure of nucleic acids and proteins.
- To distinguish between different molecular biology techniques that are used to isolate, separate, and probe for specific proteins, nucleic acids, and their interactions.
- To compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, DNA repair, transcription, and translation; to explain how DNA topology and chromatin structure affects the processes of DNA replication, repair, and transcription.

Course Contents:

- Structure of DNA
- Eukaryotic Replication, Transcription and Translation
- Post Transcriptional and post Transcriptional modifications.
- Gene Expression
- Types of DNA
- Properties of DNA
- Denaturation and Renaturation
- Heterogeneity of DNA molecule
- Genetic Code
- Mutagenesis (eukaryotic)
- Repair Mechanisms

Practical:

- Plasmid DNA isolation from Bacterial cells
- DNA isolation from fungi/plant/animal cells
- Genomic DNA isolation from human mucosa
- DNA detection by Gel Electrophoresis

Recommended Books:

1. Burton E. Tropp. 2014. Principles of Molecular Biology.
2. Robert F. Weaver. 2011. Molecular Biology, 5th edition.
3. H. D Kumar. 2014. Molecular Biology, 2nd edition.
4. Verma P.S, Agarwal V.K. 2004. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology.
5. Gerald Karp. 2013. Cell and Molecular Biology 7th Edition.

WOMEN UNIVERSITY MARDAN
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MBIO-301 General Microbiology Credit Hours: 3(2-1)

Aims and Objectives:

The course aims to:

- Enable the students to work with microorganisms.
- Understand the basic techniques of sterilization, culturing, isolation
- Determine different characteristics of the microorganisms

Course Outline:

- **The beginnings of Microbiology**
  Discovery of the microbial world; Discovery of the role of microorganisms in transformation of organic matter, in the causation of diseases, development of pure culture methods. The scope of microbiology. Microbial evolution, systematics and taxonomy; Characterization and identification of microorganisms. Nomenclature and Bergey's manual.
- **Viruses**
  Bacteriophages and phages of other protests. Replication of bacteriophages. Viruses of animals and plants; History, structure and composition; classification and cultivation of animal viruses.Effects of virus infection on cells. Cancer and viruses.
- **Morphology and fine structure of bacteria**
  Size, shape and arrangement of bacterial cells, Flagella and motility, Pili, Capsules, sheaths, Prosthecae and stalks, structure and chemical composition of cell wall, cytoplasmic membrane, protoplasts, spheroplasts, the cytoplasm, nuclear material.
- **The Cultivation of Bacteria**
  Nutritional requirements, nutritional types of bacteria, bacteriological media, physical conditions required for growth, choice of media, conditions of incubation.
- **Reproduction and growth of bacteria**
  Modes of cell division, New cell formation, Normal growth cycle of bacteria, synchronous growth, continuous culture, quantitative measurement of bacterial growth; Direct microscopic count, Electronic enumeration of cell numbers, the plate count method, Membrane-filter count, Turbidimetric method, Determination of nitrogen content, Determination of the dry weight of cells, The selection of a procedure to measure growth, Importance of measurement of growth
- **Pure cultures and cultural characteristics**
  Natural microbial populations, selective methods; Chemical methods, Physical methods, Biological methods, Selection in nature, Pure cultures; Methods of isolating pure cultures, Maintenance and preservation of pure cultures, Culture collections, Cultural characteristics; Colony characteristics, Characteristics of broth cultures.
- **Eukaryotic Microorganisms**
  Algae: Biological and economic importance of algae; Characteristics of algae; Lichens. Fungi: Importance of fungi; Morphology; Physiology and reproduction, Cultivation of fungi. Economic importance of protozoa.
- **Prokaryotic diversity Bacteria**

Purple and green bacteria; cyanobacteria, prochlorophytes, chemolithotrophs, methanotrophs and methylotrophs, sulfate and sulfur-reducing bacteria, homoacetogenic bacteria, Budding and appendaged bacteria, spirilla, spirochetes, Gliding bacteria, Sheathed bacteria, Pseudomonads, Free living aerobic nitrogen fixing bacteria, Acetic acid bacteria, Zymomonous and chromobacterium, Vibrio, Facultatively aerobic Gram-negative rods, Neisseria and other Gram-negative cocci, Rickettsias, Chlamydias, Gram-positive cocci, Lactic acid bacteria. Endospore forming Gram-positive rods and cocci, Mycoplasmas, High GC Gram-positive bacteria; Actinomycetes, Coryneform bacteria, propionic acid bacteria, Mycobacterium, Filamentous Actinomycetes.

