



**Bachelor of Science in Medical
Microbiology**
(B. Sc. Medical Microbiology)

Syllabus

**Faculty of Science and Technology
Pokhara University**

2006

Bachelor of Science in Medical Microbiology

(B. Sc. Medical Microbiology)

Goal and Focus:

Microbiology is one of the youngest branches of biomedical science. The rapid increase in the number of hospitals, medical colleges, nursing homes, health institutions, health related research institutes, pharmaceutical and biotechnological industries, food industries both in private and public area over the last decade accelerated tremendous demand for microbiology. The demand is equally felt in the NGOs and INGO sectors involved in health care and promotion activities. At the beginning, this subject was included either in botany or in the zoological field and was considered as a minor branch of these subjects. As there is the introduction of genetic engineering as revolutionary science, Microbiology is being the research tool. In recent years, it is one of the main subjects of research throughout the world. With the growing interest of microbiology, (graduate students for bachelor degree in Medical microbiology) and increasing market demand with the increase of Pharmaceutical, cosmetic, Ayurvedic and consumer goods, Clinical Diagnostic and research.

Objectives:

The main aim of the course is to train students in the field of Medical Microbiology. Training in both theory and practical is imparted to the students covering all the subspecialties: Systemic and Diagnostic Bacteriology, Parasitology, Virology, Mycology and Immunology. After graduation, the graduates of Pokhara University can be part in patient care, Disease prevention and control in the community effectively along with active participation as researcher in health research and QC staffs in Pharmaceutical and cosmetic industries. They will be trained with the modern methods of teaching learning and IT skills to enable them to tackle the future assignments in laboratory diagnostic, experimental animal, industrial along with academic ventures. They will also be introduced to basic research methodology so as to enable them to start basic and applied research independently.

Career Opportunity:

There is tremendous demand of medical microbiologists due to rapid increase in the number of hospitals, medical colleges, nursing homes, health institutions, health related research institutes, pharmaceutical and biotechnological industries, food industries both in private and public area over the last decade.

AN INTRODUCTION TO BACHELOR OF SCIENCE IN MEDICAL MICROBIOLOGY (*B. Sc. Medical Microbiology*)

A. GENERAL

1. Title

The title of the program is Bachelor of Science in Microbiology (Medical), B. Sc. MM

2. Objective

The objective of the BScMM program is to produce competent and need based public health graduates.

3. Course Structure:

- The program follows the credit system. Each course is assigned a certain number of credits depending generally upon its lecture, and practical work hours in a week. In theory subjects, one lecture per week is assigned one credit as a general rule.
- Three credit hours of theory is equivalent to 48 hours lecture and one credit hour of practical is equivalent to 45 hours practical is one semester.
- The B. Sc. Medical Microbiology course comprises the total of 154 credit hours spreading over eight semesters.

4. Course Coding

- Each course is identified by initial letter of the course title followed by three digit number and credit hours after decimal i.e. Fundamental Chemistry (FCH 104.3), LAB I (LAB 1.1).

5. Normal and Maximum Duration of Stay in the University

The normal duration for completing the BScMM course is four years. In exceptional case, however, the student is allowed normal duration plus four years to complete the course. If a student is unable to complete the course within eight years from the time of admission, the University registration is annulled.

6. Academic Schedule

The academic session consists of two semesters per year. Generally the Fall Semester (September-February) starts in September and the Spring Semester (February-

August) begins in February, however it may differ slightly in any particular year.

7. Medium of Teaching and Examination

The medium of instruction and examination for BScMM program will be English.

B. ADMISSION AND EXAMINATION

1. Entry Requirement for New Student

The entry requirement for a new student in BScMM will be Intermediate in Science (I.Sc) Higher Secondary Level (10+2 Science streams) or Proficiency Certificate Level (PCL Science), or Certificate in Health Sciences or equivalent as recognized by Pokhara University with at least 50% marks. Besides the basic academic requirement an entrance examination will be held for all applicants.

2. Admission Procedure

A notice inviting application for admission is publicly announced. The application forms and information brochures are provided, on request, after the payment of the prescribed fee.

The concerned college scrutinizes the applications. The eligible candidates are informed to take the entrance test. The date and time for the entrance test is informed to the prospective students by the college. The college may also interview the candidates for final selection for admission.

The candidates, who are given provisional admission under special condition, are required to submit all necessary documents within a month of the beginning of regular classes. Otherwise, the admission will be annulled.

3. Student Evaluation

The student's academic performance during a semester will be evaluated internally (sessional work) and externally (the final examination). The sessional work examination will be evaluated by the teaching Faculty and it will be of 50% weight. The remaining 50% will be the final examination, conducted by University.

In the practical courses, 80% will be internal and 20% final examination.

To pass a particular course, a student must obtain a minimum of D grade in sessional work (average of internal assessments) and the final examination separately.

4. Attendance Requirement

The students must attend every lecture, tutorial, seminar and practical classes. However, to accommodate for sickness and other contingencies, the attendance requirement shall be a minimum of 80% of the classes in any particular subject, otherwise she/he shall not be allowed to take the final examination in that subject. If a student is continuously absent in the class for more than four weeks without notifying the authorities, his/her name will be removed from the school roll.

5. Course Registration

The academic record of a student shall be maintained in terms of the courses for which s/he register in any semester, and the grades s/he obtain in those course. Registration for course is done at the beginning of each semester. Since registration is a very important procedural part of the credit system, it is absolutely essential that all students present themselves at the school. In case of illness or any exceptional circumstance during the registration period, the student must inform the University authority. Registration absentia may be allowed only in rare case, at the discretion of the authorized person. However, the students nominee cannot register for course and will only be allowed to complete other formalities.

Generally in a particular semester or year only those courses would be offered for registration which are mentioned in the syllabus, however their sequence may be interchanged if necessary.

6. Repeating a Course

Since passing of all course individually is a degree requirement, the student must retake the falling core course when offered and must successfully complete the course. Retaking a course in which a student has earned a D grade is optional. Student can retake a course when one receives GPA less than 2.0. The grade earned on the retake

will be substituted for the grade earned previously

7. Transfer of Credit Hours

A maximum up to 25% of the total credit hours of course complete in an equivalent program of a recognized institution may be transferred / waived for credit on the recommendation of the head of the faculty. For transfer of credit, a student must have received a grade of B or better in respective course. Courses taken earlier than five years from the time of transfer may not be accepted for transfer of credit. However, a student transferring from one program to another program of Pokhara University may receive a credit transfer of all the compatible courses completed with at least grade C.

The concerned Subject Committee of the University will make an evaluation of the applicant for transfer of credit. The awarding of transferred credit will be based on the applicant's score in the University, which s/he has attended previously.

8. Final Examination

University conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the University.

9. Unsatisfactory Results

Students may apply for retotalling or rechecking of their grades as per University rule, upon payment of prescribed fee.

C. GRADING SYSTEM

The grades (marks) awarded to student in a course is based on his/ her consolidated performance in sessional and final examinations. The letter grade in any particular subject is an indication of a student's relative performance in that course. The pattern of grading will be as follows:

Letter	Grade	Grade point description
A	4.0	Excellent
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Satisfactory
C	2.0	
C-	1.7	
D+	1.3	

D	1.0	Minium requirement
F	0	Failing

In unusual circumstances, the student may be awarded an incomplete grade of “I”. If all the requirements are not complete within the semester, the performance of a student in a semester will be evaluated in terms of the semester grade point average (SGPA). The student’s final grade will be calculated on cumulative grade point average (CGPA).

SGPA = Total honor points earned in a semester / total number of credits registered in a semester.
 CGPA = Total honor points earned / total number of credits completed.

D. DIVISION EQUIVALENCE

In Pokhara University, CGPA 2.5 or more and 3.0 or more considered as Second and First divisions, respectively.

E. DISMISSAL FROM THE PROGRAM

A student is normally expected to maintain a CGPA of 2.0, A student failing to maintain a satisfactory academic standard shall be dismissed from the program. In case a student gets less than 2.0 SGPA then in marginal cases only the Dean or the faculty can allow the student to continue his/her studies on the recommendation of program director or the subject committee.

following semester, the grade of “I” will be **automatically** converted to an “F”. A student receiving an “I” grade does not need to register for that subject in the following semester to complete the required works.

F. AWARD OF DEGREE

On completion of all requirements with CGPA of 2.0 or better, the student will be awarded a degree of Bachelor of Science in Medical Microbiology.

G. DEGREE WITH DISTINCTION

To obtain a degree with distinction, a student must obtain CGPA 3.6 or better.

H. DEAN’S LIST

The Dean’s list recognizes outstanding performances of academic excellence by students. To qualify, a student must obtain a CGPA of 3.7 or better.

