

***The programs at IPDM are focused on basic, translational and clinical aspects in the fields of Chemical Pathology, Histopathology, Hematology, Microbiology and Oral Pathology. In addition, we aim to introduce new programs BS Medical Microbiology at IPDM.***

BS. Medical Microbiology Course Curriculum





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**Scheme of Studies for BS Medical Microbiology (4 Years)**

|  |  |  |
| --- | --- | --- |
| **Semester / Year** | **Name of Subject**  | **Credits** |
| **First**  | [MIC-301: (ENGLISH –I)](#_Toc160033674)  | 2+0=2 |
|  | [MIC-302: BIOCHEMISTRY-I](#_Toc160033675)  | 2+1=3 |
| [MIC-303: MATHEMATICS - I](#_Toc160033676)  | 3+0=3 |
| [MIC-304: FUNDAMENTALS OF MICROBIOLOGY](#_Toc160033677)  | 2+1=3 |
| [MIC-305: ISLAMIC STUDIES](#_Toc160033678)  | 2+0=3 |
| [MIC-306: MICROBIAL TAXONOMY](#_Toc160033679)  | 2+1=3 |
| **Total Credit Hours**  | **17** |
| **Second**  |  |  |
|  | [MIC-307: ENGLISH –II](#_Toc160033681)  | 2+0=2 |
| [MIC-308: PAKISTAN STUDIES](#_Toc160033682)  | 2+0=2 |
| [MIC-309: BIOCHEMISTRY-II](#_Toc160033683)  | 2+1=3 |
| [MIC-310: BIOSTATISTICS](#_Toc160033684)  | 2+1=3 |
| [MIC-311: HUMAN PHYSIOLOGY-I](#_Toc160033685)  | 2+1=3 |
| [MIC-312: COMPUTER APPLICATIONS](#_Toc160033686)  | 2+1=3 |
| **Total Credit Hours**  | **16** |
| **Third**  |  |  |
|  | [MIC-413: HUMAN PHYSIOLOGY-II](#_Toc160033688)  | 2+1=3 |
| [MIC-414: GENERAL IMMUNOLOGY](#_Toc160033689)  | 2+1=3 |
| [MIC-415: GENERAL PATHOLOGY](#_Toc160033708)  | 2+1=3 |
| [MIC-416: MICROBIAL ANATOMY AND PHYSIOLOGY](#_Toc160033709)  | 2+1=3 |
| [MIC-417: GENERAL ANATOMY](#_Toc160033710)  | 2+1=3 |
| [MIC-418: MOLECULAR CELL BIOLOGY](#_Toc160033711)  | 2+1=3 |
| **Total Credit Hours**  | **18** |
| **Fourth**  |  |  |
|  | [MIC-419: INTRODUCTION TO MEDICAL MICROBIOLOGY](#_Toc160033713)  | 2+1=3 |
| [MIC-420: SPECIAL PATHOLOGY](#_Toc160033714)  | 2+1=3 |
| [MIC-421: Zoonosis](#_Toc160033715)  | 2+1=3 |
| [MIC-422: BACTERIAL GENETICS](#_Toc160033716)  | 2+1=3 |
| [MIC-423: BIOINFORMATICS](#_Toc160033717)  | 2+1=3 |
| [MIC-424: ONE HEALTH](#_Toc160033718) | 2+0=2 |
| **Total Credit Hours**  | **17** |
| **Fifth**  |  |  |
|  | [MIC-525 BIOSAFETY AND BISECURITY](#_Toc160033720)  | 2+1=3 |
| [MIC- 526: MEDICAL VIROLOGY](#_Toc160033721)  | 2+1=3 |
| [MIC-527: CLINICAL BACTERIOLOGY](#_Toc160033722)  | 2+1=3 |
| [MIC-528: PUBLIC HEALTH MICROBIOLOGY](#_Toc160033723) | 2+1=3 |
| [MIC-529: GENERAL PHARMACOLOGY](#_Toc160033724)  | 2+1=3 |
| [MIC-530: MEDICAL MYCOLOGY](#_Toc160033736)  | 2+1=3 |
| **Total Credit Hours**  | **18** |

|  |  |  |
| --- | --- | --- |
| **Sixth**  |  |  |
|  | MIC-531: Advanced Microbial Diagnostics | 2+1=3 |
| [MIC-532: Medical Parasitology](#_Toc160033738)  | 2+1=3 |
| [MIC-533: MOLECULAR MECHANISMS OF ANTIMICROBIAL THERAPUTIC AGENT](#_Toc160033740)  | 2+1=3 |
| [MIC-534: Proteomic and Gene therapy](#_Toc160033741)  | 2+1=3 |
| [MIC-535: Clinical Rotation](#_Toc160033742)  | 1+3=4 |
| **Total Credit Hours**  | **16** |
| **Seventh**  |  |  |
|  | [MIC-636: RESEARCH METHODOLOGY AND BIO ETHICS](#_Toc160033744)  | 3+0=3 |
| [MIC-637: FOOD and Water MICROBIOLOGY](#_Toc160033745) | 2+1=3 |
| [MIC-638: Medical Entomology](#_Toc160033746)  | 2+1=3 |
| [MIC-639: Epidemiology](#_Toc160033747) | 2+0=2 |
| [MIC-640: Clinical rotations](#_Toc160033748)  | 1+3=4 |
| **Total Credit Hours**  | **15** |
| **Eight** |  |  |
|  | [MIC-641: MICROBIAL BIOTECHNOLOGY](#_Toc160033750)  | 2+1=3 |
| [MIC-642: TROPICAL INFECTIOUS DISEASES](#_Toc160033751)  | 2+1=3 |
| [MIC-643: RESEARCH MINIPROJECT](#_Toc160033752)  | 6+0=6 |
| **Total Credit Hours**  | **12** |

**Total Course Credit Hours = 129**

BS MEDICAL MICROBIOLOGY

# Vision

 Global leader in health sciences academics and research for efficient and compassionate health Care.

# Mission

 Khyber medical university aims to promote professional competence through learning and innovation for providing comprehensive quality health care to the nation.

# Overview

The mission of BS Microbiology is to produce skilled graduates by providing them quality education through diverse learning environment, by providing equipped laboratories and through internship and research programs under the supervision of highly qualified and experienced staff. Further, graduate program in microbiology will enable our graduates with skills in the areas of basic and applied microbiology. To meet this goal, we give them research based teaching necessary to meet the needs of advancements in microbiology.

#  Program Objectives

* To learn the microbiological concepts and applications of the knowledge in the diverse fields of Medical Microbiology, Infectious diseases, Immunology, and Molecular microbiology
* To explain the theoretical basis of the tools, technologies and methods common to microbiology
* To demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments

# Core values

* Perform integrated interdisciplinary teaching and research with the highest level of ethics and professionalism, to meet the needs of stakeholders; and be responsive to changing global trends.
* Promote and defend the freedom of thought, academic enquiry, expression and association.
* Demonstrate sensitivity to student welfare and staff needs, and to practice environmental stewardship to the highest standards.

# Core Activities

* The institute instructs in the *biomedical sciences* related to Medical Microbiology.
* The institute trains Undergraduate students in Medical Microbiology in the four years’ degree program.
* In addition, the institute also invests in preparing active future Medical Microbiologist, *researchers and teachers*.
* It engages its students in activities ranging from *optimization of laboratory* protocols and *animal handling* to *poster & oral presentations* and *critical reviews*.
* The institute arranges *research days and conferences* throughout the year, in which the new inductees are given an opportunity to develop an orientation regarding the core activities and structure of the department while the current students present their posters and critical reviews and receive feedback from the faculty members of different departments.
* Furthermore, students assessed for their understanding and application of knowledge through both *formative and summative assessments*.

# Teaching and Learning Methods

Students will experience a wide variety of teaching and learning methods from expert staff including *tutorials, lectures, seminars, workshops, small group discussions, and problem-based learning, and laboratory sessions*. As such the students will develop a wide range of skills useful in basic and applied environment. These skills will aid in *teamwork, scientific exploration, and problem solving and identifying relevant laboratory protocols*.

# Assessment Methods

Students will be assessed both *formatively and summative*. Throughout the year formative assessment in the form of class tests, presentations and assignments along with the feedback will be carried out. Summative assessment will include end of the course terminal exam featuring multiple-choice questions. The practical aspects will be assessed using viva and Objective structured Practical examination (OSPE).

# Compulsory Courses

The BS Medical Microbiology are required to undertake of Compulsory courses are Islamic Studies, Computer Application, English, Pak Studies and Mathematics.

# Specialty Courses

These courses are designed for the in-depth study of the Medical Microbiology The basic knowledge will be learned to a level to teach undergraduate. This part of the course with regular tutorials and laboratory sessions and taught by respective faculty. The related specialty courses of each specialty are mentioned in their corresponding sections.

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# Registration in the University

* Registrar of the university shall maintain a register of BS Medical Microbiology through Centralized Admission Test (CAT) and Open Merit list of KMU.
* A "notification of registration" for each candidate approved /allowed for admission to BS program shall be issued by the University.
* Registration may be renewed on payment of the prescribed fee if a scholar is re-admitted within a year after having been struck off the rolls for any valid reason.
* A person registered for the BS degree program shall be called Medical Microbiologist. Each student so selected shall be required to register and pay the dues within 30 days from the date of issuance of the notification of registration, failing which the admission of the selected candidate shall be deemed as cancelled. The university shall determine the tuition fee and other dues from time to time.

# Mentors

The students shall select their teaching mentor in the first year and research mentor at the end of last year. The coordinator shall serve as mentor before selection of mentors.

# Student Assessment Methods

a. Class quiz to assess continuous learning process

b. Terminal Examination to assess learning out comes

c. Presentations to assess communication skills

d. Assignments to assess writing skills

# Weighting of assessments Total marks=100

 Midterm exam 20

 Terminal examination 70

 Oral/practical examination 05

 Presentations/Assignment 05

 **Total 100**

# BS MICROBIOLOGY COURSE DOCUMENT

# BS SEMESTER – I

# Cr Hrs. (17)

**Course Code/Course Title/Credit Hours**

MIC-301: English-I (3+0)

MIC-302: Biochemistry-1 (2+1)

MIC-303: Mathematics (3+0)

MIC-304: Fundamentals of Microbiology (2+1)

MIC-305: Islamic Studies (2+0)

MIC 306: Microbial Taxonomy (2+1)

# MIC-301: (ENGLISH –I)

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

#### Objectives:

To enhance language skills and develop critical thinking

#### Course Detail:

#### Basics of Grammar

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

#### Comprehension

* Answers to questions on a given text

#### Discussion

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

#### Listening

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

#### Translation skills

* Urdu to English

#### Paragraph writing

* Topics to be chosen at the discretion of the teacher

#### Presentation skills

* Introduction

Note: Extensive reading is required for vocabulary building

#### Recommended Books:

#### 1. Functional English

#### a) Grammar

* Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
* Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

#### b) Writing

* Writing. Intermediate by Marie-Christine outin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0194354057 Page 20-27 and 35-41.

#### c) Reading/Comprehension

* Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992.