- **Prokaryotic Diversity**

  Archaea: Extremely Halophilic archaea, Methane producing archaea: Methanogens, Hyperthermophilic archaea, Thermoplasma.

Practical:

- Preparation of culture media
- Pure culturing and cultivation of bacteria
- Simple, Gram, endospore, capsular, flagellar and acid fast stainings of different genera of bacteria\Vital staning and microscopic observations of protozoa
- Cultivation methods of fungi
- Isolation of bacteriophages.

Recommended Books:

1. Eugene W. N., Denise, G., Anderson, M. T., Nester, C., Roberts, E. Nancy, N. 2001. Microbiology: A Hhuman Perspective, McGraw Hill Higher Education.
2. Jacquelyn, G.G. 2001. Microbiology: Principles and Explorations, John Wiley & Sons Inc.
3. Madigan, M.T., Martinko, J.M. and Parker, J. 1997. Brock Biology of Microrganisms, Prentice-Hall, London.
4. Benson, H.J. 1994. MICROBIAL APPLICATIONS: LABORATORY MANUAL IN GENERAL MICROBIOLOGY, WMC Brown Publishers, England.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

Semester-VI

MIC-521 INTRODUCTORY IMMUNOLOGY Credit Hours: 3(2+1)

Aims and Objectives

- The objective of this course is to learn about the structural features of the components of the immune system as well as their functions.
- The primary emphasis of this course will be on the mechanisms involved in immune system development and responsiveness.
- The major experiments that allowed the elucidation of these mechanistic features will be featured to help understand how immunologists think and work.

Course Outline

- Basic immunological concepts
- Principles and techniques of serology
- Immunological response to foreign agents
- Nature of antigens and antibodies
- Antigen-antibody reaction
- Immune competent cells
- Allergic reactions
- Tumor transplantation and immunology
- Immunogenetics

Practical

- Techniques used in serological studies of RBC & WBC count
- Different leukocyte count
- Blood grouping
- Body testing

Recommended Books:

1. Abbas, A. K., Lichtman, A. H. and Pillai, S. 2007. Cellular and Molecular Immunology, Elsevier Health Sciences, N.Y.
2. Johnson, A. G. G., Ziegler, R. J., Lukasewycz, O. A. and Lukasewycz, O. A. 2007. Microbiology and Immunology: Board Review Series, Lippincot Williams and Wilkins, M.D.
3. Lichtman, A. H. 2007. Basic Immunology. Elsevier Health Sciences, N.Y.

4. Murphy, K., 2011. Janeway'sImmunobiology (Immunobiology: The Immune System, 8th Edition. Garland Science Publishers.

MIC-522 VETERINARY MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

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

Course Outline:

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

Practical:

- Isolation of etiological agents of infections in animals.
- Isolation of etiological agents of infections in poultry.
- Mode of immunization of birds and animals.
- Field trips.

Recommended Books:

1. Martin E., Jones,H., William T. and Hubbert,V. H., 2005. Zoonoses: Recognition, Control and Prevention, Blackwell Publishing.
2. Mettenleiter, T. C and F. Sobrino, F., 2008. Animal Viruses: Molecular Biology Caister Academic Press.
3. Songer, J, G., and Post, K., 2009.Veterinary Microbiology: Bacterial and Fungal Agents of Animal Disease. 1st Edition. Wiley, John & Sons, Incorporated.
4. Quinn, P.J., Markey, B.K., Leonard, F.C.,Hartigan, P., Fanning, S.,2012.Veterinary Microbiology and Microbial Disease. Wiley, John & Sons, Incorporated.

MIC-523 PARASITOLOGY Credit Hours: 3(2+1)

Aims and Objectives

- To understand the existence of pathogenic parasites in different environment
- To study some human diseases caused by parasites
- To study about the diagnosis, treatment and control of parasites

Contents Outline:

- Etiology, life cycle, epidemiology, symptomatology, pathogenisis, lab. diagnosis, treatment, prevention and control of different parasites.
- Brief introduction of different parasites.
- Mediators/vectors of parasitic infection
- Recent advances in the diagnosis and control of parasitic infections.
- Newly emerging parasitic infections.