Note: The provisions of this document are not be regarded as a binding contract between the University and the students. The University reserves the right to change any provisions or requirements contained in this document at any time, without pre-notification, within the students term of residence.

CURRICULUM STRUCTURE
Bachelor of Science in Medical Microbiology
(B. Sc. Medical Microbiology)

FIRST YEAR

Course no	Course Title	Credit Hours	Remarks
FIRST SEMESTER			
ENG 101.3	Professional English	3	
MBO 102.3	Medical Botany	3	
MEN 103.3	Medical Entomology	3	
FCH 104.3	Fundamental Chemistry	3	
GMB 105.3	General Microbiology I	3	
LAB 1.1	Medical Botany	1	
LAB 2.1	Medical Entomology	1	
LAB 3.1	Fundamental Chemistry	1	
LAB 4.1	General Microbiology I	1	
Total		19	
SECOND SEMESTER			
GMB 106.3	General Microbiology II	3	
HAP 107.3	Human Anatomy and Physiology I	3	
MBC 108.3	Microbial Biochemistry	3	
MBI 109.3	Molecular Biology I	3	
IBE 110.3	Instrumentation & Biomedical Engineering	3	
LAB 5.1	General Microbiology II	1	
LAB 6.1	Human Anatomy and Physiology I	1	
LAB 7.1	Microbial Biochemistry	1	
LAB 8.1	Molecular Biology I	1	
LAB 9.1	Instrumentation & Biomedical Engineering	1	
Total		20	

SECOND YEAR

Course no	Course Title	Credit Hours	Remarks
THIRD SEMESTER			
HAP 201.3	Human Anatomy & Physiology II	3	
MBI 202.3	Molecular Biology II	3	
SBA 203.3	Systemic Bacteriology I	3	
EPI 204 .3	Epidemiology	3	
BIM 205.3	Bio-informatics	3	
LAB 10.1	Human Anatomy & Physiology II	1	
LAB 11.1	Molecular Biology II	1	
LAB 12.1	Systemic Bacteriology I	1	
LAB 13 .1	Epidemiology	1	
LAB 14.1	Bio-informatics	1	
Total		20	
FOURTH SEMESTER			
SBA 206.3	Systemic Bacteriology II	3	
SVI 207.3	Systemic Virology	3	
SPA 208.3	Systemic Parasitology	3	
SMY 209.3	Systemic Mycology	3	
PHM 210.3	Public Health Microbiology- I	3	
LAB 15.1	Systemic Bacteriology II	1	
LAB 16.1	Systemic Virology	1	
LAB 17.1	Systemic Parasitology	1	
LAB 18.1	Systemic Mycology	1	
LAB 19.1	Public Health Microbiology- I	1	
Total		20	

THIRD YEAR

Course no	Course Title	Credit Hours	Remarks
FIFTH SEMESTER			
PHM 301.3	Public Health Microbiology II	3	
PMB 302.3	Pharmaceutical Microbiology	3	
IMB 303.3	Industrial Microbiology	3	
MBI 304.3	Microbial Biotechnology	3	
IMM 305.3	Immunology	3	
LAB 20.1	Public Health Microbiology II	1	
LAB 21.1	Pharmaceutical Microbiology	1	
LAB 22.1	Industrial Microbiology	1	
LAB 23.1	Microbial Biotechnology	1	
LAB 24.1	Immunology	1	
Total		20	
SIXTH SEMESTER			
DBA 306.3	Diagnostic Bacteriology I	3	
DVI 307.3	Diagnostic Virology	3	
DPA 308.3	Diagnostic Parasitology	3	
DMY 309.3	Diagnostic Mycology	3	
DIM 310.3	Diagnostic Immunology	3	
LAB 25.1	Diagnostic Bacteriology I	1	
LAB 26.1	Diagnostic Virology	1	
LAB 27.1	Diagnostic Parasitology	1	
LAB 28.1	Diagnostic Mycology	1	
LAB 29.1	Diagnostic Immunology	1	
SEM 1.1	Seminar	1	
Total		21	

FOURTH YEAR

Course no	Course Title	Credit Hours	Remarks
SEVENTH SEMESTER			
DBA 401.3	Diagnostic Bacteriology II	3	
DMB 402.3	Diagnostic Microbiology	3	
RME 403.3	Research Methodology	3	
BDM 404.3	Bio-statistics and Data Management	3	
MML 405.3	Management of Microbiology Laboratory	3	
LAB 30.1	Diagnostic Bacteriology II	1	
LAB 31.1	Diagnostic Microbiology	1	
LAB 32.1	Research Methodology	1	
LAB 33.1	Bio-statistics and Data Management	1	
LAB 34.1	Management of Microbiology Laboratory	1	
SEM 2.1	Seminar	1	
Total		21	
EIGHTH SEMESTER			
ITR 406.6	Hospital / Factory Internship	6	
DIS 407.6	Thesis / Dissertation	6	
SEM 3.1	Seminar	1	
Total		13	

SYLLBUS
For
Bachelor of Science in Medical Microbiology
(B. Sc. Medical Microbiology)

FIRST YEAR
(First and Second Semester)

ENG 101-3 (Credit hours 3)

Professional English

B. Sc. Medical Microbiology: First Year, First Semester

Course Objectives:

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

- Use tense, time and aspect, communicate on different professional topics.
- Identify sentences (clause) and its types and transformation of sentences and develop reading skills, note making and summarizing from different passages.
- Prepare short memoranda; write business letters, job application, seminar papers, and proposal writing.

Course Contents:

Unit I: Review of Written English

8 hours

- Sentence structure (identification of sentences or its types and transformation of sentences).
- Clauses.

Unit II: Oral Communication, Note taking and Summarizing

15 hours

- Prepositions and noun phrases (noun, adjective and adverbs) their use, verbal phrases,
- Type of English (variety/ levels of English).
- Professional writing and talk (Microbial Infection, Control of infection in the community).
- Impact of satellite communication (urban development, drug use problems, role of Microbiologist in disease investigation).

Unit III: Technical Writing Skill

15hours

- Preparation of short memoranda (importance –formats), health messages, business letters (importance- purposes).
- Paragraph writing (descriptive / narrative, argumentative, compare and contrast etc.).
- Seminar papers writing (conduction of seminar, preparation of circular presenting seminar paper).
- Proposal writing, Rapport writing, (importance, type, formats), preparation of reports (importance, types, formats).

Unit IV: Reading Skill

10 hours

- Comprehension questions and exercises from prescribed passages
- Discovery of antibiotics,
- Communicable diseases,
- People and environment healthy life styles,
- Different microbial report and article from the journal,
- Outlining or note taking, precise writing.

References:

1. Eisenberg A.: *Effective Technical Communication*, McGraw-Hill Inc, 1982.
2. Houp and Pearsall TE.: *Reporting Technical information*, Allyn and Bacon, Boston.
3. Narayanswami VR.: *Strengthen Your Writing*, Orient Longman, Madras.
4. Tickoo C. and Sasi Kumar J.: *Writing with a Purpose*, Oxford University Press, Bombay.
5. A Hand Book of Pronunciation of English Words (with 90 minutes audiocassette).
6. Communication skill in English.
7. 'Oxford Advanced Learners' Dictionary of Current English.

MBO 102-3 (Credit hours 3)

Medical Botany

B. Sc. Medical Microbiology: First Year, First Semester

Course Objectives:

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

- Understand botany associated to clinical microbiology
- Understand basic life process and characteristics of medically important plants.
- Collect and identify medicinal plants.

Course Contents:

Unit I: Introduction:

4 hours

- Nature and scope of medical biology in relation to clinical microbiology,
- Life components,
- Diversity of life,
- Reproduction, Mendel's law of inheritance.

Unit II: Classification, General Characteristic, and Pathogenesis:

12 hours

- Phycomycetes Zygomycetes, Basidiomycetes, Deuteromycetes and Lichens
Rhizopus, Mucor, Aspergillus and *Penicillium*
- Dematiaceous and Hyaline
Microsporum, Trichophyton, Epidermophyton,
- Dimorphic molds
Blastomyces
Histoplasma
Coccidioides
Paracoccidioides.

6 hours

Unit III: Classification, General Characteristic, and Pathogenesis of Yeast:

- Hyphal, Non-hyphal and Pseudohyphal
 - *Candida* and *Arthouroconidia*
- *Cryptococcus*
- *Rhotorulla*
- *Saccharomyces.*

Unit IV: Importance of Various Fungi and Molds:

4 hours

- Fungi in medicine
 - Ergot
 - Antibiotics
 - Steroid
 - Vitamins
 - Therapeutic use
- Fungi in industry
- Fungi in food

Unit V: Habit, Distribution, Parts used for Medicinal Value, Uses, Identification of Medicinal Plants of Nepal.