#### d) Speaking

# MIC-302: BIOCHEMISTRY-I

#### Credit Hours (2 +1)

#### Objectives

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

#### Course Detail

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

#### Practical

* Normal Solutions
* Acid and Bases
* Electrolytes
* Non Electrolytes
* Buffers and pH
* Study of hydrolysis of starch by using mineral acids
* Various qualitative tests for Monosaccharide, oligosaccharides and polysaccharides
* Preparation of calibration curve for glucose
* Estimation of serum glucose by using calibration curve
* Detection of reducing sugars in the presence of non-reducing sugars
* Qualitative tests for different lipids
* Paper and thin-layer chromatography of sugars
* Paper chromatography of various amino acids
* Determination of pK values of amino acids (Glycine, Alanine) by preparation of titration curves
* Qualitative and quantitative analysis of proteins by colorimetric methods (Biuret and Lowry’s)

####  Recommended Books

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

# MIC-303: MATHEMATICS - I

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

#### Objectives

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

#### Course Detail

* Limits and continuity
* Derivative of a function and its applications
* Optimization problems
* Definite integral and applications
* Lab Mathematics (Conversion factor, dilution, concentration)
* Inverse functions (Chapters 1-6 of the text)
* Basic Math (functions, sets, matrices, complex numbers, quadratic equations, sequence and series)

#### Recommended Books

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

# MIC-304: FUNDAMENTALS OF MICROBIOLOGY

#### Credit Hours (2+1)

#### Objectives

* To understand structure, functions and classification of microorganism
* To learn isolation, identification and control methods of different microorganism

#### Course Detail

* Fundamentals of microbiology
* Microorganisms and their respective place in the living world
* Differentiation between pro- and eukaryotic cells
* Historical development of Microbiology and its scope
* Microscopy: An outline of the principles and applications of light and electron microscope
* Morphology, arrangement and detailed anatomy of bacterial cell
* Bacterial taxonomy and nomenclature, basis of classification of bacteria
* Growth, nutrition (physical and nutritional requirement and nutritional types; sources of energy, C, N, H, O, S, P, H2O, trace elements, growth factors) and reproduction
* General methods of studying microorganisms: cultivation, isolation, purification and characterization
* Control of microorganisms by physical and chemical methods
* Chemotherapeutic agents and antibiotics
* Modes of action of antibiotics on microorganisms
* Basic properties of fungi, protozoa and algae.
* A brief introduction to structure and propagation of viruses and bacteriophages

#### Practical

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

#### Recommended Books

* Baker, S., Khan, N., Nicklin, J. and Killington, R., 2006. Instant Notes in Microbiology, 3rd Ed edition, Taylor and Francis.
* Black, J. G. 2005. Microbiology: Principles & Explorations, 6th edition, John Wiley and Sons, N.Y.
* Talaro, K. P. 2008. Foundations in Microbiology: Basic Principles, McGraw-Hill Companies, N.Y.
* Tortora, G. J., Funke, B. R. and Case, C. L. 2012. Microbiology: AnIntroduction, Benjamin-Cummings Publishing Company, U.S.A.
* Tortora, G. J., Funke, B. R. and Case, C. L. 2012. Study Guide for Microbiology: An Introduction. 11th edition. Benjamin-Cummings Publishing Company, U.S.A.

# MIC-305: ISLAMIC STUDIES (Compulsory)

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

#### Objectives:

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

#### Course Detail

**Introduction to quranic studies**

* Basic Concepts of Quran
* History of Quran
* Uloom-ul-Quran

**Study of selected text of holly quran**

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

**Study of selected text of holy quran**

* Verses of Surah Al-Ihzab Related to Adab-e-Nabi (Verse No. 6,21,40,56,57,58.)
* Verses of Surah Al-Hashar, (18,19,20) Related to thinking, Day of Judgment
* Verses of Surah Al-Saf, Related to Tafakar, Tadabar (Verse No-1,14)

**Seerat of holy prophet (s.a.w)**

* Life of Muhammad Bin Abdullah (Before Prophet Hood)
* Life of Holy Prophet (S.A.W) in Makkah
* Important Lessons Derived from the life of Holy Prophet in Makkah

**Seerat of holy prophet (s.a.w) ii**

* Life of Holy Prophet (S.A.W) in Madina
* Important Events of Life Holy Prophet in Madina
* Important Lessons Derived from the life of Holy Prophet in Madina

**Introduction to sunnah**

* Basic Concepts of Hadith
* History of Hadith
* Kinds of Hadith
* Uloom–ul-Hadith
* Sunnah & Hadith
* Legal Position of Sunnah

**Selected study from text of hadith**

Introduction to islamic law & jurisprudence

* Basic Concepts of Islamic Law & Jurisprudence
* History & Importance of Islamic Law & Jurisprudence
* Sources of Islamic Law & Jurisprudence
* Nature of Differences in Islamic Law
* Islam and Sectarianism

**Islamic culture & civilization**

* Basic Concepts of Islamic Culture & Civilization
* Historical Development of Islamic Culture & Civilization
* Characteristics of Islamic Culture & Civilization
* Islamic Culture & Civilization and Contemporary Issues

**Islam & science**

* Basic Concepts of Islam & Science
* Contributions of Muslims in the Development of Science
* Quran & Science

**Islamic economic system**

* Basic Concepts of Islamic Economic System
* Means of Distribution of wealth in Islamic Economics
* Islamic Concept of Riba
* Islamic Ways of Trade & Commerce

**Political system of islam**

* Basic Concepts of Islamic Political System
* Islamic Concept of Sovereignty
* Basic Institutions of Govt. in Islam

**Islamic history**

* Period of Khilafat-e-Rashida
* Period of Ummayyads
* Period of Abbasids

**Social system of islam**

* Basic Concepts of Social System of Islam
* Elements of Family
* Ethical values of Islam

**Recommended Books:**

* Hameed ullah Muhammad, “Emergence of Islam”, IRI, Islamabad
* Hameed ullah Muhammad, “Muslim Conduct of State”
* Hameed ullah Muhammad, ‘Introduction to Islam
* Hussain Hamid Hassan, “An Introduction to the Study of Islamic Law. Leaf Publication Islamabad, Pakistan.
* Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic University, Islamabad (1993)
* Mir Waliullah, “Muslim Jurisprudence and the Quranic Law of Crimes” Islamic Book Service (1982)
* H.S. Bhatia, “Studies in Islamic Law, Religion and Society” Deep & Deep Publications New Delhi (1989)
* Dr. Muhammad Zia-ul-Haq, “Introduction to Al Sharia Al Islamia”. Allama Iqbal Open University, Islamabad (2001).

# MIC-306: MICROBIAL TAXONOMY

#### Credit Hours (2+1)

#### Objectives

* Identify the Objectives of classification
* Identify traits used to classify microorganisms
* Locate microorganisms in the realm of living world

#### Course Detail

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

#### Practical

* 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

* 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.
* Scott F. and Jon c. H., 2007. Evolutionary Analysais. Benjamin Cumming.
* Roberto K. and Stanley M. 2012. Microbes and Evolution: The World T\that Darwin Never Saw. ASM. Press.
* David L. K. 2012. Process in Microbial Ecology. Oxford University
* 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.

# BS SEMESTER – II

# Cr Hrs (16)

#### Course Code/Course Title/Credit Hours

MIC-307: English-II (3+0)

MIC-308: Pakistan Studies (2+0)

MIC-309: Biochemistry-II (2+1)

MIC-310: Biostatistics (2+0)

MIC-311: Human Physiology-I (2+1)

MIC-312: Computer Applications (2+1)

# MIC-307: ENGLISH –II

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

#### Objectives:

* The extensive knowledge gained from this course will help to develop both written and spoken abilities. This course aims to provide a student a thorough understanding by many subjects by covering broad themes, listening skills, daily deliberations, and developing speaking, reading, listening and writing abilities.
* The primary goal of this course is to shed light on different aspects of English language and significance of having a well- pronounced vocabulary and being able to gratify every day communication demands in real life.

#### Course Detail

* Paragraph writing
* Practice in writing a good, unified and coherent paragraph
* Essay writing
* Introduction, CV and job application
* Translation skills
* Urdu to English
* Study skills
* Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension
* Academic skills
* Letter / memo writing and minutes of the meeting, use of library and internet recourses Presentation skills
* Personality development (emphasis on content, style and pronunciation)
* Note: Documentaries to be shown for discussion and review

#### Recommended Books

#### a) Grammar

* Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0194313506

#### b) Writing

* Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
* Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0194354065 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

#### c) Reading

* Reading Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0194534030.
* Reading and Study Skills by John Langan
* Study Skills by Richard Y

# MIC-308: PAKISTAN STUDIES

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

(As Compulsory Subject for Degree Students)

#### Objectives

* Inculcate a sense of gratitude to Almighty Allah for blessing us with an independent and sovereign state
* Promote an understanding of the ideology of Pakistan, the Muslim struggle for independence and endeavors for establishing a modern welfare Islamic state
* Acquaint the students with various phases of Pakistan’s historical, political and constitutional developments
* To study the process of governance, national development issues

#### Course Detail

* Definition, Sources and Significance of Ideology
* Reformers Political, Social and economic deprivation of Pakistan
* Two-Nation Theory: Origin and explication
* Pakistan Ideology: Allama Muhammad Iqbal’s and Quaid-e-Azam’s pronouncements
* Pakistan Movement (1940-47)
* Pakistan’s Resolution
* Quaid-e-Azam’s role in the making of Pakistan
* Consolidation of the state and search for a constitution,1947-58
* Ayyub Khan Era,1958-1969
* Yahya Khan Regime,1969-71
* Separation of East Pakistan and Emergence of Bangladesh

#### Recommended Books

* Burki, Shahid Javed. State & Society in Pakistan, the MacMillan Press Ltd 1980.
* Akbar, S. Zaidi. Issue in Pakistan’s Economy. Karachi: Oxford University Press, 2000.
* S.M. Burke and Lawrence Ziring. Pakistan’s Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
* Mehmood, Safdar. Pakistan Political Roots & Development. Lahore,1994.
* Wilcox, Wayne. The Emergence of Bangladesh., Washington: American Enterprise, Institute of Public Policy Research, 1972.
* Mehmood, Safdar. Pakistan Kyun Toota, Lahore: Idara-e-Saqafat- e-Islamia, Club Road.
* Amin, Tahir. Ethno-National Movement in Pakistan, Islamabad: Institute of Policy Studies, Islamabad.
* Ziring, Lawrence. Enigma of Political Development. Kent England: WmDawson & sons Ltd, 1980.
* Zahid, Ansar. History & Culture of Sindh. Karachi: Royal Book Company, 1980.
* Afzal, M. Rafique. Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
* Sayeed, Khalid Bin. The Political System of Pakistan. Boston: Houghton Mifflin, 1967.
* Aziz, K.K. Party, Politics in Pakistan, Islamabad: National Commission on Historical and Cultural Research

# MIC-309: BIOCHEMISTRY-II

#### Credit Hours (2 +1)

#### Objectives

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

#### Course Detail

* Metabolism: Carbohydrate, Lipid and Protein, Gluconeogenesis, Biosynthesis and breakdown of glycogen in animals, Regulation of glycogen metabolism.
* Bioenergetics and Thermodynamics, Electron transport chain and oxidative phosphorylation in mitochondria, Role of mitochondria in Apoptosis and oxidative stress, Photosynthesis, Photophosphorylation and light absorption.
* Biosynthesis of Lipids: Mobilization and transport of fats, Biosynthesis of fatty acids and Eicosanoids.
* Biosynthesis of triacylglycerols. Membrane phospholipids Cholesterol and steroids.
* Biosynthesis of amino acids. Integration and hormonal regulation of mammalian metabolism.