Practical:

- Collection and processing of clinical samples.
- Immuno and molecular techniques.
- Detection of plasmodium in blood.
- Detection of Protozoa, Helminthes and Amoeba in clinical samples and water.
- Staining methods.

Recommended Books:

1. Pearson, R.D., Gillespie, S.H., 2009. Principles and Practice of Clinical Parasitology.1st Edition .Wiley, John & Sons 3. Sun, T., 2012. Progress in Clinical Parasitology.
2. Springer-Verlag New York, LLC 4. Zeibig, E., 2012. Clinical Parasitology: A Practical Approach. 2nd edition. Elsevier Health Sciences
3. CK JayaramPaniker., 2013. Paniker textbook of medical parasitology. 7th Edition.

MIC-524 FOOD MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- To learn about the relevance of microbes with food industries
- To learn about food related microorganism.
- To learn about microbial food spoilage and its control.

Course Outline:

- 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.

Practical:

- Detection of food borne pathogens.
- Total viable count.
- Detection of mycotoxins and toxins.
- Application of hurdle technology.
- Visits to food industries: Brewery, Fisheries and food factories.

Recommended Books

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

MIC-525 **MYCOLOGY** **Credit Hours: 3(2+1)**

Aims and Objectives:

- Learn the characteristics of fungi for classification.
- Examine fungal metabolism.
- Learn about pathogenic fungi and their infections in plant and animals

Course Outline:

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

- Economic impact of fungal plant, animal and human diseases and their control. Mycotoxins.
- Use of fungi in biotechnology.
- Edible fungi.

Practical:

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

Recommended Books:

1. 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.
2. Katherine B., Daniel J. E, 2010. Cellular and Molecular Biology of Filamentous Fungi. ASM Press
3. CaisterGioconda, S-B. and Richard, C. A., 2012. Pathogenic Fungi: Insights in Molecular Biology. Academic Press.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

Semester-VII

MIC-611 SOIL AND ENVIRONMENATAL MICROBIOLOGY
Credit Hours: 3(2+1)

Aims and 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 Outline:

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

Practical:

- Role of microbes in soil formation.

- Reduction of metallic salts by microbial activity.
- Buried slide technique.
- Symbiotic and antagonistic relationship of soil microflora.
- Cellulolytic activity of soil microorganisms.
- Isolation of antibiotic producing and pesticide degrading microbes.
- Effects of biofertilizer on plant growth and health.
- Detection of water, air and soil pollutants.
- Isolation of microbes from air samples.
- Designing of schemes as flow diagram for waste water treatment/management.
- BOD and COD detection.

Recommended Books:

1. Diane Tice, D., 2005. Principles and Applications of Soil Microbiology. 2nd Edition. Oxford University Press.
2. Paul, E.A., 2007.Soil Microbiology, Ecology and Biochemistry .Elsevier Science. Varma, A., 2010. Advanced Techniques in Soil Microbiology: 1st Edition .Springer-Verlag New York, LLC.
3. Geoffrey R. Dixon,G.F.,2010. Soil Microbiology and Sustainable Crop Production: 1st Edition. Springer-Verlag New York, LLC
4. Paul, E.A., Study guide for Soil Microbiology, Ecology. Content Technologies, Inc. Publisher
5. Vallabhaneni, S., 2012. Soil Microbiology- A Laboratory Manual. LAP Lambert Academic Publishing AG & Co. KG.
6. Carrey. 2013. Recent Advances in Soil Microbiology and Soil Biotechnology. RDM.

MIC-612 EPIDEMIOLOGY AND PUBLIC HEALTH Credit Hours: 3(2+1)

Aims and Objectives:

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

Course Outline:

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

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

Practical:

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

Recommended Books:

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

MIC-613 IMMUNOGENETICS Credit Hours: 3(3+1)

Aims and Objectives:

This course will enable students to comprehend:

- The advances in the field of immuno-genetics
- Genetics of disease resistance
- Immune response through experimentation in different disease models

Course Outine:

- Concept of immune and immune system

- anti-body response
- nature of anti-bodies
- structure and heterogeneity of immunoglobulin
- allelic exclusion
- monoclonal antibodies.
- Inheritance of immune response
- Immune tolerance
- specific immune variations
- human IR genes
- anti-genic variation: genetic pathways for synthesis of A, B & O antigens
- secretor loci
- Rh factor and other blood groups.
- Histocompatibility: Histocompatibility of blood antigens, transplantation.
- HLA complex: HLA haplotypes, MHC/HLA and diseases.
- Immunological diseases: immune deficiency diseases, AIDS, auto immune diseases, inherited abnormalities of complement system.