16 hours

- *Adhatod visica* (Asuro)

- *Aiadiachta indica* (Neem)
- *Atropa belladonna* (Belladonna)
- *Artimisia (Titepati)*
- *Cinnamomum zylenicaa* (Dalchini)
- *Colchicum luteum* (Colchicum)
- *Cordyceps sinensis* (Yarasgumba)
- *Datura stromonium* (Dhaturu)
- *Digitalis purpurea* (Foxglove)
- *Epheara geradiana* (Bhutukesh)
- *Fleneris cordamonum* (Alaichi)
- *Mella asadirachta* (Bakainu)
- *Mentha arvensis* (Pudina or Babari)
- *Ocimum sancrum* (Tulsi)
- *Orchis larifolia* (Panchanle)
- *Paparer somniferum* (Opium)
- *Platago ovato* (Esnovggol)
- *Rauwolfia serpentina* (Sarpagandha)
- *Santaium album* (Shoureekantha)
- *ASloe vera* (Gheukumari)
- *Zinger officinalis* (Aduwa).

Laboratory Practices

- Study of microscope.
- Collection and characterization of medically important plants.
- Demonstration and observation of medically important fungi.

References :

1. Joshi KK & Joshi SD, *Genetic heritage of Medicinal & aromatic plants of Nepal Himalayas*, Buddha Academic Publishers, 2001.
2. Bailey & Scotts *Diagnostic Microbiology*, 4th edition.
3. Ghimire K. R., *Botany for Health Sciences*. Vidhathy Pustak Bhandar Publisher, first edition, Kathmandu, 2005.

MEN 103-3 (Credit hours 3)

Medical Entomology

B. Sc. Medical Microbiology: First Year, First Semester

Course Objectives:

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

- Understand medical entomology in relation of clinical microbiology
- Understand basic characteristics of medically important insect vectors, arthouropods and rodents
- Identify medically important insect arthouropods and rodents.

Course Contents:

Unit I: Introduction:

2 hours

- Introduction: history, scope and application,
- Definition and classification of medically important insects/vectors,
- Medical importance of entomology in relation clinical microbiology.

Unit II: Introduction to mosquitoes

16 hours

~~16 hrs~~ External Morphology, Life cycle,

Medical Importance and Control of:

- Anophilinae
- Culicinae
- Culex
- Aedes
- Haemagogus
- Sabethes
- Mansonia
- Coquilletidia
- Psorophora

Unit-III: Flies:

15 hours

Morphology, Life cycle, Medical Importance and Control of:

- Black flies (Simuliidae).
- Phlebotomine sandflies (Phlebotominae),
- Tsetse-flies (Glossinidae)
- House-flies and stable-flies (Muscidae) and latrine flies (fanniidae)
 - House-flies and stable-flies,
 - The common house fly,
 - The greater house-fly,
 - The stable-fly,
 - Lesser House-flies and latrine flies,
- Flies and myiasis- Classification, metallic and non-metallic flies, sarcophagidae, Oestridae, other myiasis-producing flies.

Unit-IV: Fleas, Lice, Bugs, Ticks, Mites and Cockroaches

15 hours

Morphology, Life cycle, Medical Importance and Control of

- Fleas (Siphonaptera), 1
- Lice (Anoplura)- Body louse, head louse, pubic louse,

- Bed bugs (Cimicidae),
- Cockroaches (Blattaria),
- Soft ticks (Argasidae),
- Hard ticks (Ixodidae),
- Scabies mites (Sarcoptidae),
- Scrub typhus mites (Trombiculidae),
- Miscellaneous mites-

Laboratory Practices

1. Identify medically important arthropods and rodents.
2. Classify up to the species level of mosquitoes, flies, bugs, arachnids (scorpions, spiders, ticks and mites) and rodents of medical importance.
3. Illustrate the different stages of the life cycle of medically important insects (different stages of the life cycle) and arachnids to study their morphology.

References: :

1. Medical Entomology for students- M W Service, Chapman & Hall-1996.

FCH 104-3 (Credit hours 3)

Fundamental Chemistry

B. Sc. Medical Microbiology: First Year, First Semester

Course Objectives:

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

- Understand the physical, organic and inorganic chemistry.
- Understand the importance of water, pH, buffer, and solution and biochemical reaction.

Course Contents:

Unit I: General Introduction of Chemistry and Biochemistry 2 hours

- Scope, definition, history, classification (nomenclature) and medical importance of biology chemistry and biochemistry.
- Importance and application of chemistry and biochemistry in medicine.

Unit II: Physical Chemistry: 12 hours

- **Matter**
 - State
 - Atom, atomic weight,
 - Molecules, molecular weight,
 - Mixture, separation of mixture,
 - Chemical classification and reaction – Oxidation /reduction.
- **Water**
 - Chemical structure
 - Biological function
 - Properties
 - Colloids.
- **Solutions**
 - Molar
 - Molal
 - Normal
 - Percentage
 - pH, buffers, acids, alkali, salts and indicators (example with body fluid and blood).

Unit III: Inorganic Chemistry: 12 hours

- Bio-molecules and Bio- elements.
- Importance and characteristics of metals and electrolytes (Na, K, Mg, Ca, Co, Cu, Mn, Zn, Cr, and Fe)
- Introduction and general characteristics and laboratory preparation of hydrogen, oxygen, nitrogen, sulphur, phosphorous, chlorine, bromine, fluorine, carbon and carbon dioxide.
- Titration: Principle and methods.

Unit IV: Organic Chemistry:**22 hours**

1. Nature of organic compound.
2. Mechanisms of organic reactions.
3. General introduction and concept of Alkane, Alkenes, Alkynes and Alkyl halides
4. Alcohol and ether
 - Structure
 - Nomenclature
 - Physical properties
 - Industrial and laboratory preparation
 - Reaction
5. Aldehyde and ketone
 - Structure
 - Nomenclature
 - Physical properties
 - Industrial and laboratory preparation
 - Reaction
6. Carboxylic acids and derivatives
 - Structure
 - Nomenclature
 - Physical properties
 - Industrial and laboratory preparation
 - Reaction.

Laboratory Practices

1. Preparation of different solutions, (Molar, Normal, Percentage, PPM, Buffer)
2. Measurements of pH
3. Titration- acid and base, non-aqueous.
4. Quantitative analysis of simple inorganic salt.
5. Purification of the substance.
6. Separation of mixture by different methods.

References:

1. Sthapit M. K. and Pradhananga R. R. , *Foundation of Chemistry*, Volume I, II and III. Sthapit M. K. and Pradhananga R. R Publisher, Nepal. 1995
2. Lee, J. D., *Concise Inorganic Chemistry*, 4th ed., ELBS with Chapman and Hall. 1991
3. Lehninger, A. L., Nelson, D. L and Cox, M., *Principles of Biochemistry*, First Indian ed. CBS Publisher and distributor.1993.
4. Plumber, D. T., , *An Introductory to Practical Biochemistry*, 14th Ed, Tata McGraw– ill Company (UK) limited. 2000

GMB 105-3 (Credit hours 3)

General Microbiology I

B. Sc. Medical Microbiology: First Year, First Semester

Course Objectives:

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

- Acquire knowledge on the Prokaryotic and Eukaryotic organisms.
- Define and describe different forms, features, morphology, classification and diseases concerning with different groups of microorganisms.

Course Contents:

Unit I: Introduction of Microbiology

8 hours

- Historical development of Microbiology.
- Scope and medical importance of Microbiology.
- Discipline of microbiology and its multidisciplinary role.
- Modern concept of classification of microorganisms (nomenclature).
- Prokaryotic and Eukaryotic organisms.
- Germ theory of diseases, Spontaneous generation theory.
- Opportunistic and pathogenic organisms.
- Infection and mechanism of infection

Unit II: Bacteriology:

12 hours

- Introduction, classification, nomenclature and characteristic of major groups of bacteria.
- Pathogenic, nonpathogenic {Normal bacterial flora (Commensal)}/ opportunistic bacteria.
- Bacterial diseases.

Unit III: Mycology:

8 hours

- Introduction, classification and characteristic of major groups of fungi.
- Morphology and structure of mould and yeast
- Fungal diseases.

Unit IV: Virology:

8 hours

- Nature, shape, structure and chemical composition of viruses.
- Classification of viruses.
- Viral diseases.

Unit V: Parasitology:

12 hours

- Introduction, definition, history, scope and medical importance of parasites
- Definition and classification of host.
- Definition and classification of parasites (protozoa, helminthes - intestinal, blood and tissue parasites).
- Host parasite relationship.