#### Practical

* Extraction and salting out of proteins.
* Isolation and purification of proteins by various column
* chromatographic techniques (gel filtration and ion exchange).
* Quantitative analysis of proteins by UV spectrophotometry
* Extraction and quantitative analysis of amino acids.

#### Recommended Books

* Voet, D., Voet, J. G. and Pratt, C. W., 2002. Fundamentals of Biochemistry; John Wiley and Sons. Inc., New York.
* Berg, J. M., Tymoczko, J. L. and Stryer, L., 2002. Biochemistry 5th Edition. W.H. Freeman and Company, New York.
* Devlin, T. M., 2002. Textbook of Biochemistry with Clinical Correlations 5th Edition. John Wiley and Sons. Inc., New York.
* Zubay, G., 1995. Biochemistry 4th Edition. W. C. Brown Publishers, Inc., Oxford England.
* Plummer, D. T., 1990. An Introduction to Practical Biochemistry 4th Edition. McGraw-Hill Book Company, London,
* Wilson, K. and Walker, J., 1994. Practical Biochemistry: Principles and Techniques, 4th Edition. Cambridge Univ. Press, London
* Berg, J. M., Tymoczko, J. L., Stryer, L., 2006. Biochemistry: International 6th edition. W.H. Freeman & Co Ltd.
* Cox, M. and Nelson, D.L., 2005. Lehninger Principles of Biochemistry 4th edition, Palgrave Macmillan.
* Murray, R., Granner, D., Mayes, P., and Rodwell, V., 2006. Harper's Illustrated Biochemistry 27th Edition. McGraw-Hill Education.
* Denniston, S. 2006. General, Organic and Biochemistry, 5th Edition.McGraw-Hill.

# MIC-310: BIOSTATISTICS

#### Credit Hours (2+0)

**Objectives**

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

**Course Detail**

* Introduction to Biostatistics and its scope in Microbiology
* Collection of Primary and Secondary data
* Editing of data
* Presentation of data: Tabulation, Classification, Visual Presentation (Diagrams and Graphs)
* Measures of Central Tendency: Arithmetic Mean by direct and short-cut method, Geometric Mean, Harmonic Mean, Mode, Median, ED50(LD50 in detail), Quantile
* Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation by direct and short-cut method, Variance, and their Coefficient
* Correlation: Simple Correlation Table, Rank Correlation, Partial and Multiple Correlation
* Regression and method of least square
* Probability: Concept of Probability, Laws of Probability
* Permutation and Combination
* Probability distributions: Binomial distribution, Poisson distribution and their fitting to observed data, Normal distribution
* Sampling and Basic Design
* Hypothesis Testing
* Chi-square test, Student’s t-test, Analysis of variance
* Laboratory Experiments pertaining to the course

#### Recommended Books

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

# MIC-311: HUMAN PHYSIOLOGY-I

#### Credit Hours (2 +1)

#### Objectives

* This course will provide comprehensive knowledge about the human physiology. As no science can proceed without the understanding of its underlying mechanisms; this course will cover the structural and functional mechanisms of human body.
* To understand coordination among various systems.

#### Course Detail

* Introduction to Organization of human body including chemical and cellular levels.
* Tissue: Structure and function, Epithelial, Connective, Muscle and Nervous tissues, Bone and Cartilage, Adaptive cellular and tissue behavior, Hyperplasia, Hypertrophy, Atrophy and Genetic abnormalities.
* Blood: Physical characteristics and components of blood, Origin and development of blood cells, Structure and function of RBC, WBC, Platelets, Clotting Cascade, Blood groups and Homeostasis.
* Cardiovascular System: Cardiac Cycle, Heart Sounds, Cardiac Conduction System, Structure and Function of Blood Vessels.
* Lymphatic System: Overview of Lymph, Structure and function of lymphatic tissues and organs.
* Antibodies and Immune cells. Specific and nonspecific immune reactions.
* Respiratory System: Lung volumes and capacities, Non-respiratory air movements, Alveolar ventilation; mechanism of alveolar gas exchange.
* Digestive System: Structure and function of the digestive organs, Salivary glands and their secretions, Phenomenon of deglutition, Gastric and pancreatic juice and Digestion, absorption and movements of GIT.

#### Practical

* Methods of obtaining blood samples, choice of anticoagulants and preservation
* To determine the Clotting Time
* To determine total leukocytes count (TLC)
* To Determine Differential leukocytes count (DLC)
* To determine the specific gravity and viscosity of blood and plasma
* To record the human blood pressure by using Palpatory and Auscultatory methods.
* To observe and record normal heart activity in exposed frog heart by Kymography.
* To observe respiratory movement and determination of respiratory rate by Kymography.
* To determine the normal chemical composition of human saliva.

#### Recommended Books

* Shier, D., Butler, J., Lewis, R., 2003. Hole’s Essentials of Human Anatomy and Physiology, 8th ed; McGraw-Hill
* Tortora, G. J. J., and Grabowski, S. R., 2000. Principles of Anatomy and Physiology, 9th ed; John Wiley and Sons
* Guyton, A. C. and Hall, J. E. 2005. Textbook of Medical Physiology, 12th ed; W. B Saunders
* Waugh, A., Grant, 2002. A., Ross and Wilson Anatomy and Physiology in Health and Illness, 9th ed; Churchill Livingstone
* Marieb, E. N., 1997. Human Anatomy and Physiology, 4th ed; Benjamin/Cummings Science Publishing
* Hall, J. E and Guyton, A. C., 2005. Guyton and Hall Physiology Review Elsevier Health Sciences. 7. Seifter, J., 2005. Concepts in Medical Physiology. Lippincott Williams and Wilkins.
* Martini, F. H., and Ober, W. C., 2005. Fundamentals of Anatomy and Physiology, Pearson Education.
* Marieb, E. N., 2005. Human Anatomy and Physiology Laboratory Manual: Fetal Pig Version, Update, Pearson.Murray, R., Granner, D., Mayes, P., and Rodwell, V., 2006. Harper's Illustrated Biochemistry 27th Edition. McGraw-Hill Education.

# MIC-312: COMPUTER APPLICATIONS

#### Credit Hours: (2 +1)

#### Objectives

Upon completion of the course students will be able to:

* Recognize when to use a particular information processing and dissemination application to create professional and academic documents
* Use the available computer applications, tools and techniques to create personal, academic and business documents following the standards or requirements of the current organization

#### Course Detail

#### MS Office 2016

#### 1. Word

* Formatting
* Sections
* Header & Footer
* Table of Contents, Table of Figures, and cross reference
* Academic Referencing
* Mail Merge

#### 2. PowerPoint

* Basics
* Graphs
* Animation

3. Excel

* Basics
* Functions - Graphs - Analysis – Formatting

**Practical**

**WORD, POWER POINT, EXCEL**

**Recommended Books**

www.google.com

[www.bing.com](http://www.bing.com)

www.ask.com

# BS SEMESTER – III

# Cr Hrs (18)

**Course Code/Course Title/Credit Hours**

MIC-413: Human Physiology II (2+1)

MIC-414: Genera Immunology (2+1)

MIC-415: General Pathology (2+1)

MIC-416: Microbial Anatomy & Physiology (2+1)

MIC-417: General Anatomy (2+1)

MIC-418: Molecular Cell Biology (2+1)

# MIC-413: HUMAN PHYSIOLOGY-II

#### Credit Hours (2 +1)

#### Objectives

* To study the details of physiological systems maintaining the homeostasis.
* Interrelations of the systems
* Regulatory features of each system’s function.
* To study the details of nervous and hormonal coordination at molecular and cellular level in animal
* Biosynthetic, secretary and regulatory aspects of coordination.

#### Course Detail

* Excretory system: System organization, Kidneys, Urine formation, Glomerular filtration, Processes of tubular reabsorptions and secretion.
* Endocrine System: Cellular secretions and their types, Structure and function of endocrine glands, Basic mechanism of hormone action, Control of hormone secretion by Hypothalamus-pituitary axis, Secretions of non-endocrine glands of body.
* Reproductive System: Female reproductive system, Oogenesis and its hormonal regulation, Menstrual cycle: Phases of menstruation, hormonal regulation, Overview of secondary sex characteristics, external genitalia and mammary glands, Male reproductive system, Testes and Spermatogenesis, Male sex hormones and their role in spermatogenesis, Accessory sex glands and composition of semen.
* Musculoskeletal System: Structure and function of muscle, Neuromuscular junction.
* Nervous System: Structure and function of neuron, Membrane potential and nerve impulse, Synaptic transmission, Sensory and motor system.
* Spinal Cord: Nerve Pathways, Sensory and motor tracts and Spinal nerves, Reflexes and reflex arc.
* Brain: Functional areas of brain and cranial nerves, Formation and regulation of cerebrospinal fluid, Cerebral blood flow and blood brain barrier, Receptors and their classification.

#### Practical

* To observe and determine the normal physical and chemical properties of urine sample.
* Detection of abnormal constituents of urine in detail.
* To determine (quantitative) blood urea nitrogen/Creatinine in the provided pathological sample for the detection of uremia.
* Spectrophotometric determination of urinary calcium/Uric acid concentration.
* Spectrophotometric determination of urinary phosphate concentration.
* To study the muscular contraction kamyography
* Isolation of nerve and muscle (Sciatic and Gastrocnemius) in frog and to observe irritability on mechanical and electrical stimulation.

#### Recommended Books

* Shier, D., Butler, J., Lewis, R., 2003. Hole’s Essentials of Human Anatomy and Physiology, 8th ed; McGraw-Hill.
* Tortora, G. J. J., and Grabowski, S.R., 2000. Principles of Anatomy and Physiology, 9th ed; John Wiley and Sons,
* Guyton, A. C. and Hall, J. E. 2005. Textbook of Medical Physiology, 12th ed; W. B Saunders.
* Waugh, A., Grant, (2002). A., Ross and Wilson Anatomy and Physiology in Health and Illness, 9th ed; Churchill Livingstone,
* Marie, E.N., 1997. Human Anatomy and Physiology, 4th ed; Benjamin/Cummings Science Publishing,
* Hall, J. E and Guyton, A. C., 2005. Guyton and Hall Physiology Review Elsevier Health Sciences
* Seifter, J., 2005. Concepts in Medical Physiology Lippincott Williams & Wilkins.
* Martini, F. H. and Ober, W. C., 2005. Fundamentals of Anatomy and Physiology, 2005. Pearson Education.
* Marieb, E. N., 2005. Human Anatomy and Physiology Laboratory Manual: Fetal Pig Version, Update, Pearson.
* Martini, F. H. 2005. Fundamentals of Anatomy and Physiology – Study Guide, Pearson.
* Wood, M., 2005. Laboratory Manual for Anatomy and Physiology, Cat Version Pearson.
* Wood, M. G., 2005. Anatomy and Physiology: Main Version. Pearson Education
* Moore, K, L., Dalley, A. F. and Dalley, A. F., 2005. Clinically Oriented Anatomy. Lippincott Williams and Wilkins.