Practical:

- Coomb's test
- Agglutination test (WIDAL, RF, CRP)
- Precipitin test (Radio-immunodiffusion technique)
- ELISA
- Immunochromatographic technique

Recommended Books:

1. Methods and Applications in Clinical Practice, Ch Immunogenetics, Editors: Frank T. Christiansen, Brian D. Tait 2012.
2. Cellular and molecular immunology. 4th Ed. Abbas, A. K., A. H. Lichtman, J, S. Pober. W. B. Saunders Co. 2000.
3. Advances in Immunology. Dixon, F. J., F. Alt, and K. F. Austen. Vol. 75. Academic Press. 2000.
4. Immunogenetic: Webster's Timeline History, Icon Group International, 1950 – 2007. 2010
5. Fundamentals of immunology. 2nd Edition. Myrvik, W. LEA & Febiger. 1984.
6. Immunogenetics of Autoimmune Disease. Oksenberg, J. R.; B. David (Eds.) 2006

MIC-614 INDUSTRIAL MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- Learn about microorganisms of industrial importance.

- Learn about the commercial utilization of microbes for the production of organic acids, organic solvents and fermentable products.
- Learn the industrial microbial processing techniques.

Course Outline:

- Culturing techniques
- The food processing
- Food manufacturing
- Preservation
- Environmental quality
- Sanitation
- General survey of biotechnologically important microorganism
- Outlines of isolation, cultivation and maintenance of biotechnologically important microorganisms
- Microbial biomass
- Biological control
- Microbial biotechnology
- Brewing
- Recombinant protein production
- Vaccine production
- End waste treatment industries
- Scientific perspective
- Case studies:
- Industrial alcohol production from sugar cane
- Quorn® myco-protein
- A spectrum of approach for microbial strain development
- Empirical strain developmet
- Mutagenesis and screening
- Semi empirical strain development, selection
- The use of auxotroph and analogue resistant mutants in strain development
- Continuous culture technologies for strain development
- Metabolic control analysis
- Principles and means of rational strain development
- Case study tryptophan biosynthesis in neurosporacrassa

Practical:

- Industrial waste water treatment by various techniques

- Determination of physical conditions for microbes for better quality of industrial products development
- Comparative study of prototroph and auxotroph used in industry for better yield.
- Lal test and Gel test.

Recommended Books:

1. Presctt S. C., 2007. Industrial Microbiology, AgrobiosIndiad
2. NadukaOkafor. 2007 Modern Industrial Microbiology and Biotechnology. Science Publisher.
3. Richard H. B. Julian E. D. et al., 2010. Manual of Industrial Microbiology and Biotechnology. ASM Press. El-Mansi E. M. T. et al., 2011. Fermentation Microbiology and Biotechnology. CRC Press.
4. Pauline M. D., 2012. Bioprocessing Engineering Principles. Academic Press.
5. K. Sukesh, M.M. Joe & P K Sivakumar. 2010. An Introduction to Industrial Microbiology. 1st edition

Semester-VIII

MIC-621 DNA DAMAGE, REPAIR AND CARCINOGENESIS Credit Hours: 3(2+1)

Aims and Objectives:

- To learn about physical and chemical DNA damaging agents.
- To learn about exo and endogenous mutagenic agents.
- To learn about the mechanism of carcinogenesis and mutations.

Course Outline:

- Radiation (ionizing and non-ionizing) as damage inducing agents. DNA, the critical site for damage and interaction. Biological consequences of damage.
- Inactivation of biological systems: bacterial cells and bacteriophages by UV radiations. Post-irradiation macromolecular system.
- Chemical as damage inflicting agents. Exogenously and endogenously induced base modifications and their biological consequences.
- Restoration of DNA damages: photo-enzymatic restoration and dealkylation. Environmental and physiological factors influencing recovery phenomenon viz. Liquid holding recovery, thermal and UV reactivation.
- Repair of DNA damages: excision repair processes, mismatch repair, tolerance mechanism, conditioned repair phenomenon (phenomenology and genetic control of SOS functions, adaptive responses to DNA alkylation and oxidative stress.
- Relevance of inducible repair to carcinogenesis.
- Somatic theory of cancer. Chemistry of carcinogenesis, cellular transformation.