Laboratory Practices

1. Handling of instruments in microbiology laboratory.
 - a. Autoclave, Hot-air oven, laminar flow hood, pH meter, colony counter etc.
2. Preparation of smear from different samples / medium.
3. Preparation and use of different stains.
4. Study of morphology of microorganisms- using Gram staining technique.
5. Sterilization, Disinfection, Aseptic techniques.

References :

1. A text book of Medical Laboratory Technology, HG Shourestha, JB Sherchand, BM Pokhourel, M Nakanishi, JICA
2. Parajuli K. Laboratory Practical Microbiology, Vidharti Pustak Publication, Bhotahity, Kathmandu. Ghimire P. & Parajuli K. *A Text Book of Microbiology*, Vidhyarthi Pustak Bhandar Publication, Kathmandu. 2005.
3. Thomas D. Brock and Michael T. Madigan: *Biology of Microorganisms*, Prentice-Hall International, 1998.
4. Roger Y, Stanier, Edward A, Adelberg and John L. Ingraham: *General Microbiology*, the Macmillan Press Ltd. 1998.
5. Chester. W. Emmons, *Medical Mycology 3rd edition*, Chapman-H. Binford, John P. Utz, K and K.J. Kwon-Chun.
6. Evan E. and Gentles J.C.; *Essentials of Medical Mycology*, Churchill Livingstone, New York 1995.
7. Atlas, R.M. *Principles of Microbiology*, Mosby Publisher.
8. Isenberg H. D., and Albert *Clinical Microbiology Procedure Hand Book Vol. II*, American Society for Microbiology, Einstein College of Medicine, New Work, Washington DC & I.
9. Parker MT., & Collier L. H., *Topley & Wilson's Principle of Bacteriology, Virology & Immunity Vol. I, II III & IV*, 8th Edition, 1990.
10. Colle J. G., Fraser A. G., Marmion B. P., Simmons A., *Mackie & McCartney: Practical Medical Microbiology*, 4th Edition, Churchill Living Stone, New Work, Melbourne, Sans Francisco, 1996.
11. Geo. F. Brook, Janet S. Butel & Stephen A. Mores, *Jawetz, Melnick and Adel berg's Medical Microbiology*, 21st Edition, Appleton & Lance, Co. Stamford Connecticut, 1998.
12. Barron G. I. & Felthani R. K., *Conan & Steel's Manual for the Identification of Medical Bacteria*, 3rd Edition, 1993, Cambridge University Press.
13. K. D. Chatterjee, *Parasitology: Protozoology and Helminthology*, 20th Edition, Chatterjee Medical Publishers, Calcutta 1998.

14. Markell, Joh Krotoski, *Medical Parasitology*, 8th Edition, W. B. Saunders Co. Philadelphia, London, New Work.
15. Dickson D, Despommier, Robert W. Gwatz, Peter J. Hotez, *Parasitic Diseases*, Springer, Verlag, New York, London, Paris, Tokyo,
16. Lawrence R. Ash. Thomas C. Orihel, *Atlas of Human Parasitology*, 3rd Edition, ASCP Press. Chicago.

GMB 106-3 (Credit hours 3)

General Microbiology II

(B. Sc. Medical Microbiology: First Year, Second Semester)

Course Objectives:

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

- Understand microbial physiology, growth and metabolism in microorganisms.
- Describe cultivation and growth of different groups of medically important microorganisms.
- Understand sterilization, biohazard and bio-safety.

Course Contents:

Unit I: Physiology and Growth of Medically Important Bacteria

8 hours

- Bacterial reproduction,
- Growth of microorganism,
- Bacterial physiology and factors affecting the microbial growth:
 - a. Nutrition (source of carbon nitrogen, mineral and other sources of vitamin),
 - b. Temperature,
 - c. Water activity,
 - d. Salinity (osmotic effect and electrolytes),
 - e. pH,
 - f. Gases (aerobic, anaerobic, facultative anaerobic, micro-aerophilic, carbon dioxide),
- Growth curve,
- Host Parasite interaction,
- Microbial interactions, and mechanism of infection,

Unit II: Metabolism and Metabolic Product of Medically Important Microorganisms 20 hours

- Nutritional types (Photolithotropic, Chemolithiotropic, Photoorganotrophic chemoorganotrophic, microbial energetic).
- Carbon metabolisms-general concept of glycolysis and TCA cycle.
- Biochemical properties of microorganisms.
- Various metabolic product and identification.

Unit III: Biohazards and Bio-safety in Microbiology

5 hours

- Basic concept on biohazard and bio-safety.
- Universal precaution.

- Laboratory waste products and disposal.

Unit III: Culture Media and Cultivation of the Medically Important Microorganisms

5 hours

- Various culture media (types, forms, composition, selection and uses),
- Various culture techniques.

Unit IV: Sterilization Techniques

5 hours

- Structure and model of working principal and procedure of hot air oven, autoclave, incubator, bio-safety hood, steam sterilizer,
- Principle and procedure of various sterilization methods - Physical and mechanical (dry heat, moist heat, radiation and filtration, and incineration)
- Chemical sterilizer.
- Biological sterilizer.

Unit IV: Staining Techniques

3 hours

- Various staining techniques and principle and uses (types, forms, composition, selection and uses).

Laboratory Practices

1. Preparation and use of various culture media.
2. Sterilization by various methods
3. Inoculation of different samples-Aerobic Culture methods.
 - Streak plate method
 - Pour plate method
 - Serial dilution method
4. Study of growth of bacteria, fungi in different conditions.
5. Study the metabolic products of bacteria
 - Biochemical tests.

References: :

1. Brock, T. D. Smith, T.W., Modigan M. T.: *The Biology of Microorganisms*, Prentice Hall. 1992.
2. Harold, J. B., *Microbiological Applications: Laboratory Manual in General Microbiology*, WC Broom Co Publishers, 1995.
3. References: as course GMB 105

HAP 107-3 (Credit hours 3)

Human Anatomy and Physiology I

(B. Sc. Medical Microbiology: First Year, Second Semester)

Course Objectives:

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

- Understand structures of various organs and system of human body.
- Understand various functions, physiology and infections of organs and systems.
- Describe basic human anatomy and physiology.

Course Contents:

Unit I: Introduction to Applied Human Anatomy and Physiology: 6 hours

- Introduction to applied human anatomy and physiology.
- Anatomical position.
- Structure, types and function of cells.
- Structure, function and types of tissues.

Unit II: Musculoskeletal System (MSS) and Skin: 12 hours

- Introduction of musculo-skeleton system.
- Different parts of involved in skeleton system.
- Function of skeleton.
- Gross and microscopic structure of skeleton.
- Introduction, types and function of joints
- Different parts involved in muscular system.
- Function of muscular system.
- Gross and microscopic structure of muscular system
- Type (transude exudates), function and composition of body fluids and method of collection of body fluids.
- Parts and function of skin.
- List the common pathological conditions in relation to infection.
- Physiology of musculoskeletal system.
- Physiological changes in infection.
- Method of sample collection: biopsy, autopsy.

Unit III: Respiratory System (RS): 10 hours

- Different organs of the Respiratory System.
- Functions of the different organs of the Respiratory System.
- Gross and microscopic structure of different organs of the Respiratory System
- Physiology of Respiratory System
- Physiological changes in microbial infection.
- List the common pathological conditions in relation to infection.
- Methods of sample collection from different sites: sputum, bronchial lavage, and bronchial aspiration.

Unit IV: Gastro Intestinal (GI) System:**10 hours**

- Different organs associated with the Gastro Intestinal system: (Salivary glands, Pancreas, Liver and Gall bladder and others).
- Functions of the organs of the Gastro Intestinal system and associated organs.
- Gross and microscopic structure of different organs of the Gastro Intestinal system and associated organs.
- Physiology of Gastro Intestinal System
- Physiological changes on microbial infection.
- List the common pathological conditions in relation to infection.
- Methods of sample collection from different sites of the Gastro Intestinal system and associated organs.