# MIC-414: GENERAL IMMUNOLOGY

#### Credit Hours (2+1)

**Objectives**

1 To understand basis of immunity and cells and organs involved in acquired immunity.

1. To understand the role of antibodies and induction of antibody response to antigens.

3 To understand the various types of antibodies: their structure and function.

4 Immune cells surface receptors involve in immune response and histocompatibility.

5 To study the molecular mechanisms of various molecules involved in induction of immune response.

6 To understand hypersensitivity reactions and their clinical aspects.

7 To understand autoimmunity and its clinical significance

8 To understand transplant rejection and graft versus host disease

9 To immune deficiency

10 to understand cytokines involved in immune responses

11 To understand monoclonal antibodies and its concept in drug development

**Course Detail**

1.Introduction: Development and scope of immunology.

2. Immunity and immune responses: Definitions and types (specific and non-specific). Humoral and cellular immunity.

3 Introduction to complement system.

4 Cells and tissues of immune system.

5 The antigens: structure (simple and complex molecules, proteins and polysaccharides) and immunogenicity.

6 Immunoglobulin: structure and function; classes, subclasses, types and subtypes; immunoglobulin genetics.

7. Immune response to an antigen.

8 Introduction to antigen-antibody reactions: methods for detecting antigens and antibodies (agglutination, precipitation, complement fixation, EIA, etc.).

9. Introduction to HLA & MHC and its role in immune response, disease and its significance in tissue transplantation.

10. Immune-regulation and tolerance.

11 Introduction to immunopathology: hypersensitivity reactions, autoimmune diseases and immunodeficiencies.

1. .Immunization (methods of immunization, vaccines and adjuvants).
2. Structure and functions of human immunoglobulins: Three dimensional configurations and location of paratope in the molecule of IgG, IgM, and IgA, Antibody diversity, maturation of B lymphocytes and expression of Immunoglobulin genes.
3. Structure and function of the T-cell Receptor: Molecular basis of T- cell antigen recognition and activation, Immunoglobulin superfamily. T-cell gene rearrangement and generation of diversity.
4. Chemkines and cytokines.
5. Human Leukocyte Antigens: classes, distribution, chemistry and basis of polymorphism.
6. Complement System: Chemistry, components, activation via classical and alternate pathway, complement genes, their expression and regulation.

**Practical**

1. Normal leukocytes morphology and functions
2. Differential leukocyte count.
3. Blood grouping (ABO & Rh).
4. Radio immune assay
5. ELIZA
6. Agglutination test (Widal test).
7. Precipitation tests.
8. ICT Test
9. Coombs test
10. Flow cytometry
11. Hemolytic disease of newborn
12. Mantoux test
13. Amyloidosis
14. Corticosteroids as immunomodulators
15. Monoclonal antibodies and drugs
16. Revision

#### Recommended Books

* **"Kuby Immunology"** by Judy Owen, Jenni Punt, and Sharon Stranford

Publisher: W.H. Freeman

Year of Publication: 2018

* **"How the Immune System Works"** by Lauren M. Sompayrac

Publisher: Wiley-Blackwell

Year of Publication: 2019

* **"Immunology for Dummies"** by John D. Wagner and Casey Morrow

Publisher: For Dummies

Year of Publication: 2019

* **"Janeway's Immunobiology"** by Kenneth Murphy, Casey Weaver, and Allan Mowat

Publisher: Garland Science

Year of Publication: 2016

* **"Cellular and Molecular Immunology"** by Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai

Publisher: Elsevier

Year of Publication: 2020

* **"Clinical Immunology and Serology: A Laboratory Perspective"** by Christine Dorresteyn Stevens

Publisher: F.A. Davis Company

Year of Publication: 2018

* **"Immunology at a Glance"** by J. H. L. Playfair and B. M. Chain

Publisher: Wiley-Blackwell

Year of Publication: 2013

# MIC-415: GENERAL PATHOLOGY

#### Credit hours (2+1)

#### Course Objectives:

Upon completion, of course the students will be able to:

* Comprehend basic knowledge of cell pathology, like cell injuries, death, and various adaptations
* Comprehend general pathological conditions like inflammation, hemodynamic disorders, diseases of immunity and neoplasia
* Apply the knowledge of current research and therapeutic approaches of all these diseases.

**Course Contents:**

The course contents of this subject include; reversible and irreversible cell injury, cell death/ necrosis and apoptosis**,** cellular adaptations, intracellular accumulation calcification/ pigmentation. Inflammation, acute inflammation, vascular changes/ mediators, chronic/granulomatous inflammation, repair. Cell cycle, stem cells and wound healing. Thrombosis, shock, oedema haemorrhage, thrombosis embolism, infarction. General features of immune system, cell/ humoral immunity, hyper sensitivity, autoimmune disorders, amyloidosis. Benign/ malignant tumors, epidemiology, carcinogenesis, metastasis, grading/ staging.

#### Practical

####  Histotechniques:

* Specimen Collection
* Fixation
* Gross
* Tissue processing
* Microtomy
* Block preparation
* Staining
* Steps of routine (H&E) staining

#### Microscopy:

* Basics of microscope handling
* Examination of slides

#### Special Staining:

* Names and use of different special stains
* Steps of commonly used special stains

#### Cytology:

* Collection
* Processing
* Staining

#### Immunohistochemistry:

* Basics
* Procedure
* Common IHC and uses

#### Recommended Readings:

1. Vinay Kumar, Abul K. Abbas, Nelson Fausto, Richard Mitchell. Robbins Basic Pathology. Saunders. Latest Ed.
2. Pathologic Basis of Diseases by Corton, Kumar and Collins, Latest Ed.
3. General Pathology by Walter and Israel Latest Ed.
4. General and Systematic Pathology by Underwood, Latest Ed.

#### Journals:

* Pathology
* Histopathology
* Human Pathology
* Pathology and Pathobiology
* Journal of Clinical Pathology
* Analytical Cellular Pathology
* Annals of Diagnostic Pathology
* Blood Cells, Molecules and Diseases
* Experimental and Molecular Pathology
* Experimental and Toxicologic Pathology

# MIC-416: MICROBIAL ANATOMY AND PHYSIOLOGY

#### Cr hours: (2+1).

#### Objectives

After completion of the lecture component of the course, successful students will:

* Differentiate Virus, bacteria, fungi and parasite
* Demonstrate an understanding of cellular superstructure and the functional components of cells.
* Comprehend the how cells metabolize the nutrients necessary for life including carbon, nitrogen, sulfur and phosphorus.
* Appreciate how biochemical pathways and processes are integrated into a network, which provides robustness to life.
* Comprehend how cellular physiology is altered by interactions between microbes and the environment.
* Appreciate that the diversity of life is driven by the metabolic diversity of microbes.

#### Course contents:

Introduction to microbial anatomy physiology. Anatomy of virus, bacteria, fungi and parasites... Microbial cell division. Bacterial Growth curve, Factors effecting growth of microorganisms. Cell signaling Microbial stress responses: osmotic, oxidative, pH, thermal and nutrient stress. osmoregulation, aerobic and anaerobic regulation, acid tolerance, heat shock and starvation responses. Metabolic channeling. Gene regulation under stress condition. Quorum sensing and biofilm formation. Microbial cell differentiation: sporulation, endospore formation, activation, germination and outgrowth of microbial spores. Molecular basis of sporulation.

**Practical’s**

**Books recommended**

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

# MIC-417: GENERAL ANATOMY

#### Cr hours: (2+1).

#### Course Objectives

The objectives of this course is to appreciate the biological nature of humans and to appreciate the biological variability of humans (among the male and female). This course is designed in such a way that the students graduating must have acquired a reasonable working knowledge about the:

#### Course contents

* The basic biological organization of human body (cells, tissues, organs and organ systems)
* Various Sub divisions of anatomy
* Various anatomical terms used for describing muscles, bones, joints, and even planes or section of body
* The fundamental components of various systems in the human body
* The various cavities present in the human body
* The gross and microscopic features of various visceras
* Neurovascular supply of human visceras
* Functional anatomy of various human visceras
* Organization of peritoneum and its various compartments
* Different regions, and regions of thorax, abdomen and pleural and pericardial cavities
* To solve the clinical cases/problems related to anatomy of human visceras.

#### Practical

To comprehend human anatomy fully, a combination of classroom instruction and visual/imaginative capacities is essential. While classroom teaching provides foundational knowledge, the ability to visualized and imagine the body’s intricacies is equally important. Practical sessions following each class allow students to explore deeper, studying models, original bones, and Stan anatomical skeleton models. These hands-on experiences facilitate understanding of organ positions, bone structures and muscle arrangements.

#### Recommended Books

1. Prescribed textbook
* Grant's Atlas of Anatomy
* Atlas of Human Anatomy, 4th Edition, Netter
* Clinically Oriented Anatomy, 4th or 5th Ed. Moore & Dalley, Lippincott Williams and Wilkins
* Clinical Anatomy for Medical Students, Snell
1. Online teaching sources
* Teach me anatomy.com
* Anatomy zone.com
* Kenhub.com
* Learn.visiblebody.com

# MIC-418: MOLECULAR CELL BIOLOGY

#### Credit Hours (2+1)

#### Objectives

* To understand 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 Detail

* E. coli and yeast as representative prokaryotic and eukaryotic models for molecular differentiation.
* Molecular mechanism of Replication.
* Transcription and Translation.
* Transcriptional and translational regulation of gene expression.
* Regulation of gene expression in prokaryotes and eukaryotes.
* Types of recombination.
* Mutations and chromosomal aberrations.
* DNA damage and repair.
* Gene sequencing.
* Principles of Recombinant DNA technology.
* Role of Recombinant DNA Technology in economic development.
* Human Genome Project.
* Stem Cell Research.

#### Practical

* Karyotyping
* Study of DNA damage by physical and chemical methods
* Case study of chromosomal abnormalities in human and agricultural specimen
* Ames test for identification of mutagenic agents

#### Recommended Books

* Alberts. B., 2007. Molecular Biology of the Cell. Taylor and Francis, Inc.
* Pollard, T. D., Lippincott-Schwartz, J., Earnshaw, W. C., 2007. Cell Biology: Saunders W. B. Co.
* Alberts, E.A., 2006. Essential Cell Biology Academic Internet Publisher
* Lodish, H., 2011. Solutions Manual for Molecular Cell Biology.7thEdition. W.H. Freeman & Company.
* 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.
* James D. W. 2013. Molecular Biology of Gene. Benjamin Cumming.

# BS SEMESTER – IV Cr Hrs (17)

**Course Code/Course Title/Credit Hours**

MIC-419 Introduction to Medical Microbiology (2+1)

MIC-420 Special Pathology (2+1)

MIC-421 Zoonosis (2+1)

MIC-422 Bacterial Genetics (2+1)

MIC-423 Bioinformatics (2+1)

MIC-424 One Health (2+0)

# MIC-419: INTRODUCTION TO MEDICAL MICROBIOLOGY

#### Credit Hours (2+1)

#### Objectives

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

#### Practical

* 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

* 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.
* Hawkey, P and Lewis, D. 2004. Medical Bacteriology: A Practical Approach. 2nd Edition, Oxford University Press, U.K.
* Mims, C., Dockrell, H., Goering, R., Roitt, I Wakelin, D. and Zuckerman, M. 2007. Medical Microbiology. 3rd Edition .Mosby Co., M.O.
* Murray, P. R., Rosenthal, K. S., Pfaller, M. A. and Rosenthal, K. S. 2005. Medical Microbiology, Elsevier Health Science, N.Y.
* Murray, Baron, Pfaller, Tenover, Yolken. 2011. Manual of Clinical Microbiology by 10th Ed . ASM Press USA.
* Brooks, G., Carroll, K.C., Butel, J., Morse , S., 2013. Jawetz Melnick& Adelbergs Medical Microbiology 26th Edition McGraw-Hill sCompanies. North America

# MIC-420: SPECIAL PATHOLOGY

#### Credit Hours (2+1)

**Course Objectives**

Upon completion, of course, the students will be able to:

* Comprehend basic knowledge of pathological conditions involving the organ system caused by infective organisms.
* Comprehend clinical features, pathogenesis and microbiological diagnosis of the pathological conditions.