- Anticarcinogenesis: role of repair processes in tumor progression. Molecular genetics of human cancer: diagnostic and therapeutic indices.
- Repair and spontaneous mutagenesis, plasmid gene mediated repair, genetic control of repair phenomenon.
- Enzymology of DNA repair.
- Cancer and gene therapy.

Practical:

- Screening of mutagenic agents by AMES test.
- To determine the effect of UV radiation on prokaryote and eukaryotes.
- Screening of carcinogenic agents by the use of indicator cell lines.

Recommended Books:

1. Friedberg, E.C., 2006.DNA Repair and Mutagenesis: 2nd Edition Publisher: ASM Press.
2. Howe, H., 2007. Gene Cloning and Manipulation Cambridge University Press
3. Snyder, L. and W. Champness, W., 2007. Molecular Genetics of Bacteria, 3rd edn American Society for Microbiology.
4. Caldecott , K.W.,2011. Eukaryotic DNA Damage Surveillance and Repair: 1st Edition. Springer-Verlag New York, LLC.
5. Stone, M., 2011. Structural Biology of DNA Damage and Repair. American Chemical Society.
6. James D. W. 2013. Molecular Biology of Gene. McGraw-Hill Science.

MIC-622 MICROBIAL GENOMICS AND PROTEOMICS Credit Hours: 3(2+1)

Aims and Objectives:

This course will enable students to develop:

- Understanding of the structural and functional genomics and proteomics and their applications.

Course Outline:

- Concepts of genomics and proteomics.
- Structural Genomics: Genetics and physical maps, genome sequencing, single nucleotide polymorphism, copy number variations, expressed sequence tags, bioinformatics, metagenomics, synthetic biology.
- Functional Genomics: Prediction of function from sequences, gene expression and microarrays, gene expression and reporter sequences, genome wide mutagenesis. Comparative Genomics: Origin of genomics, prokaryote genomics, eukaryotic genomics, comparative *Drosophila* genome, the human genome.
- Proteomic Analysis: Determination of cellular proteins, affinity capture, protein microarrays, structural proteomics.

- Prediction of protein coding gene
- Prediction of RNA coding gene
- Promoter prediction through feature recognition
- functional categories of genes
- Genome scale gene mapping
- Genome perspective on horizontal gene transfer (HGT).

Practical's:

Genome and proteome analysis on aspects given in the theory.

- Complete genome investigation of *E. coli* and *Neurospora*.
- Genome Analysis of *Arabidopsis.*
- Isolation and identification of various proteins using different techniques

Recommended Books:

1. Genomics and Proteomics: Principles, Technologies, and Applications Devarajan Thangadurai, Jeyabalan Sangeetha, Apple Academic Press. 2015
2. Concepts and Techniques in Genomics and Proteomics: A volume in Woodhead Publishing Series in Biomedicine, N. Saraswathy and P. Ramalingam. 2011
3. Genomics and Proteomics Engineering in Medicine and Biology Akay M. John Wiley and Sons, Inc. 2007.
4. Bioinformatics, genomics and proteomics, getting the big picture. Batiza A. F. Infobase publishers. 2006.
5. Plant Genomics and Proteomics. Cullis A. C. John Wiley and Sons Inc. Hoboken, New Jersey. 2004.
6. Data Mining for Genomics and Proteomics: Analysis of Gene and Protein Expression Data. Dziuda M. D. John Willey & Sons, Inc, New Jersey USA. 2010.

MIC-623 PHARMACEUTICAL MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- At the end of the course, students will be able to;
- Describe what Pharmaceutical microbiology and Antimicrobial agents are.
- Understand the interrelationship between microorganisms and drugs
- Explain the role that microbes and plants play in antibiotic production
- Describe the methods of producing antimicrobial agents
- Describe the methods of Testing antimicrobial agents

Course Outline

1. Introduction to Pharmaceutical Microbiology
2. Intro to Antimicrobial agents

3. Nature of Antimicrobial Phenomenon
4. Methods to produce antibiotics from microorganisms
5. Drug spoilage and preservation
6. Drug contamination and spoilage
7. Mechanism of drug spoilage
8. Mechanism and rate of drug degradation. Microbial, physical and chemical means of drug degradation

9. Conditions associated with contamination of pharmaceuticals with microorganisms.
10. - Effects of contamination of pharmaceuticals with microorganisms.
11. Standardized methods for in-vitro antibacterial and antifungal susceptibility.
12. - Susceptibility of organisms to systemic and topical agents.