Unit V: Circulatory System (CS):**10 hours**

- Blood: Site of formation, composition, functions of blood cells, Blood groups and fate of RBC.
- Different parts of the circulatory system and its function.
- Gross and microscopic structure of the different parts of the circulatory system.
- Physiological changes in circulatory system in relation of infection.
- List the common pathological conditions in relation to infection.
- Methods of blood sample collection from different sites and other sample collection from circulatory system

Laboratory Practices

1. Organization of human body- skeleton articulated and disarticulated.
2. Gross anatomy of the different systems of the body (anatomical position, skeletal and bones and muscle)-Dummy, Models, Chart.
3. Study of different histological slides (MS Skin, RS, GI, CS).
4. Measurement of Pulse, BP
5. Demonstration of ECG/Echo and its interpretation techniques.
6. Blood sample collection by different methods
7. Demonstration of TLC, DLC, Hb% and ESR

References:

1. Cathleen JW Wilson OBE Anne Wanh: *Anatomy and physiology in Health and illness*. Churchill Livingstone Publication, UK, NK, 1996.
2. Waugh A., Grant, *A Ross and Wilson's Anatomy and Physiology in Health and Illness*, 9th Edition, Churchill Livingston, London.2001.
3. Chaurasia, *Handbook of Human anatomy*. CBS publication
4. Anatomy and Physiology for Nurses
5. Guyton AC and Hall JE. *Guyton Human Physiology and Mechanisms of Disease*. Hartcourt Publishers, Limited, 1996.
6. Williams PL (Ed). *Gray' anatomy*, Churchill Livingstone, London.

MBI 108-3 (Credit hours 3)

Microbial Biochemistry

(B. Sc. Medical Microbiology: First Year, Second Semester)

Course Objectives:

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

- Know human and microbial biochemistry and chemical processes associated with living cells specifically medically important microorganisms.
- Understand metabolic process.

Course Contents:

Unit I: Introduction to Microbial Biochemistry

4 hour

- Introduction, definition, scopes, and application of biochemistry.
- Biological membrane:
 - Introduction and basic concepts on cytoplasmic (plasma) membrane and cell wall.
 - Structure of biological membrane (fluid mosaic model).
 - Movements of main proteins and lipids, membranes transport.

Unit II: Carbohydrates:

14 hours

- Introduction, classification, sources, structure, properties, and biomedical importance
- Metabolism: anabolism and catabolism.
 - Glycolysis - Aerobic and Anaerobic
 - Gluconeogenesis
 - Glycogenesis
 - Hexose monophosphate shunt
 - Citric Acid Cycle (TCA Cycle)
 - Glycogenolysis
 - Futile cycle
 - Cori cycle
 - Biological oxidation, electron transfer chain, and oxidative phosphorylation

Unit III: Lipids:

9 hours

- Introduction, definition, sources, classification, structure, properties, and biomedical importance of different lipids (fatty acids, cholesterol and its derivatives, triglycerides).
- Metabolism of lipid – Digestion and absorption of dietary lipids,
- Degradation of phospholipids, glycosphingolipids and cholesterol.
- Role of lipid in human health.

Unit IV: Amino acids and Proteins:

6 hours

- Introduction, definition, sources, classification, structure, properties, and biomedical importance of proteins, essential and non-essential amino acids.
- Metabolism of proteins and amino acids
 - Transamination and deamination, Urea cycle and its link with TCA cycle,
 - Metabolic defects in amino acid metabolism

Unit VI: Enzymes:

7 hours

- Introduction, definition, classification, properties and biological function of enzymes
- Definition and biological function of coenzymes
- Mechanisms of enzymatic actions
- Regulation of enzyme activity and factors affecting enzymatic reaction
- Concepts on microbial enzymes
- Role of enzymology in human health

Unit VII: Minerals and Vitamins:

4 hours

- Introduction, definition, types, roles, functions and clinical importance of minerals and vitamins.

Unit VII: Hormones:

4 hours

- Introduction, definition, types, roles, functions and clinical importance of hormones.

Laboratory Practices

Estimation/Demonstration (quantitative) of metabolic product from clinical samples:

- Sugar,
- Urea,
- Cretinine,
- Electrolytes
- Cardiac enzymes
- Lipid profile
- Enzymes
- Liver function test
- Total protein and Albumin
- Thyroid function test
- Tumor markers.

References: :

1. Chouristopher K. Mathews and K.E. Van Holde, *Biochemistry*, Second Edition, The Benjamin/Cumings Publishing Company Inc, 1996.
2. M.N. Chatterjea and Rana Shinde, *Text book of Medical Biochemistry*, Second Edition, Jaypee Brothers Medical Publishers (p) Ltd, 1995.
3. Pamela C Champe and Richard A. Harvey, *Biochemistry*, 2nd Edition, J.B. Lipincott Company, 1994.
4. Robert K. Murray, Peter A Mayes, Daryl K. Granner and Victor W. Rodwell, *Harper's Biochemistry*, Twenty-second Edition, Pretice-Hall International Inc., 1990.
5. Geoffrey Zubay, *Biochemistry*, Second Edition, Maxwell Macmillan Publishing Company Inc., 1989.
6. Lubert Stryer, *Biochemistry*, Third Edition, W.H. Freema and Company, 1988.

MBI 109-3 (Credit hours 3)

Molecular Biology I

(B. Sc. Medical Microbiology: First Year, Second Semester)

Course Objectives:

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

- Understand the basic concept of molecular biology
- Understand the molecular nature, replication, gene expression and recombinant DNA.

Course Contents:

Unit I: Introduction:

10 hours

- a. Introduction to molecular biology,
- b. Molecular biology of cell,
 - Evolution and Molecular structure of cell and its organelles,
 - Types of cells. Including different kinds of Prokaryotic and eukaryotic cells,
 - Cell growth,
 - Cell adhesion, cell junctions and extra cellular matrix organelles,
 - Cell cycle,
 - Cell membrane and its structure (fluid-mosaic model)
 - Factors influencing on membrane fluidity, asymmetry of membrane and membrane transport (active and passive)

Unit II: Molecular Nature of the Genetic Material in Prokaryotic and Eukaryotic Cells:

10 hours

- Molecular biology of Genes
- DNA: Molecular structure, types:
 - Primary, secondary and tertiary
 - The Double helix, types
- RNA: Molecular structure, types.
- Evolution of DNA and RNA
- Gene and genetic codes

Unit III: General Concept on:

10 hours

- a. Regulation of the Gene Expression
- b. Regulating the Metabolism:
 - The Lac- Operon system.
 - Catabolic repression,
 - The Trp Operon system: regulating the biosynthesis of the tryptophan
 - Gene expression in Eukaryotic cells
 - Plasmids: types, maintenance and functions

Unit IV: DNA Replication and Gene Expression:

6 hours

- DNA Replication: Semi conservative Nature of DNA Replication
- DNA Replication in prokaryotic Cells
- DNA Replication in Eukaryotic cell
- Enzymes involved in DNA Replication: DNA polymerases
- Proofreading, post-replication Modification of DNA.

Transcription:

6 hours

- Transferring information from DNA to RNA
- Synthesis of RNA
- RNA polymerase
- Initiation and Termination of Transcription
- Post transcription modification of the RNA

Protein Biosynthesis:

6 hours

- Translation of the genetic code
- Translation of m RNA
- Role of RNA in protein synthesis
- Forming the polypeptides- elongation
- Termination of the protein biosynthesis

Laboratory Practices

1. Preparation of various chemical and reagent using molecular work
2. Demonstration of Extraction of Plasmid, DNA, RNA
3. Demonstration of handling of Electrophoresis

References: :

1. J Sambrook, EF Fritsch, T Maniatis. Molecular Cloning: A laboratory manual, 2nd edition, 1989, Cold Spring Harbour Laboratory USA.
2. B D Singh, Fundamental of Genetics, Kalyani Publishers 2000, India
3. Bruce Alberts, Danis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D Watson, Molecular Biology of the Cell, Second Edition, Garland Publishing Inc, New York.
4. Watson, Baker, Bell, Gann, Levine, Losick. Molecular Biology of the Gene, Fifth Edition, Cold Spring Harbour Laboratory Press 2004
5. Benjamin Lewin. Genes VIII. Pearson, Prentice Hall 2004.

IBE 110-3 (Credit hours 3)

Instrumentation and Biomedical Engineering

(B. Sc. Medical Microbiology: First Year, Second Semester)

Course Objectives:

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

- Acquaint the principle, use and precautions for using various instruments
- Understand biochemical techniques (bio-technology), and biomedical engineering

Course Contents:

Unit I: Biomedical Engineering

6 hours

- Introduction: scope, importance,
- Principles and practices of bio- medical engineering.

Unit II: Instrumentation: Introduction, Principle, Types, Importance and Operation (care and handling) of Various Diagnostic Biomedical Instruments:

26 hours

- Colorimeter and Spectrophotometer
- Fluorimeter
- Microscopy
- Centrifuge
- Filtration
- Electrophoresis
- Auto analyzer
- Blood gas analyzer
- Micro cell counter
- pH meter
- Flow cytometer
- Chouromatography
- Other diagnostic devices.

Unit III: Introduction, Principle, Types, Importance and Operation (care and handling) of Various Biomedical materials and Prosthetic devices.