**Course Contents**

1. Head and Neck
2. Oral cavity
	1. Viral infections
		1. Herpes labialis, Herpes gingivostomatitis ---- Herpes simplex virus
		2. Verucca vulgaris, Squamous cell carcinoma ----- Human Papilloma virus
	2. Bacterial infections
		1. Dental caries, Gingivitis ----- Streptococci
	3. Fungal infections
		1. Oral candidiasis ------- Candida albicans
3. Nose/ Nasal cavity/ Nasopharynx
	1. Viral infections
		1. Infectious Rhinitis ------ Adenovirus, Rhinovirus, Influenza virus
		2. Sinusitis ---- Adenovirus, Rhinovirus, Influenza virus
		3. Pharyngitis -------- Adenovirus, Rhinovirus, Influenza virus
		4. Nasopharyngeal carcinoma ----- EBV
	2. Bacterial infections
		1. Sinusitis ---- Streptococci. Staphylococci
		2. Pharyngitis
		3. Tonsillitis
	3. Fungal infections
		1. Sinusitis ------ Mucormycosis, Aspergilosis
4. Larynx
	1. Laryngoepiglottitis ---- Influenza virus, Streptococci
5. Salivary Glands
	1. Sialadenitis ------ Viral (Mumps ---- Paramyxovirus), Herpes simplex, Influenza virus, Staphylococcus. Haemophillus Influenza
6. Ears
	1. Otitis media ------ Streptococcus pneumonia, H. influenza
7. Eyes
	1. Conjunctivitis ----- Adenovirus, Streptococcus pneumonia, H. influenza, Moraxella Catarrhalis
	2. Stye ----- Staphylococci
8. Gastrointestinal Tract and Liver
9. Esophagus
	1. Esophagitis ---- Herpes Simplex virus, Cytomegalovirus, Candidiasis
10. Stomach
	1. Gastritis ------ H. pylori
	2. Gastric Adenocarcinoma ----- H pylori
11. Small/ Large Intestine
	1. Viral Gastroenteritis ----- Norovirus, Rotavirus, Adenovirus
	2. Bacterial Enterocolitis ----- Cholera, Shigellosis, Salmonella, E.coli, Pseudomembranous Colitis, Whipple Disease, Mycobacterial infection
	3. Parasitic Enterocolitis ----- Ascaris lumbricoides, Nector duodenale, Ancylostoma duodenale, Enterobius vermicularis, Trichuris trichiura, Schitosomiasis, Intestinal cestodes, Entamoeba histolytica, Giardia lamblia.
12. Liver
	1. Hepatitis ------- HAV, HBV, HCV, HCV, HDV, HEV
	2. Hepatocellular carcinoma ----- HBV, HCV
13. Urinary System
14. Kidney
	1. Streptococcal Glomerulonephritis -------- Streptococci
	2. Nonstreptococcal Acute Glomerulonephritis --- Staphylococci, Pneumococci, Meningococci, HBV, HCV, HIV
	3. Pyelonephritis ------- Adenovirus, BK polyomavirus, Ecoli,
	4. Renal Tuberculosis ----- Mycobacterium tuberculosis
15. Urinary Bladder/ Urethra
	1. Cystitis ---- E. coli, Mycobacteria, Candida, Schistosoma haematobium, Adenovirus.
	2. Urethritis ----- Chlamydia, Mycoplasma
16. Male Genital Tract
	1. Epididymitis/ Orchitis ------C. trachomatis, Niesseria gonorrhoeae
	2. Prostatitis --------- Escherichia coli, Pseudomonas, Proteus, Staphylococcus aureus
17. Female Genital Tract
	1. Lower and upper genital tract infections ------- Candida, Mycoplasma, Trichomonas, Neisseria gonorrhoeae, Chlamydia, HSV, HPV
	2. Lower and upper genital tract tumors --------- HPV
	3. Placental infections -------- TORCH group
18. Skin
	1. Verrucae (Warts) ------- HPV
	2. Molluscum contagiosum ----- Poxvirus
	3. Impetigo ------- Streptococci, Staphylococci
	4. Fungal infections ----- Tinea capitis, Corporis , cruris, pedis, versicolor

#### PRACTICAL

After completion of this course the students of BS Microbiology will be able to:

* Identify the slides of the microorganisms and the disease they cause.
* Identify the points of interpretation of each slide.

#### RECOMMENDED BOOKS

* Robbins Textbook of Basic Pathology
* Periodicals, Websites
* Pathology outlines
* Journal of Clinical Pathology
* Analytical Cellular Pathology
* [Annals of Diagnostic Pathology](http://www.sciencedirect.com/science/journal/10929134)
* Blood Cells, Molecules and Diseases
* [Experimental and Molecular Pathology](http://www.sciencedirect.com/science/journal/00144800)
* Experimental and Toxicological Pathology

# MIC-421: Zoonosis

**Credit Hours (2+1)**

**Objectives**

* different management strategies for prevention and control of such
* diseases
* Contribute technically to the establishment of multidisciplinary research
* programs

**Course Contents:**

* Introduction: Zoonosis Overview
* Zoonotic infectious diseases - the following aspects of the most common
* Parasitic (e.g. Toxoplasma, Leishmania, Echinococcuc) Bacterial (e.g. Brucella,
* Anthrax, Mycobacterium, Salmonella, E. coli) and Viral (e.g. Rabies, Congo,
* Influenze, Dengue) infections.
* Classification
* Epidemiology
* Pathogens’ morphology, life cycle, pathogenesis and transmission patterns
* Diagnostic methods (Clinical, Laboratory methods both serological and
* molecular)
* Health Risks
* Management of Zoonotic infections (from awareness at the
* individual/community level to cellular/molecular level)
* Impact of Zoonosis on human health
* Research aspects/intervention methods

**Practical:**

* Microscopy techniques for identifying zoonotic pathogens.
* Serological and molecular diagnostic testing for zoonotic infections.
* Culturing and isolating zoonotic pathogens from various samples.
* Hands-on training in implementing infection control measures.

 **Recommended readings:**

 **Books:**

* Human-Animal medicine by Peter M. Rabinowitz
* Handbook of Zoonoses by Joann L. Colville
* Zoonoses vol.III Parasitoses by Pedro N. Acha
* Zoonoses vol.II Clamydioses, Reckettisoses and Viroses by Pedro N. Acha
* Zoonoses vol.I Bacterioses by Pedro N. Acha
* Management of Zoonotic diseases by Inam-ur-Rahim Relief international
* Publication
* Manual of information and training for health workers Relief international
* Publication

**MIC-422: BACTERIAL GENETICS**

Credit Hours (2+1)

**OBJECTIVES:**

* Students will gain a sense of the role of genetics in defining biological phenomena through the study of systems where genetics uncovered new processes and/or mechanisms.
* Students will understand the continuity of the bacterial life from one generation to other generation on the basic mechanisms involving nuclear, extra chromosomal genetic events etc.
* Students will understand the process of continuity and transfers of traits of the prokaryotic cells to next progeny, that imparts variations and render the generations sustainable in changing environment.
* Students will come to understand how the level of understanding of a biological process increases by using a historical approach to study classical systems of gene regulation in bacteria.
* Students will observe and learn the essentiality of the development of methods, e.g., those of bacterial genetics, recombinant DNA, and molecular genetics, in the ever-increasing depth of understanding of biological processes, using mechanisms of gene regulation as the model.

**Course Contents:**

• Nucleic acids structure and function.

• 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 mutations: 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.

• Mechanisms of genetic exchange: Transformation, transduction, conjugation and cross-phylogenetic transfer.

• Gene mapping by conjugation and transduction.

• Circular chromosomal maps of bacteria.

• Introduction to genetic rearrangements.

**Practicals**

 1. Plasmid extraction.

2. Nucleic acid extraction (DNA & RNA).

3. Transformation, transduction, conjugation.

4. Catabolite repression through growth curve.

5. Beta-galactosidase assay.

6. Development of mutant by physical and chemical agents.

**Recommended Books**

1. Jeremy W. Dale, Simon F. Park. Molecular Genetics of Bacteria. 5th Edition, Wiley-blackwell. John Wiley & Sons, Ltd., Publication, UK.
2. Sneider and Champness Molecular Genetics of Bacteria, 5th Edition, by Tina M. Henkin and Joseph E. Peters. Wiley, ASM Press Washington.
3. Costa, L.G., and Eaton, D. L., 2006. Gene-Environment Interactions Fundamentals of Ecogenetics, John Wiley and Sons Limited.
4. Brooker, R.J., 2011. Genetics: Analysis and Principles 4th Edition. McGraw-Hill Science. Harlt,
5. D., L., and Ruvolo, M.,2011. Principles of Genetics. 8th Edition. Snustad, D.P and Simmons. John Wiley and Sons.
6. Strickberger, M.V. 2012. Genetics .Macmillan Publishing Company. New York.

# MIC-423: BIOINFORMATICS

####  Credit Hours (2+1)

Bioinformatics and Computational Biology have become integral disciplines in modern biological research, offering powerful tools and methodologies to analyze biological data, understand biological systems, and make predictions about biological phenomena. This course provides students with a comprehensive understanding of bioinformatics principles, biological databases, sequence analysis techniques, and computational methods used in biological research.

#### Objectives:

This course is designed to provide a fundamental knowledge of Bioinformatics and its significance in microbiology today. Upon completion of this course, students will be able to:

1. Explain the structure and function of biological databases including NCBI, EBI, and DDBJ, and utilize them effectively for data retrieval and analysis.
2. Describe the primary and secondary databases for protein sequences, protein pattern databases, and structure classification databases, and interpret the information stored in them.
3. Analyze protein sequences using pairwise sequence alignment techniques, understand sequence homology, similarity, and identity, and distinguish between global and local alignment strategies.
4. Perform database similarity searches using BLAST and FASTA. Analyze evolutionary relationships and construct phylogenetic trees using molecular phylogenetics methods. Understand genome structure, RNA structures, and gene prediction methods. Analyze biological images using image analysis tools.
5. Understand the importance of bioinformatics in biological research and its applications in various fields such as genomics, proteomics, and structural biology.