Recommended Books:

1. Bruker Corporation: Pharmaceutical Microbiology
2. Prescott's Microbiology, 8th ed. (International ed. 2011)
3. Industrial Pharmaceutical Microbiology: Standards & Controls - 2015 Edition edited by Geoff Hanlon and Tim Sandle

MIC-624 INTRODUCTION TO BIOINFORMATICS Credit Hours 3(2+1)

Aims and Objectives

The aim of course is

- To familiarize students with biological data mining from online databases and the use of various bioinformatics tools for extracting and processing biological data.

Course outline

- Introduction
- Bio-Computing
- Biological Databases - Types and Retrieval Of Nucleic Acid (Or
- Genomic)
- Protein Sequence Information
- Sequence Alignment - Pairwise, Multiple.
- Phylogenetics
- In Silico Identification of Protein Motifs and Domains
- Structural Bioinformatics Of
- Proteins And Rnas Including Protein Modelling and Prediction Of Their Interactions With Other

- Proteins And Small Molecules
- Identification Of Genes and Promoter Regions Within Genomes
- Strategies For Whole Genome Sequencing and Assembly

Recommended Databases and tools:

1. NCBI, PDB, EcoCyc, DDBJ, SWISS-PROT, TIGR, KEGG etc.
2. Bioedit, Repeatmasker, PHRED, PHRAP, BLAST, Prosite/BLOCKS/PFAM, CLUSTALW, Emotif, RasMol, Oligo, Primer3, Molscript, Treeview, Alscript, Genetic Analysis Software, Phylip, MEGA4.0 etc.

Recommended books

1. Claverie JM and Notredame C, 2006. Bioinformatics for Dummies. 2nd Edition; Wiley
2. Publishing.
3. Xiong J, 2006. Essential Bioinformatics. 1st Edition; Cambridge University Press.
4. Xia X, 2007. Bioinformatics and the Cell: Modern Computational Approaches in Genomics,
5. Proteomics and Transcriptomics. 1st Edition. Springer
6. Mathura V and Kangueane P, 2009. Bioinformatics: A Concept-Based Introduction. Springer
7. Mount DW, 2004. Bioinformatics Sequence and Genome Analysis. 2nd Edition; Cold Spring

DETAIL OF ELECTIVE COURSES

MIC-626 CELL AND TISSUE CULTURE Credit Hours: 3(2+1)

Aims and Objectives:

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

Course outline:

- 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
- Growth control
- Source substitutes, pH regulation.
- 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.
- Negative selection:
- Differentiated, serum dependent normal cells
- Applications of plant tissue culture.
- Stem cell technology

Practical:

- Starting a primary culture (tissue digestion, cell count and cell culture).
- Maintenance of a cell line.
- Cryopreservation of cell line.
- Plant cell culture.
- Vital staining. 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. Freshney, R.I., 2006. Culture of Animal Cells: A Manual of Basic Technique. 5th Edition. Wiley, John & Sons.
4. 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 in Plant Tissue Culture and Biotechnology. RDM.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

MIC- 627 EPIGENETICS Credit Hours: 3(2+1)

Aims and Objectives:

- This will give insight into the genetic regulation.
- To learn heritable changes in gene expression and cellular phenotypes.
- To learn about changes in phenotypes other than changes in underlying DNA sequences.

Course Outline:

- Genome organization of eukaryotes.
- Structure of chromosomes.
- Structure of gene
- Types of DNA.
- Types of RNA.
- Regulatory sites on DNA.
- Heterochromatin and euchromatin.
- Genetic modulation by CpG Island, DNA methylation and its implication on gene expression.
- Types of methylases, DNA/RNA methylation, and its implication on gene expression.
- Types of acetylases, acetylation of histones.
- Book marking, Imprintig, Maternal effects, Paramutation, X chromosome inactivation, Position effect, Gene silencing, Transvection and Reprogramming.
- Implication of epigenetic on gene expression, cellular differentiation and signal transduction.