4 hours

- Orthopedic
- Cardiovascular

Unit IV: Introduction to Therapeutic and Other Medical Devices:

2 hours

Unit V: Tissue Engineering

6 hours

- Concepts of tissue engineering

Unit VI: a. Electrical and Other Hazard, Safety, Standards b. Maintenance of equipments

4 hours

Laboratory Practices.

1. Handling of diagnostic instruments:

- Colorimeter and Spectrophotometer
 - Fluorimeter
 - Microscopy
 - Centrifuge
 - Filtration
 - pH meter
 - Chromatography
 - Other diagnostic devices
 - Glassware,
 - Chemical in the laboratory.
2. Demonstration of handling of:
- Auto analyzer
 - Blood gas analyzer
 - Blood cell counter
 - Flow cytometer
 - Other diagnostic & prosthetic devices

References: : :

1. Keith Wilson John Walker ED. *Practical Biochemistry Principles and Techniques*, E Smith, Giotech Cambridge University Press London.
2. John E. Smith, *Biotechnology*, Cambridge University Press, London
3. R. K. Gupta, *Elements of Biotechnology*, Rastogi.

SYLLBUS
for
Bachelor of Science in Medical Microbiology
(B. Sc. Medical Microbiology)

SECOND YEARS
(Third and Fourth Semesters)

HAP 201-3 (Credit hours 3)

Human Anatomy and Physiology II

(B. Sc. Medical Microbiology: Second Year, Third Semester)

Course Objectives:

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

- Describe basic human anatomy and physiology.
- Understand structures of various organs and system of human body.
- Understand various functions, physiology and infections of organs and systems.

Course Contents:

Unit I: Lympho-reticular System (LRS):

8 hours

- Different organs of LRS (Lymph, Lymphatic vessels and Lymph nodes)
- Functions of the different organs of Lympho-reticular system.
- Gross and microscopic structure of Lympho-reticular system.
- Physiological changes in Lympho-reticular system in related to infection
- List the common pathological conditions in relation to infection.
- Method of sample collection related to Lympho-reticular system

Unit II: Urinary System (US):

8 hours

- Different organs of Urinary System.
- Functions of the different organs of Urinary System.
- Gross and microscopic structure of organs of Urinary System.
- Mechanism of urine formation and composition of urine.
- Major signs and symptoms of in infection of Urinary System.
- Physiological changes in infection.
- List the common pathological conditions in relation to infection
- Method of sample collection from different sites in relation to infection.
- Different method of urine sample collection.

Unit III: Endocrine System (ES):

8 hours

- Introduction to endocrine system.
- Different organs of endocrine system.
- Functions of endocrine system.
- Physiological changes in relation infection
- List the common pathological conditions in relation to infection.
- Method sample collection.

Unit IV: Reproductive System (RS):

8 hours

- Different organs of male and female reproductive system.
- Functions of the different organs of male and female reproductive system.
- Gross and microscopic structure of male and female reproductive system.
- Physiological changes in male and female reproductive system in related to infection.
- List the common pathological conditions in relation to infection.
- Method of sample collection related to male and female reproductive system infection.

Unit V: Special Sensory Organs (SSS):

8 hours

- Introduction to special sensory organs.
- Function and functions of eye, ear, nose, tongue, and skin.
- Physiological changes in infection of eye, ear, nose, tongue, and skin
- List the common pathological conditions in relation to infection.
- Method of sample collection from organ. (Pus swab)

Unit VI: Nervous System (NS):

8 hours

- Introduction to nervous system.
- Different organs and function of central nervous system (CNS) and peripheral nervous system (PNS).
- Gross and microscopic structure of central nervous system (CNS) and peripheral nervous system (PNS).
- Physiological changes in central nervous system (CNS) and peripheral nervous system (PNS) in relation to infection.
- List the common pathological conditions in relation to infection.
- Method of sample collection related to central nervous system (CNS) and peripheral nervous system (PNS). CSF

Laboratory Practices

1. Gross anatomy of the different systems of the body (anatomical position, skeletal and bones and muscle)-Dummy, Models, Chart.
2. Study of different histological slides (LRS, VS, ES, RS, SSS, and NS)
3. Blood cell count and haemoglobin estimation (TLC, DLC, ESR and Hb %)
4. Perform blood grouping.
5. Measurement of Blood pressure
6. Measurement of pulse
7. Measurement of respiration, respiratory volume and capacity

References:

1. Cathleen JW Wilson OBE Anne Wagh: *Anatomy and physiology in Health and illness*. Churchill Livingstone Publication, UK, NK, 1996.
2. Waugh A., Grant, *A Ross and Wilson's Anatomy and Physiology in Health and Illness*, 9th Edition, Churchill Livingstone, London.2001.
3. Chaurasia, *Handbook of Human anatomy*. CBS publication
4. *Anatomy and Physiology for Nurses*
5. Guyton AC and Hall JE. *Guyton Human Physiology and Mechanisms of Disease*. Hartcourt Publishers, Limited, 1996.
6. Williams PL (Ed). *Gray's anatomy*, Churchill Livingstone, London.

MBI 202-3 (Credit hours 3)

Molecular Biology-II

(B. Sc. Medical Microbiology: Second Year, Third Semester)

Course Objectives:

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

- Understand and utilize the basic molecular techniques in microbiological studies.
- Understand the recombinant DNA technology.

Course Contents:

Unit I: Mutations:

8 hours

- Definition
- Types of Mutation: Lethal Mutation, Nutritional mutation, Base substitution, Missense mutation, Silent mutation, Nonsense mutation, Frame shift situation, Suppressor Mutation;
- Mutation Rates
- Detection of Mutants: Replica plating; Complementation.
- Mutagenic agents: Radiation, Chemical mutagens; Ames tests; Photo-reactivation;
- **Recombination:** Types, Homologous and Non-Homologous, Transposable genetic elements, Insertion sequence, Transposon, Transposon mutagenesis.

Unit II: DNA Transfer in Prokaryotes:

8 hours

- Transformation
- Transduction: generalized and specialized,
- Conjugations

Unit III: Genetic Mapping

12 hours

- Extraction of DNA, RNA and plasmids,
- PCR (conventional, semi nested and real time)
- PFGE
- DNA Finger printing,
- Western, Southern and Northern Blotting
- DNA sequencing

Unit IV: Recombinant DNA Technology:

10 hours

- Cloning: definition and importance
- Gene cloning, protoplast fusion,
- DNA for Cloning
- Formation of the Recombinant DNA,
- Cloning vectors, Expression vectors,
- Detection of the recombinant DNA
- Cloning the Eukaryotic genes in bacteria
- Benefit and Risk recombinant DNA technology

Unit V: Basic Idea on Operational Principles of Molecular Techniques: 10 hours

- Extraction of DNA, RNA and plasmids,
- PCR (conventional, semi nested and real time)
- PFGE

- DNA Finger printing,
- Western, Southern and Northern Blotting
- DNA sequencing

Laboratory Practices

1. Extraction of the DNA & Plasmids from bacteria.
2. Electrophoresis
 - a. PAGE,
 - b. SDS-PAGE
 - c. Agarose gel electrophoresis
3. Demonstration of PCR

References: :

1. J. Sambrook, EF Fritsch, T Manniatis. Molecular Cloning: A laboratory manual, 2nd edition, 1989, Cold Spring Harbour Laboratory USA.
2. B D Singh, Fundamental of Genetics, Kalyani Publishers 2000, India
3. Bruce Alberts, Danis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D Watson, Molecular Biology of the Cell, Second Edition, Garland Publishing Inc, New York.
4. Watson, Baker, Bell, Gann, Levine, Losick. Molecular Biology of the Gene, Fifth Edition, Cold Spring Harbour Laboratory Press 2004
5. Benjamin Lewin. Genes VIII. Pearson, Prentice Hall 2004.

EPI 203-3 (Credit hours 3)

Epidemiology

(B. Sc. Medical Microbiology: Second Year, Third Semester)

Course Objectives:

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

- Understand principles, concepts, approaches and methods used in epidemiology of microbial diseases.
- Appropriate use of epidemiological tools in investigations.