#### Course Contents:

1. Introduction to Bioinformatics (Definition and Importance & Applications in Biological Research)
2. Biological Databases (Overview of NCBI, EBI, and DDBJ, Protein Sequence Databases & Structure Classification Databases)
3. Protein Sequence Analysis (Pairwise Sequence Alignment, Sequence Homology, Similarity, and Identity, Global vs Local Alignment & BLAST and FASTA)
4. Multiple Sequence Alignment
5. Phylogenetic Tree Construction and Evaluation
6. Genome Analysis (Gene Prediction in Prokaryotes and Eukaryotes)
7. Computational Protein Structure Prediction (Secondary and Tertiary Structure Prediction Methods & Structure Prediction Evaluation)
8. Protein Fold Identification (Computer-Aided Drug Designing & Molecular Docking)

**Practical**

1. DNA and Protein sequence retrieval from different databases.
2. Databases of online tools for DNA and Protein sequence analysis.
3. Global Sequence Alignment, Local Sequence Alignment, Database Similarity Searching using BLAST and FASTA
4. On-line Tools for Multiple Sequence Alignment
5. Primer designing
6. Phylogenetic Tree Construction and evaluation.
7. Gene annotation using online tools
8. Protein secondary and tertiary structure prediction using online server and its visualization and molecular docking using different programs both online and offline.

**Recommended Books**

1. Baxevanis, A. D. and Ouellette, B.F.F. (2004) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. A John Wiley and Sons, Inc. Publication, New York.
2. Baxevanis, A. D. et al., (2013) Current Protocols in Bioinformatics. Wiley Publishers (Online Library).
3. Ye, S.Q. (2008) Bioinformatics: A practical Approach. Chapman and Hall/CRC Publishers, Taylor and Francis Group, London, UK.
4. Xiong, J. (2006) Essential Bioinformatics. Cambridge University Press, Cambridge, UK.
5. Claverie, J.M. and Notredame, C. (2007) Bioinformatics for Dummies. Wiley Publishing Inc., Indianapolis, Indiana.

#### Hall, B.G. (2004) Phylogenetic Trees Made Easy: A How to Manual. Sinauer Associates,

# MIC-424: ONE HEALTH:

#### Credit Hours (2+0)

#### Objectives:

* This course is an introduction to the One Health approach of cross-disciplinary problem solving.
* Students will be introduced to the disciplines of infectious disease prevention and control through partnerships between human health, animal health, and environmental health.
* Through the cross-disciplinary One Health approach professionals are tackling public health’s most difficult problems such as epidemics of zoonotic diseases and international food safety.
* The course will introduce students to infectious disease surveillance, diagnostic tools, outbreak investigations, vaccine trials, public health interventions, food safety, biodefense, emerging infectious diseases, and analytical approaches pertaining to infectious disease prevention and control.

**Course Objectives:**

The course is designed with under-mentioned objectives:

* Understand the value of the One Health approach in tackling difficult public health problems
* Understand the etiologic, environmental, and host factors important to infectious disease epidemiology;
* Understand the value of epidemiological principles and methods in the identification and control of infectious disease;
* Develop skills needed to apply epidemiological principles and methods in solving problems related to infectious diseases and including identifying surveillance and control measures given a specific infectious disease outbreak.

#### Course Contents:

* One Health: Introduction to the One Health Approach – To introduce students to the principles of employing the One Health approach in preventing and controlling infectious diseases. It includes a practical overview of host factors, environmental factors, and microbiological factors that influence this dynamic field of study. Through lectures and exercises, students will be introduced to infectious disease surveillance, diagnostic tools, outbreak investigations, vaccine trials, public health interventions, biodefense, emerging infectious diseases and analytical approaches as they pertain to infectious disease prevention and control.
* One Health: Public Health Laboratory Techniques – To introduce students to public health laboratory methods. A special emphasis will be placed upon respiratory virus work, especially influenza.
* One Health: An Introduction to Entomology, Zoonotic Diseases, and Food Safety –To introduce students to the epidemiology and control of entomological, zoonotic, and food-borne diseases. Each day there will be 3 hours of lecture and 3 or more hours of field activity. The course is comprised of readings, lectures, field studies, laboratory exercises, and a term paper. Zoonoses endemic to the Southeastern United States are emphasized.
* One Health: An Introduction to Environmental Health – To examine sources, routes, media, and health outcomes associated with biological, chemical, and physical agents in the environment. Effects of agents on a disease, water quality, air quality, food safety, and land resources are reviewed, as well as legal frameworks, policies, and practices associated with environmental health and intended to improve public health.
* Advantages of a closer cooperation between human and animal health
* Trans-disciplinary processes that can solve an everyday One Health problem
* Shortfalls resulting from poor communication between human doctors and veterinarians
* Social-ecological perspectives for the improvement of human and animal well- being
* Fundamental principles of cross-sector human and animal health economics
* Environmental policy and law that supports food safety
* Prevention of diseases from livestock to human via food
* Matrix calculations to describe growth rates of populations
* Principles of disease transmission dynamics between humans and animals
* Collection of vaccination coverage data
* Interpretation of vaccination coverage data

**Recommended Readings:**

* David L. Heymann, MD, ed., Control of Communicable Diseases Manual (CCDM), 20th edition, 2015, ISBN 978-0-87553-018-5 Stadtländer CT. One Health: people, animals, and the environment. Infect Ecol Epidemiol. 2015; 5:30514. Published 2015 Dec 31. doi:10.3402/iee. v5.30514
* Cork SC,Hall D, Karen L.One Health Case Studies: Addressing Complex Problems in a Changing World. Published 2016/11/15.ISBN: 9781910455555.

# BS SEMESTER – V

**Credit Hours = 18**

**Course Code/Course Title/Credit Hours**

MIC-525 Biosafety and Biosecurity (2+1)

MIC-526 Medical Virology (2+1)

MIC-527 Clinical Bacteriology (2+1)

MIC-528 Public Health Microbiology (2+1)

MIC-529 General Pharmacology (2+1)

MIC-530: Medical Mycology (2+1)

# MIC-525 BIOSAFETY AND BISECURITY

**Credit Hours (2+1)**

**Objectives**

• To learn safe practices for handling of microbes.

• To learn about risky and hazardous environment.

• To learn about the development of safe and healthy environment.

**Course Detail**

• Detailed concept of Risk and Hazardous Environment, Chemicals, Biological factors and Radiations.

• Risk assessment & Management: Preventions, Surveillance and Monitoring.

• Judicial rights / Penalties.

• Concepts of Biosafety Environment: Terrestrial, Marine, Atmosphere.

• Designing of labs based on Biosafety and Biological Containment parameters.

• Details of Biological Containment: Plants, Animals, Microbes.

• Bioethical issues related to Biosafety.

• Biosafety levels.

**Recommended Books**

1. Fleming, D.O., and D.L. Hunt, D.L.2006. Biological Safety. Principles and Practices, 4th edition, ASM Press, Washington, D.C.

2. US Health Department. 2010. Biosafety in Microbiological and Biomedical Laboratories Edition 5. Books Express Publishing.US

3. Horst, K.N., 2011. Biosafety Cabinet. Dig Press.

4. Russell, J. Cohn, R., 2012. Biosafety. Bookvika Publisher.

# MIC- 526: MEDICAL VIROLOGY

**Credit Hours (2+1)**

**Objectives**

• To understand different systems used for classification of viruses.

• To learn viral multiplication, pathogenesis and viral oncogenesis.

**Course Detail**

• Classification and structure of medically important viruses.

• Host cells for viral multiplication, productive infections.

• Introduction to the replication of viral genome.

• Maturation and release of viruses.

• Special features of molecular biology, biochemistry and genetics of the following viruses: Picornaviruses, Poxviruses, Myxoviruses, Paramyxoviruses, Rubella viruses, Rhabdoviruses, Reoviruses, Herpes viruses, Hepatitis viruses, Retroviruses and Tumor viruses (DNA & RNA), Adenoviruses, Coronaviruses.

• Viruses of Zoonotic significance.

• Virus-host interactions.

• Genetics of viruses shift and drift.

• Diagnostic procedure for viral infections including isolation identification and serology.

• Antiviral agents, viral prophylaxis.

• Interferon and chemotherapeutic agents.

• Emerging viral infection.

**Recommended Books**

1. Strauss,J. H., Ellen G. Strauss, E.G.,2007. Viruses and Human Disease. Elsevier Science.

2. Mettenleiter , T.C.,and Francisco Sobrino, F., 2008. Animal Viruses: Molecular Biology . Caister Academic Press

3. Shi, P.Y.,2012. Molecular Virology and Control of Flaviviruses . Caister Academic Press

4. Stent,G.S., and Dohm, J.L., 2012.Molecular Biology Of Bacterial Viruses .Literary Licensing, LLC.

5. Maramorosch,K., and Frederick A. Murphy, F.A., 2013.Advances in Virus Research Elsevier Science.

# MIC-527: CLINICAL BACTERIOLOGY

**Credit Hours (2+1)**

**Objectives**

• To explore the general nature of relationship between human and microorganisms

• To identify the major factors determining virulence and their genetic basis

**Course Detail**

• An introduction to clinical bacteriology.

• Hazards in clinical microbiology laboratory.

• Role and importance of normal flora in different parts of body.

• Respiratory tract infections.

• Infections of eye ear and skin.

• Fluids from infected joints, CSF, pleural and peritoneal fluids.

• Differential diagnosis of selective systemic bacterial infections of GIT, genito-urinary, cardiovascular and central nervous system.

• Nosocomial infections: community acquired infection, prevention and control.

• Principles of conventional, rapid and molecular diagnostic procedures.

**Practical**

1. Good laboratory practices.

2. Collection and processing of different clinical specimen for isolation and identification of pathogens.

3. Antibiotic sensitivity test by various techniques.

4. Conventional, rapid and molecular diagnostic methods.

**Recommended Books**

1. Murray, P. R., Rosenthal, K. S., Pfaller, M. A., Rosenthal, K. S., 2005, Medical Microbiology: Elsevier Health Science.

2. Hawkey, P.M., Gillespie, S.H., Hawkey, P., 2006. Principles & Practice of Clinical Bacteriology. 2nd Edition. Wiley, John &Sons.

3. Woodford, N. Johnson, A.P., 2010. Genomics, Proteomics, and Clinical Bacteriology: Methods and Reviews.1st Edition. Springer- Verlag New York, LLC.

4. Versalovic, J., 2011. Manual of Clinical Microbiology, 10th Edition. ASM Press

5. Vinay, K., 2011. Robbin’s and Ctran Pathologic Basis of Disease Saunder.

# MIC-528: PUBLIC HEALTH MICROBIOLOGY

**Course Objectives**

To learn the occurrence, abundance and distribution of microorganism in the community and their role in the associated with Public health and also learn different methods for their detection and characterization.

To understand the basic principles of environment microbiology and be able to apply these principles to understanding and solving environmental problems – Water pollution and waterborne diseases, Air pollution and airborne infections.

**Course contents**

 **I**: Introduction to public health: definition, scope, concept and importance of public health microbiology – roles of microbiologist in public health – microbial association of water, air and soil.

 **II**: Air borne infections: air and its composition – indoor air – outdoor air – air borne diseases (bacterial, fungal and viral) – methods of enumeration of microorganisms in air – air sanitation.

 **III**: Water borne infections: kinds of water – water borne diseases (viral, bacterial, protozoan) – methods of enumeration of microorganisms in water – indicator organism – water treatment, control of water borne diseases.

 **IV**: Food borne diseases: definition and importance of food hygiene – types (spoilage of meat and its products, milk and dairy product, fish and fish products and eggs) – role of microorganisms in food spoilage and poisoning – food borne diseases – types of food borne diseases – food poisoning – food borne infection.

**V**: Hospital acquired infection: Prophylactic immunization – disposal of infective hospital and laboratory materials – monitoring of sanitation in community – techniques used for the diagnosis of hospital acquired infection.