Practical:

- Karyotyping of eukaryotes.
- Detection of CpG motifs by restriction enzymes.
- Detection of CpG motif by PCR.
- Detection of methylated sites on DNA.

Recommended Books:

1. TrygyeTollefbol. 2010. Handbook of Epigenetics. Academic Press.
2. Jhon Hancock. 2010. Cell signaling. Oxford University Press.
3. Benedikt H. and Brian K. H., 2011. Epigenetics: Linking Genotype and Phenotype in Development and Evolution University of California Press.
4. Richard C. F., 2012. Epigenetics. W. W. Norton & Company.
5. Nessa Carey. 2012. The Epigenetic Revolution. Columbia University Press.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

MIC- 628 **MYCOTIC INFECTION** **Credit Hours: 3(2+1)**

Aims and Objectives:

- To learn about some selected human fungal infections
- To learn about etiology of some cutaneous and systematic mycosis.
- To learn about sample collection, diagnosis and control of fungal infections.

Course Outline:

- Introduction to human mycotic infections.
- Host parasite interactions and molecular mechanisms.
- Study of the following human diseases with particular reference to etiology, epidemiology, symptomatology, lab. Diagnosis and therapeutic considerations of: Actinomycosis, nocardiosis, candidiasis, hisotoplasmosis, blastomycosis, coccidiomycosis, geotrichosis, aspergillosis, chromoblastomycosis, mycetoma, sporotrichosis, cryptococcosis, and zygomycosis.
- Determatophytes and dermatomycosis, Tineaversicolor, white and black Piedra, Tineanigra.
- Prohylaxis and chemotherapy.
- Immunity in fungal infections.
- Zoonotic fungal infections.
- Newly emerging fungal infections.

Practical:

- Detection of etiological agents in sputum, nails, hairs, and skin samples.
- Microscopic observation of fungi in clinical samples.
- Cultivation of fungi.
- Rapid molecular diagnostic methods
- Antifungal sensitivity test.

Recommended Books:

1. Webster, J. and Weber, R., 2008 Introduction to Mycology. Cambridge University Press.
2. Lechevealier, H., A practical guide to Generic Identification of Actinomycetes volume 4 of Bergey's Manual of Systematic Bacteriology.
3. Borkovich K. and Daniel J. E. 2010. Cellular and Molecular Biology of filamentous Fungi. ASM Press.
4. Errol R., Shadomy J. and Lyon G. H. 2011. Fundamental Medical Mycology. Wiley Blackwell.
5. Gioconda, S.B. and Richard, C. A., 2012. Pathogenic Fungi: Insights in Molecular Biology. Caister Academic Press.
6. Goadby K. W. ,2012. The Mycology of the Mouth. Rare Books Club.

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

MIC-629 GENERAL BIOTECHNOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- To understand the potentials of microorganisms and utilizations of beneficialmicroorganisms.

Course Outline:

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

Practical:

- 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:

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

WOMEN UNIVERSITY MARDAN
DEPARTMENT OF MICROBIOLOGY

MIC- 526 PROBIOTICS Credit Hours: 3(2+1)

Aims and Objectives

- To study about the beneficial bacteria found in the intestine of humans
- To understand the mechanisms or working of probiotics
- To learn about the development and production of probiotics in industries

Course outline

- Introduction
- The intestinal flora
- Development of probiotics
- Probiotic usage
- Mechanism of working

Practical

- Isolation, characterization and identification of intestinal flora
- Study of reaction produced by probiotics
- Methods for development of probiotics.

Recommended Books

1. Gary B. Huffnagle., Sarah Wernick., 2008. The Probiotics Revolution The Definitive Guide to Safe, Natural Health Solutions Using Probiotic and Prebiotic Foods an Supplements
2. Petra Foerst.,ChalatSantivarangkna., 2015. Advances in Probiotic Technology.
3. Martin H. Floch., Adam S. Kim., 2010. Probiotics A Clinical Guide.

MIC MARINE MICROBIOLOGY Credit Hours: 3(2+1)

Aims and Objectives:

- To identify distribution of various types of microorganisms in marine environment.
- To identify sources of food contamination and water pollution.
- To study the effect of pollution on marine fauna and flora.