Course Contents:

Unit I: Introduction to Principles of Epidemiology:	2 hours
<ul style="list-style-type: none">• History, Definition, and scope of epidemiology,• Achievements in epidemiology• Terms & Terminologies used in epidemiology.	
Unit II: Measuring Health and Disease	4 hours
<ul style="list-style-type: none">• Definitions of health and disease• Measures of disease frequency• Use of available information• Comparing disease occurrence	
Unit III: Concept of Epidemiological Study:	12 hours
<ul style="list-style-type: none">• Basic concepts of epidemiology• Descriptive / Analytical• Applied/Experimental• Field Epidemiology	
Unit IV: Concept of Prevention and Control of Diseases.	12 hours
<ul style="list-style-type: none">• Causation in epidemiology<ul style="list-style-type: none">○ The concept of cause○ Establishing the cause of a disease○ Epidemiological markers○ Phenotypic and genetic markers including molecular epidemiology.• Disease surveillance<ul style="list-style-type: none">○ Clinical○ Laboratory	
Unit V: Applied Epidemiology:	14 hours
<ul style="list-style-type: none">• Communicable disease epidemiology• Clinical epidemiology• Environmental & occupational epidemiology• Nutritional epidemiology• Reproductive epidemiology• Social epidemiology• Food epidemiology	
Unit VI: Epidemiology, Health services and health Policy	4 hours
<ul style="list-style-type: none">• Health care planning, Monitoring & evaluation	

- The planning cycle
- Epidemiology, public policy and health policy
- Healthy public policy in practice

Laboratory Practices

1. Field investigation of an outbreak /disease prevalence study in a community.

References :

1. Beaglehole R., Bonita R., Kjellstrom T., *Basic Epidemiology*. World Health Organization, Geneva, 1993.
2. B Gregg, *Field Epidemiology*, 2nd Edition, Oxford University Press, 2002
3. Gordis L. *Epidemiology*, 2nd Edition, WB Saunders Company Aharcourt Health Sciences Company, Philadelphia, 2000.
4. Heninkens CH, Buring JE, *Epidemiology in Medicine*, Lippincott Eilliams and Wilkins, and Walters Kluwer Company, 1987.
5. McMahon B, Trichopoulos D, *Epidemiology, Principle and Method*, 2nd Edition, Boston, Little, Brown, 1996.
6. Mahajan BK, *A Textbook of Preventive and Social Medicine*.
7. Park JE and Park K., *Text Book of Social and Preventive Medicine*, 2000.
8. Rothman KJ, Greenland S., *Modern Epidemiology*, 2nd Edition, Lippincott, Raven Publishers: 19998
9. Rothman KJ. *Epidemiology: An Introduction*, Oxford University Press, 20002.

SBA 204-3 (Credit hours 3)

Systemic Bacteriology I

(B. Sc. Medical Microbiology: Second Year, Third Semester)

Course Objectives:

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

- Understand systematic bacteriology associate to clinical microbiology.
- Understand the bacteria along with pathogenesis, prevention, and control.

Course Contents:

Unit I: Morphology, Metabolism, Pathogenesis, Laboratory Diagnosis, Prevention and Control of:

a. Cocci (Gram Positive): 8 hours

- **Aerobic:**
 - *Micrococcus* spp,
 - *Staphylococcus* spp.
 - *Streptococcus* spp.
- **Anaerobic:**
 - *Peptococcus* spp.
 - *Peptostreptococcus* spp.
 - *Villanelle* spp.
 - *Acidaminococcus* spp,
 - *Megasphaeria* spp.
 - *Coprococcus* spp.
 - *Ruminococcus* spp. and others.

b. Cocci (Gram Negative): 4 hours

- **Aerobic:** *Neisseria* spp.
- **Anaerobic** Gram negative bacteria

Unit II: Morphology, Metabolism, Pathogenesis, Laboratory Diagnosis, Prevention and Control of: 10 hours

a. Aerobic non-spore forming gram positive bacilli:

- *Bacillus* spp.,
- *Corynebacterium* spp.,
- *Actinomyces pyogens*,
- *Nocardia* spp.,
- *Mycobacterium* spp.-pathogenic,
 - Tubercle bacilli and MOTT bacilli (Atypical mycobacterium) and
 - Hansen's bacilli and others.

b. Anaerobic:

- *Bifidobacterium* spp.,
- *Eubacterium* spp.,
- *Actinomyces* spp.,
- *Propionebacterium*,
- *Arachenia* spp.,
- *Clostridium* spp and others.

Unit III: Morphology, Metabolism, Pathogenesis, Laboratory Diagnosis, Prevention and Control of Gram Negative Bacilli 26 hours

Aerobic:

- *Enterobacteriaceae*
 - *Citrobacter spp*
 - *Edwardsiella spp*
 - *Enterobacter spp*
 - *Escherichia coli*
 - *Ewingella*
 - *Hafnia spp.*,
 - *Klebsiella spp*
 - *Kluyvera*
 - *Leclercia*
 - *Leminorella*
 - *Moellerella*
 - *Morganella spp*
 - *Pantoea*
 - *Proteus spp.*
 - *Porvidencia spp.*
 - *Rahnella*
 - *Salmonella spp*
 - *Serratia spp*
 - *Shigella spp*
 - *Tatumella*
 - *Yersinia spp* and others.

Laboratory Practices

1. Preparation and use of different stains in bacteriology laboratory
 - a. Grams stain
 - b. ZN stain
 - c. Albert stain
 - d. Spore stain
 - e. Capsule stain
 - f. Flagella stain
 - g. Motility test
2. Preparation and use of different media in bacteriology laboratory
3. Isolation & identification of different groups of bacteria in laboratory
4. Antimicrobial susceptibility testing.

References: :

1. Geoffrey R. Smith and Charles S.F. Easmon Ed. *Topley and Wilson's Principles of Bacteriology Virology and Immunity*, Eighteen Edition, Volume,2-4 Edward Arnold publication UK 1990.
2. Bailey and Scotts, *Diagnostic Microbiology*, 8th Edition, Edited by Ellen J Barson and Syndey M. Finegold, The C.V. Mosby Company, 1990.

BIM 205-3 (Credit hours 3)

Bio-informatics

(B. Sc. Medical Microbiology: Second Year, Third Semester)

Course Objectives:

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

- Understand general view of computer architecture, its operation and application and basic bioinformatics.
- Understand the basic computing and electronic resources of information and the techniques for retrieval of electronic resources available in the net for research purposes).
- Understand basics concept of Proteomics, Genomics, Phylogenetic tree.

Course Contents:

Unit I: Basic Introductory Computing

10 hours

Importance and advantages of computer application in health research,

Overview of statistical software programs available for data analysis process,

- MS-DOS, MS-WINDOWS
- Working with Windows (My Computer, Recycle Bin, Desktop, Icons and Windows Explorer, Working with File and Folder
- Word processing (MS-Word) , MS-Excel, Presentation (MS-Power Point) Use of computer software and running
- Operating system in computer software
- Electronic resource searching, sending, cataloguing
- Database Management (MS-Access)
- Concept of Epi-Info (2000) and SPSS

Unit II: Introductory Bio-informatics:

4 hours

- The scope of bio-informatics
- Bio-informatics and interest
- Bioinformatics in the Pharmaceutical industry, Pharma informatics resources.
- Useful bio-informatics sites on the web.
(Gene bank, free medical journal search, Pub Med, Hinari, PERI etc.)

Unit III: Genome organization and Evolution

10 hours

- Genomics and Proteomics
- Genomes of Prokaryotes, eukaryotes and human
- SNPs
- Genetic diversity in anthouropology
- Evolution of genomes

Unit IV: Archives and information Retrieval:

8 hours

- The archives
- Gateways to archives
 - ENTREZ
 - SRS
 - PIR
 - ExPASy

- Ensembl

Unit V: Alignment & Phylogenetic Tree:

8 hours

- Introduction
- Dot plots and sequence alignments
- Measures of sequence similarity
- Computing the alignment of two sequences
- Significance of alignments
- Phylogeny
- Phylogenetic trees

Unit VI: Protein Structure & Drug Discovery:

8 hours

- Protein stability and folding
- Super position of structures
- DALI
- Protein structure prediction and modeling
- Prediction of protein function
- Drug discovery and development

Laboratory Practices

1. Handling of the computer.
2. Applying various techniques for retrieval of electronic resources available in the net for research purposes. (Gene bank, Pubmed, Hinari, PERI etc).
3. Making Presentation Slides in Computer (Power Point), Internet and web browsing, Search for electronic journals, articles, abstract and books from different search engine like www.healthnet.org.np, www.medline.com, www.bmj.com etc.

References: :

1. Arthur M Lesk, *Introduction to Bioinformatics*. Oxford Univ. Press, 2003.
2. Cyanthia Gibas & Per Jambeck, *Developing Bioinformatics Computer Skills*. O'REILLY SPD, Calcutta, 2001.
3. James Tisdall, *Beginning Perl for Bioinformatics*. O'REILLY SPD, Calcutta, 2001.

SBA 206-3 (Credit hours 3)

Systemic Bacteriology II

(B. Sc. Medical Microbiology: Second Year, Fourth Semester)

Course Objectives:

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

- Understand systematic bacteriology associate to clinical microbiology.
- Understand the bacteria along with pathogenesis, prevention, and control.
- Understand epidemiological markers.