**Text books**

1. Ghimire P. and Parajuli K. (2005) A Text Book of Microbiology, Vidhyarthi Pustak Bhandar Publication, Kathmandu.

2. Brownson, R.C., Baker, E.A., Leet T.L. and Follespie K.N. (2003) Evidence Based Public Health, Oxford University Press.

**Reference books**

1. Engelkirk P.G. and Duben-Engelkirk J. (2015) Burton’s Microbiology for the Health Sciences, 10th Edn. Wolters Kluwer Health.

2. Park K. (2017) Parks Text Book of Preventive and Social Medicine, Banarsidas Bhanot Publishers.

3. Jay J.M., Loessner, M.J. and Golden D.A. (2005) Modern Food Microbiology, 7th Edn. Springer.

# MIC-529: GENERAL PHARMACOLOGY

**Credit Hours (2+1)**

 **Objectives**

• To understand the mechanisms of chemotherapy.

• To develop general understanding of microbial control.

• To examine various factors that influence microbial control.

**Course Detail**

• Nature and historical background of chemotherapy.

• Basic strategies for drug discovery: empirical screening, molecular targets and developing models.

• Range of antimicrobial targets.

• Chemical structure and biological activity.

• Molecular basis for selective action against the prokaryotes.

• Antimicrobial agents affecting: Cell wall synthesis, Protein Synthesis, DNA/RNA synthesis and others.

• Antifungal drugs affecting cell membrane and cell wall biosynthesis in fungi.

• Mechanism of action of antiviral drugs, antimitotic agents, benzimidazole carbamates, alkaloids and taxol.

• Antiparasitic agents.

• Resistance mechanisms.

• Therapeutic implication of cytokines and vaccines.

• New approaches in Therapy: By the use of Blockers for: selective microbial enzymes, substrates, and receptors.

• Blockers for biochemical processes.

• Action of antibiotics on biofilms,

• Emerging antimicrobial technology.

**Practical**

1. Isolation of antibiotic resistant bacteria from environment.

2. Effect of antibiotics on peptidoglycan content.

3. Effect of antibiotics on total soluble protein content.

4. Determination of extended spectrum beta lactamase in bacteria resistant to beta lactam antibiotics.

5. Determination of protein profile of antibiotic sensitive and resistant bacteria by Polyacrylamide Gel Electrophoresis (PAGE).

6. Effect of antibiotic on bacteria present in biofilm.

**Recommended Books**

1. Hauser, A. R., 2007. Antibiotic Basics for Clinicians. Wolters Kluwer Health.

2. Greenwood, D., Finch ,R., Davey, P., Wilcox ,M., 2007. Antimicrobial Chemotherapy. Oxford University Press; 5Rev Ed edition.

3. Franklin, T.J., Snow , G.A.,2010. Biochemistry and Molecular Biology of Antimicrobial Drug Action. 6th Edition. Springer-Verlag New York, LL.

4. Amyes, S., 2010 Antibacterial Chemotherapy: Theory Problems, and Practice. Publisher: Oxford University Press, USA.

5. Finch, R., Davey, P .,Wilcox,, M. H., Irving , W., 2012. Antimicrobial Chemotherapy. Oxford University Press.

# MIC-530: MEDICAL MYCOLOGY

**Credit Hours (2+1)**

**Objectives**

• To learn characteristics of fungi for classification.

• Examine fungal metabolism.

• To learn about pathogenic fungi and their infections in human

**Course Detail**

• Introduction to mycology.

• Fundamentals of fungal classification.

• Structure and physiology of fungi.

• Mycoses and Mycotoxicosis.

• Superficial and cutaneous Mycosis

• Sub cutaneous mycosis

• Systemic Mycosis

• Opportunistic fungal infections

• Use of fungi in biotechnology.

• Edible and poisonous fungi/mushrooms

**Practical**

1. Isolation and identification of fungi from:

♣ Environment

♣ Rhizosphere

♣ Clinical samples.

2. Effect of temperature on growth of fungi.

3. Determination of antifungal activity of (nystatin, actidion, amphoteracin B etc.)

4. Propagation of edible mushroom.

**Recommended Books**

1. Hocking, A.D., Pitt, J.I., Samson, R.A., Thrane, U., 2006. Advances in Food Mycology, Springer.

2. Webster, J. and Weber, R. 2008. Introduction to Mycology, Cambridge University Press.

3. Ainsworth, G.C., 2009. Overview: Introduction to the History of Mycology. Cambridge University Press.

4. Inderjeet K. S. and Surinder K. W., 2010. Text Book of Fungi and Their Allies.

5. Katherine B., Daniel J. E, 2010. Cellular and Molecular Biology of Filamentous Fungi. ASM Press

6. Caister Gioconda, S-B. and Richard, C. A., 2012. Pathogenic Fungi: Insights in Molecular Biology. Academic Press

# BS SEMESTER – VI

**Credit Hours = 16**

**Course Code/Course Title/Credit Hours**

MIC-531: Advanced Microbial Diagnostics (2+1)

MIC-532: Medical Parasitology (2+1)

MIC-533: Molecular Mechanisms of Antimicrobial Drugs (2+1)

MIC-534: Proteomics and Gene Therapy (2+1)

MIC-535: Clinical Rotations (1+3)

# MIC-531: Advanced Microbial Diagnostics (2+1)

**Credit Hours (2+1)**

**Objectives**

To introduce the students with basic concepts and laboratory procedure used in basic and differential advance diagnostic in microbiology.

**Course Detail**

Introduction to Advance diagnostics of Microbiology, Collection, preservation, transport and processing of clinical specimens for the diagnosis of bacterial infections, detailed study of different methods of antibiotic susceptibility tests, media used, selection of drugs, quality control, beta lactamase detection, MRSA detection, antibiotic assay in blood and body fluids, detailed study of the principle, preparation of media and reagents, methods, interpretation and quality control of the biochemical test used for the Identification of bacteria, detail study of principles and method of preparation, pH adjustments, sterilization, storage of different types of media, transport media, anaerobic media, quality control in media preparation, cultivation of bacteria, Inoculation methods, incubation methods, Inoculation on different types of culture media in Petri dish, slopes, butt, broths, morphological study of bacterial colonies on plated media, anaerobic culture methods with recent advancements. Introduction to diagnostic bacteriology, Collection, preservation, transport and processing of clinical specimens for the diagnosis of bacterial infections, detailed study of different methods of antibiotic susceptibility tests, media used, selection of drugs, quality control, beta lactamase detection, MRSA detection, antibiotic assay in blood and body fluids, detailed study of the principle, preparation of media and reagents, methods, interpretation and quality control of the biochemical test used for the Identification of bacteria, detail study of principles and method of preparation, pH adjustments, sterilization, storage of different types of media, transport media, anaerobic media, quality control in media preparation, cultivation of bacteria, Inoculation methods, incubation methods, Inoculation on different types of culture media in Petri dish, slopes, butt, broths, morphological study of bacterial colonies on plated media, anaerobic culture methods with recent advancement

**Practical**:

* Different methods & interpretation of antibiotic sensitivity testing and minimal inhibitory concentration
* MTB culture by concentration method
* Biochemical tests used for the identification of bacteria
* Preparation of commonly used laboratory medias, sterilization, Quality control and storage
* Collection, transportation and processing of all type of clinical specimens for the diagnosis of bacterial infections discussed in theory
* Inoculation and isolation of pure and mixed bacterial culture
* Identification of medically important bacteria from pure culture
* Special stains used in bacteriology.

**Recommended books:**

* + Bailey & Scott's Diagnostic Microbiology. [Forbes, B](http://www.google.com.pk/search?tbo=p&tbm=bks&q=inauthor:%22Betty+A.+Forbes%22&source=gbs_metadata_r&cad=6)., A., [Sahm, D](http://www.google.com.pk/search?tbo=p&tbm=bks&q=inauthor:%22Daniel+F.+Sahm%22&source=gbs_metadata_r&cad=6)., A., [Weissfeld, A](http://www.google.com.pk/search?tbo=p&tbm=bks&q=inauthor:%22Alice+S.+Weissfeld%22&source=gbs_metadata_r&cad=6)., S., & [Bailey, W](http://www.google.com.pk/search?tbo=p&tbm=bks&q=inauthor:%22William+Robert+Bailey%22&source=gbs_metadata_r&cad=6)., R., Elsevier Mosby, 2007.
	+ A Photographic Atlas f o r t h eMicrobiology Laboratory. Leboffe, M., J., & Pierce, B., E., Douglas N. Morton, 2010.
	+ Principles and Practice of Clinical Bacteriology. Gillespie, S., H., & Hawkey, P., M.,Wiley-Blackwell, 2005.
	+ District Laboratory Practice in Tropical Countries, Part1 & Part 2. [Cheesbrough, M](http://www.google.com.pk/search?tbo=p&tbm=bks&q=inauthor:%22Monica+Cheesbrough%22&source=gbs_metadata_r&cad=7)., 2nd ed. Cambridge University Press, 2006.

# MIC-532: Medical Parasitology

**Credit Hours (2+1)**

**Objectives**

• To understand the existence of pathogenic parasites in different environment.

• To study some selected parasites human diseases, their diagnosis, treatment and control.

**Course Detail**

• Etiology, life cycle, epidemiology, symptomatology, pathogenisis, lab diagnosis, treatment, prevention and control of: Protozoa, Entamoeba histolytica, Giardia lamblia, Plasmodium spp, Balantidium coli, Trypanosoma spp, Leishmania spp, Toxoplasma gondii, Trichomonas vaginalis.

• Brief introduction of Helminthes, Ascaris lumbricoides, Enterobius vermicularis, Trichuris trichiura, Ancylostoma duodenum and Necator americanus, Wucherria bancrofti, Taenia solium & Taenia saginata, Echinococcus granulosus, Hymenolepsis nana, Schistosoma haematobium, Fasciola hepatica.

• Mediators/vectors of parasitic infection

• Recent advances in the diagnosis and control of parasitic infections.

• Newly emerging parasitic infections.

**Practical**

1. Collection and processing of clinical samples.

2. Immuno and molecular techniques.

3. Detection of plasmodium in blood.

4. Detection of Protozoa, Helminthes and Amoeba in clinical samples and water.

5. Staining methods.

**Recommended Books**

1. Anne, Z. and Gary C., 2006. Veterinary Clinical Parasitology. Blackwell publishing.

2. 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. Springer-Verlag New York, LLC

4. Zeibig, E., 2012. Clinical Parasitology: A Practical Approach. 2nd edition. Elsevier Health Sciences

# MIC-533: MOLECULAR MECHANISMS OF ANTIMICROBIAL RESISTANT

**Credit Hours (2+1)**

**Objectives**

* To understand the mechanisms of resistance in bacteria, fungi and parasites.
* To develop general understanding of alternative mechanisms of microbial control.

**Course Detail**

* Definition and and historical background of emergence of antibiotic resistance.
* Basic mechanisms of antibiotic resistance in bacteria, fungi and parasites.
* AMR surveillance methods and burden of drug resistant infections.
* Antiobiotic usage and agriculture.
* The role of diagnostics in reducing antibiotic usage.
* Role of vaccines in reducing AMR.
* Novel alternatives to antimicrobials.
* Combination therapies.