Course Outline:

- Introduction to marine microbiology.
- Zonation and microbial stratification in marine environment.
- Effect of movement of water in marine environment.
- Laws of ecology with particular reference to marine ecosystem: environmental factors (biotic and abiotic) and their influence on the distribution of microorganisms.

- Enumeration of bacteria: sampling and samplers, processing and actual enumeration procedures.
- Marine microorganisms: some important groups of marine microorganisms.
- Detailed study of biogeochemical cycling of C, N, S & P.
- Advantages and disadvantages of marine microorganisms including their importance in marine biotechnology.
- Some common diseases of marine fauna.

Practical:

- Isolation of luminescence organisms.
- Isolation of Cynobacteria, Photosynyhetic bacteria.
- Isolation and screening of antimicrobial activity of marine microbes.
- Isolation of polymer producing bacteria.
- Isolation of halophyte organisms.

Recommended Books:

1. Horst, D. S. and Matthias Z., 2006. Marine Geochemistry. Springer.
2. Paul F. and Andrew H. K., 2007. Evolution of Primary Producers in the Sea. Academic Press.
3. Chauhan. 2009. Cyanobacteria Antimicrobial Activity. NIPA.
4. Scheper,T., Marine Biotechnology December 2011. Springer-Verlag New York, LLC
5. Munn, C., 2011. Marine Microbiology: Ecology & Applications. Taylor & Francis press

Courses for External departments:

1.Everyday Science: (MIC-313)

Everyday Science

Credit Hours: 03

MIC-313

Objectives:

The aims of the teaching and study of sciences are to encourage and enable students to: develop inquiring minds and curiosity about science and the natural world.

Course Outline

1. **Biological Sciences**

The Basis of Life: Cell Structures and Functions (Subcellular Organelles such as Nucleus, Mitochondria and Ribosomes).

Biomolecules: Proteins, Lipids, Carbohydrates, Fats and Enzymes.

Common diseases and Epidemics: Polio, Diarrhea, Malaria, Hepatitis, Dengue their Causes and Prevention.
Environment and Pollution: The Atmosphere (Layered Structure and Composition), Hydrosphere (Water Cycle, Major Water Compartments), Biosphere (Major Biomes) and Lithosphere (Minerals and Rocks, Rock Types, Plate Tectonics).
Concept of Balance Diet: Vitamins, Carbohydrates, Protein, Fats and oil, Minerals, Fiber.
Quality of Food: Bioavailability of Nutrients, Appearance, Texture, Flavor, Quality of Packed and Frozen Food, Food Additives, Preservatives and Antioxidants

2. **Physical Science:**

Constituents and Structure: Universe, Galaxy, Light, Year, Solar System, Sun, Earth, Astronomical System of Units
Process of Nature: Solar and Lunar Eclipses, Rotation and Revolution, Weather Variables (Global Temperature, Pressure, Circulation, Precipitation, Humidity) and Weather Variations.
Nature Hazards and Disasters: Earthquake, Volcanic Eruption, Tsunami, Floods, Avalanche, Travelling Cyclone (Tropical Cyclone, Middle Latitude Cyclone and Tornadoes), Drought, Wildfire, Urban Fire. Disaster Risk Management.

3. **Chemistry:**

Atomic Structure: Chemical Bonding, Electromagnetic Radiations.
Modern Materials /Chemicals: Ceramics, Plastics, Semiconductors. Antibiotics, Vaccines, Fertilizers, Pesticides.
Communication: Basics of Wireless Communication (Mobile, Satellite, Surveillance and GPS and Fiber Optic etc.

Recommended Books:

- Exploring Life Science 1975 Walter A. Thurber, Robert E. Kilburn, Peter S. Howell.
- Food Science 1998 Norman N. Potter, Joseph H. Hotchkiss.
- Environmental Science: Systems and Solutions. 5th ed. 2013 Michael L. McKinney, Robert Schoch and Logan Yonavjak.
- Environmental Science: A Global Concern 2012 William P. Cunningham, Barbara Woodworth Saigo.
- Fundamentals of Telecommunications 2005 Roger L. Freeman.
- Exploring Life Science 1975 Walter A. Thurber, Robert E. Kilburn, Peter S. Howell
- Principles of Animal Biology 2011 Lancelot Hogben.
- Forensic Science Fundamentals & Investigation 2008 Anthony J. Bertino.
- Basics of Environmental Science 2002 Michael Allaby.