**Practical**

* Perform Kirby-Bauer Disk Diffusion Susceptibility test.
* Perform Agar well diffusion Method.
* Check the susceptibility of antibiotics using strips.
* MIC and MBC.
* Isolation of antibiotic resistant bacteria from environment.
* Effect of antibiotics on peptidoglycan content.
* Effect of antibiotics on total soluble protein content.
* Determination of extended spectrum beta lactamase in bacteria resistant to beta lactam antibiotics.
* Determination of protein profile of antibiotic sensitive and resistant bacteria by Polyacrylamide Gel Electrophoresis (PAGE).
* Effect of antibiotic on bacteria present in biofilm.

**Recommended Books**

1. Antimicrobial Drug Resistance: Mechanisms of Drug Resistance, by Douglas. L Mayers, Jack D. Sobel, Marc Ouellette, Keith S. Kaye, Dror Marchaim.
2. Antimalarial Agents: Design and Mechanism of Action by Graham L. Patrick. 2020.
3. Drug Resistance in Leishmania Parasites: Consequences, Molecular Mechanisms and Possible Treatments by Alicia Ponte-Sucre, Maritza Padrón-Nieves.
4. David Greenwood\_ et al - Medical microbiology \_ a guide to microbial infections \_ pathogenesis, immunity, laboratory diagnosis and Control-Churchill Livingstone\_Elsevier (2012)
5. Foundations in microbiology. -Mc Graw Hill Talaro and chess 10th Edition.
6. Review of Medical Microbiology and Immunology-Warren Levinson.
7. Sherris Medical Microbiology – Kenneth J. Ryan.
8. Textbook\_of MICROBIOLOGY Surinder Kumar.
9. Topley and Wilson's Microbiology and Microbial Infections, 8 Volume Set.
10. Fields Virology- David M. Knipe, Peter M. Howley.
11. Prescott, Harley, and Klein's Microbiology.
12. Oxford handbook of infectious diseases and microbiology- M. Estée Török, Ed Moran, Fiona J. Cooke.

# MIC-534: Proteomic and Gene therapy

**Credit Hours (2+1)**

**Objectives**

1. To understand the principles and techniques of proteomics and gene therapy.
2. To explore the applications of proteomics and gene therapy in various fields such as medicine, agriculture, and microbiology.
3. To analyze the ethical, legal, and social implications of proteomic and gene therapy research and applications.
4. To develop critical thinking and problem-solving skills in the context of proteomics and gene therapy.
5. To foster a deeper understanding of the molecular basis of diseases and potential therapeutic interventions.

**Course Detail**

1. Introduction to Proteomics (Definition and scope of proteomics, Historical development and significance in biological research & Comparison with genomics and transcriptomic)
2. Techniques for Protein Analysis (Protein separation techniques: SDS-PAGE, 2D gel electrophoresis, Mass spectrometry (MS) for protein identification and quantification, Protein microarrays and their applications, Protein-protein interaction analysis: yeast two-hybrid, co-immunoprecipitation)
3. Introduction to Gene Therapy (Basic concepts of gene therapy, Types of gene therapy: germline vs. somatic, in vivo vs. ex vivo, Historical milestones and current status of gene therapy research)
4. Gene Editing Technologies (CRISPR-Cas9: principles, components, and applications, Zinc finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs), RNA interference (RNAi) as a gene silencing technique)
5. Proteomics in Disease Research (Applications of proteomics in studying various diseases (e.g., cancer, neurodegenerative diseases, cardiovascular diseases).
6. Proteomics in Drug Discovery (Role of proteomics in target identification and validation, Screening approaches using proteomic technologies & Pharmacoproteomics: understanding drug mechanisms and responses at the protein level)
7. Gene Therapy for Genetic Disorders
8. Gene Therapy in Cancer Treatment (Targeting cancer-specific genes using gene therapy, Oncolytic viruses and their role in cancer gene therapy & Immunotherapy approaches in cancer treatment, including CAR-T cell therapy)
9. Ethical Issues in Proteomic Research & Ethical Challenges in Gene Therapy
10. Experimental Design in Proteomics & Data Analysis Techniques that include Statistical analysis of proteomic data, Bioinformatics tools for protein identification, quantification, and functional analysis & Interpretation and visualization of proteomic datasets.

**Practical**

1. Protein Separation Techniques (SDS-PAGE gel preparation, protein sample loading, running SDS-PAGE gels, staining for protein visualization & Analysis of protein bands using gel documentation systems)
2. Protein Microarray Experiment
3. Cell Culture for Gene Therapy
4. Proteomic Sample Preparation
5. Proteomic Data Interpretation

**Recommended Books**

1. Pennington, S. R., & Dunn, M. J. (2001). Proteomics: from protein sequence to function.
2. Mishra, N. C. (2011). Introduction to proteomics: principles and applications. John Wiley & Sons.
3. Giacca, M. (2010). Gene therapy. Springer Science & Business Media.
4. Primrose, S. B., & Twyman, R. (2006). Principles of gene manipulation and genomics. John Wiley & Sons.

# MIC-535: Clinical Rotation (1+3)

# BS SEMESTER – VII

**Credit Hours = 15**

**Course Code/Course Title/Credit Hours**

MIC-636: Research Methodology and Bioethics (3+0)

MIC-637: Food and Water Microbiology (2+1)

MIC-638: Medical Entomology (2+1)

MIC-639: Epidemiology (2+0)

MIC-640: Clinical rotations (1+3)

# MIC-636: RESEARCH METHODOLOGY AND BIOETHICS

**Credit Hours (3+0)**

**Objectives**

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

**Course Details:**

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

**Recommended Books:**

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

# MIC-637: FOOD and Water MICROBIOLOGY

**Credit hours (2+1)**

**Objectives:**

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

**Course Details:**

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

**Practicals:**

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

**Recommended Books:**

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

# MIC-638: Medical Entomology

**Credit hours (2+1)**

**Objectives:**

In this course, we will examine the role of insects as vectors of diseases and their effects on human populations. Students will learn the taxonomy, morphology, life history, ecology, and behavior of the insects of public health importance and the epidemiology of the disease pathogens they transmit. Students will also learn integrated pest management (IPM) techniques that are helpful in diagnosing, preventing, and controlling disease vectors

**Course contents**

**1.Introduction to medical entamology**

* Arthropods of medical and veterinary importance
* Orientation towards hosts in hematophagous insects
* Hematophagy and transmission of pathogens
* Genetic and Environmental determinants of vector-pathogen interactions
* Vector-parasite interactions: what is a population & why do we care
* Insecticide resistance in insect vectors
1. **Mosquitoes and viruses**
* Zika, the new threat
* Dengue fever
* Yellow fever
* Chikungunya, vector change and emergence
* Infection by West-Nile virus
* Natural history of Rift Valley fever
1. **Insect Vector and Parasites**
* History of malaria control strategies, a cycle of euphoria and apathy?
* The global malaria strategy
* Population genetics of Malaria vectors
* Tsetse flies and African trypanosomiasis
* Triatominae and Chagas disease
* sand flies and leishmaniasis

# MIC-639: Epidemiology (2+1)

**Objectives**

• To develop the understanding of epidemiology.

• To use different mathematical tools of epidemiology.

• To learn and examine the descriptive and analytical epidemiology.

**Course Detail**

• Introduction to epidemiology: Types of epidemiology, clinical, occupational, experimental, interrelation of factors.

• Epidemiological methods, incidence, prevalence, rate, susceptibility etc.

• Types of studies, cross sectional, cohort, case control.

• Epidemiologic consideration in disease process.

• Cyclicity of diseases: Chicken Pox, Measles.

• Health information and biostatistics.

• Sampling methodology: procedure, sample size, cluster sampling, sampling error, bias, risk, data collection of infectious disease cases, antibiotic resistance profile of infectious agents.

• Screening tests, accuracy of screening tests, predictive value, 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 a comparison with the existing factors in Pakistan.

**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-640: Clinical rotations (1+3)

# BS SEMESTER – VIII

**Credit Hours = 12**

**Course Code/Course Title/Credit Hours**

MIC-641: Microbial Biotechnology (2+1)

MIC-642: Tropical Infectious Diseases (2+1)

MIC-643: Research Mini Project (6)

# MIC-641: MICROBIAL BIOTECHNOLOGY

**Credit Hours (2+1)**

**Course Objectives:**

To acquaint students with how modern methods may be employed to enhance the characteristics of microbes that are commonly used in various industries including food, agriculture and pharmaceutical.

**Course Contents:**

* Issues and scope of microbial biotechnology
* Genetically modified microorganisms
* Microbes as tools for microbiological research
* Biotechnological potential of microbes
* Significance of microorganisms in food production
* Fermentation, pharmaceutical and other industries
* Vaccine development and production
* Microbiological mining
* Biofuels and use of microbes in petroleum industry
* Plant-microbe interactions
* Biofertilizers, biopesticides, composting
* Antimicrobials
* Significance of microbial biotechnology in the economic development of Pakistan.

**Practical:**

* Isolation and screening of potential microbes from different environmental sources;
* Lab scale production of bacterial enzymes;
* Lab-scale production of alcohol by yeast;
* The use of microbes in bioleaching;
* Use of microbes in microbial enhanced oil recovery.

**Recommended Books:**

1. Glick BR et al., 2022. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 6th Edition; ASM Press.
2. Mukhopadhyay SN, 2019. Process Biotechnology Fundamentals. 4th Edition. MV Learning.
3. Goodsell DS, 2004. Bionanotechnology: Lessons from Nature. John Wiley and Sons.
4. Ray RC, 2005. Microbial Biotechnology in Agriculture and Aquaculture. NBN International.
5. Kreuzer H and Massey A, 2005. Biology and Biotechnology Science, Applications, and Issues. 1 st Edition; ASM Press.
6. Harding SE, 2010. Biotechnology and Genetic Engineering Reviews. 1 st Edition. Nottingham University Press.

# MIC-642: TROPICAL INFECTIOUS DISEASES

**Credit Hours (2+1)**

**Objectives:**

* To gain a good general understanding of tropical infectious diseases
* To give an insight into the epidemiology, pathophysiology, diagnosis, and management of tropical infectious diseases

**Course Details:**

* Introduction to tropical diseases
* Global burden of tropical infectious diseases
* Infectious diseases causing agents
	+ Viruses (HIV/AIDS, Dengue, Yellow fever, Rota, Ebola, Lassa fever)
	+ Bacteria (Tuberculosis, Cholera, *Escherichia coli*, Henson’s disease (Leprosy)
	+ Parasitic single-celled protozoa and worms (Leishmania, Trypanosoma, Plasmodium, Helminthic infections, Schistosomiasis and Filariasis)
	+ Fungi (cutaneous and subcutaneous mycoses)
* Transmission dynamics of tropical diseases
* Prevention of tropical diseases
* Treatment of tropical diseases
* Vaccine preventable diseases

**Practical:**

1. Sampling and performing common diagnostic tests for various tropical infectious diseases

**Recommended Books:**

1. Drs.Richard L. Guerrant, David H. Walker, and Pete F. Weller., 2011. Tropical Infectious Diseases: Principles, Pathogens & Practice. Third Edition- ScienceDirect.
2. Laura Nabarro, Stephen Morris-Jones and David A. J. Moore., 2018. Peters’ Atlas of Tropical Medicine and Parasitology. Seventh Edition- Elsevier.

# MIC-643: RESEARCH MINIPROJECT

**Credit Hours (06)**