Course Contents:

Unit I: Morphology, Metabolism, Pathogenesis, Laboratory Diagnosis and Prevention and Control of Gram Negative Bacilli **33 hours**

1. Non Fermentative and Cocobacilli:

- *Pseudomonas spp.*,
- *Alcaligenes spp.*,
- *Acinetobacter spp.*,
- *Moraxella spp.*,
- *Eikenella spp.*,
- *Kingnella spp.*,
- *Flavobacterium spp.*,
- *Agrobacterium spp* and others.

2. Facultative Anaerobic Bacilli and aerobic cocco-bacilli:

- *Francisella spp.*,
- *Brucella spp.*,
- *Bordetella spp.*,
- *Haemophilus spp.*,
- *Ctinobacter spp.*,
- *Pasteurella spp* and others.

3. Vibriniaceae Family:

- *Vibrio spp.*,
- *Aeromonas spp.*,
- *Plesiomonas spp.*,
- *Campylobacter spp* and others.

4. Anaerobic bacilli:

- *Bactertiodes spp.*,
- *Fusobacterium spp.*,
- *Heptotrichia spp.*,
- Anaerobic vibrious and curve bacillus and others,

5. Aerobic Facultative Spore Forming Bacilli:

- *Bacillus sps.* and others

Unit II: Morphology, Metabolism, Pathogenesis, Laboratory Diagnosis and Prevention and Control of Spirochetes: **8 hours**

- *Treponema*,
 - *Borrelia*,
 - *Leptospira*,

- *Brachyspira* and others,

Unit III: Morphology, Metabolism, Pathogenesis, Laboratory Diagnosis and Prevention and Control of: **7 hours**

- *Gardnerella spp.*,
- *Listeria spp.*,
- *Legionella spp.*,
- *Clostridia of wound infection*,
- *Chlamydia spp.*,
- *Mycoplasma and Ureaplasma spp.*,
- *Rickettsia spp* and others.

Laboratory Practices

1. Organization of laboratory (Bacteriology, Virology, Parasitology and Mycology)
2. Quality control scheme on laboratory investigations:
3. Preparation of a module of
 - i. Standard operative procedure (SOP)
 - ii. Study specific protocol (SSP)
 - iii. Good laboratory practices (GLP).

References: :

1. Geoffrey R. Smith and Charles S.F. Easmon Ed. *Topley and Wilson's Principles of Bacteriology Virology and Immunity, Eighteen Edition, Volume,2-4* Edward Arnold publication UK 1990.
2. Bailey and Scotts, *Diagnostic Microbiology, 8th Edition*, Edited by Ellen Jo Barson and Syndey M. Finegold, The C.V. Mosby Company, 1990.

SVI 207-3 (Credit hours 3)

Systemic Virology

(B. Sc. Medical Microbiology: Second Year, Fourth Semester)

Course Objectives:

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

- Understand systemic virology associate to clinical microbiology.
- Understand the viruses along with pathogenesis, prevention, and control.

Course Contents:

Unit I: Introduction and Scope of Virology.	1 hour
Unit II: General Properties of Viruses and Structure (Morphology).	2 hours
Unit III: Classification of Medically Important Viruses.	2 hours
<ul style="list-style-type: none">• Genetic material• Organ system involved• Transmission	
Unit IV: Replication of Viruses	2 hours
Unit V: Virus Host Interaction, Bacteriophage.	1 hour
Unit VI: Epidemiology, Pathogenesis, Treatment, Prevention and Control of Viral Diseases (DNA Viruses):	12 hours
<ul style="list-style-type: none">• <i>Adenoviridae</i>,• <i>Poxviridae</i>,• <i>Herpes viridae</i>,• <i>Papoviridae</i>• <i>Parvoviridae</i>• <i>Hepadnaviridae</i>	
Unit VII: Epidemiology, Pathogenesis, Treatment, Prevention & Control of Viral Diseases (RNA Viruses):	28 hours
<ul style="list-style-type: none">• <i>Orthomyxoviridae</i>,• <i>Paramyxoviridae</i>,• <i>Picornaviridae</i>,• <i>Coronaviridae</i>• <i>Togaviridae</i>,• <i>Rhabdoviridae</i>,• <i>Retroviridae</i>• <i>Coronaviridae</i>• <i>Bunyaviridae</i>• <i>Arenaviridae</i>• <i>Filoviridae</i>• <i>Reoviridae</i> and <i>Calciviridae</i>	

Laboratory Practices

1. Organization of laboratory - Virology

2. Demonstration of virus isolation techniques.
3. Demonstration of cell and tissue culture techniques used for virus isolation.
4. Serological techniques used in diagnostic virology.

References:

1. Geoffrey R. Smith and Charles S.F. Easmon Ed. *Topley and Wilson's Principles of Bacteriology Virology and Immunity, Eighteen Edition, Volume, 2-4* Edward Arnold publication UK 1990.
2. Bailey and Scotts, *Diagnostic Microbiology, 8th Edition*, Edited by Ellen Jo Barson and Sydney M. Finegold, The C.V. Mosby Company, 1990.

SPA 208-3 (Credit hours 3)

Systemic Parasitology

(B. Sc. Medical Microbiology: Second Year, Fourth Semester)

Course Objectives:

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

- Understand systemic parasitology associated to clinical microbiology
- Understand medically important parasites along with pathogenesis, prevention, and control. .

Course Contents:

Unit I: Introductory Parasitology:

4 hours

1. Definition, scope and classification of parasites
2. Medically important parasites
 - Protozoa- Blood, Tissue and Intestine
 - Platyhelminthes
 - Nematelminthes

Unit II: History, habitat, epidemiology, pathogenesis, laboratory diagnosis, treatment, prevention and control of intestinal parasites:

A. Protozoa:

12 hours

- *Entamoeba histolytica*, *E. coli* and other groups of amoeba
- *Giardia lamblia*,
- *Trichomonas spp*
- *Cyrtosporidium*
- *Cyclospora*
- *Isospora*

B. Helminthes:

16 hours

- *Ascaris lubricoides*.
- Hook worm: *Anacyclostoma and Necator*
- *Enterobius vermicularis*
- *Trichuris trichuira*
- *Strongyloides spp*

C. Trematodes/cystodes:

- Tapeworms (*Taenia*, *Hymenolepis*)
- *Paragonimus*
- *Liver fluke*
- *Office turkis*
- *Cystosomes*

Unit III: Blood and Tissue Parasites:

16 hours

History, habitat, epidemiology, pathogenesis, laboratory diagnosis, treatment, prevention and control of

- *Plasmodium sps*
- *Leishmania*
- *Wuchereria*, *Brugia*, *Loa loa*,
- *Oncocerca*,

- *Dracuculus*
- *Echinococcus spp.*

Laboratory Practices

1. Organization of laboratory - Parasitology
2. Preparation and use of different stains - parasites
3. Preparation and use of different media - parasite culture
4. Identification of different parasites in the laboratory.

References:

1. K. D. Chatterjee, *Parasitology: Protozoology and Helminthology*, 20th Edition, Chatterjee Medical Publishers, Calcutta 1998.
2. Markell, Joh Krotoski, *Medical Parasitology*, 8th Edition, W. B. Saunders Co. Philadelphia, London, New Work.
3. Dickson D, Despommier, Robert W. Gwatz, Peter J. Hotez, *Parasitic Diseases*, Springer, Verlag, New York, London, Paris, Tokyo,
4. Lawrence R. Ash. Thomas C. Oriel, *Atlas of Human Parasitology*, 3rd Edition, ASCP Press. Chicago.

SMY 209-3 (Credit hours 3)

Systemic Mycology

(B. Sc. Medical Microbiology: Second Year, Fourth Semester)

Course Objectives:

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

- Understand systemic mycology associated to clinical microbiology.
- Understand structure, morphology, physiology, pathogenesis, prevention and control of medically important fungi, yeast and molds.

Course Contents

Unit I: Mycology:

6 hours

- **Introduction:** Scope and medical importance of fungi- Molds, Mushroom, Yeast.
- **Definition:** Mycology, Medical Mycology, Mycetes, Mycosis, Thallus, Hypha, Mycelium, Coenocyte, Rhizoids and Club.

Unit II: Classification, Structure and Physiology of fungi:

20 hours

- Cryptogam (Thallophyta: Fungi Algae), Phanerogam
- Pseudomycetes
- Schizomycetes (Bacteria Actinomycetes, Actinomycetaliae, Nocardia, Yeasts)
- Myxomycetes (Slime, Molds)
- Eumycetes (True fungi)
- Ascomycetes (Histoplasma, Candida, Blastomycosis)
- Basidiomycetes (Cryptococcus, Rhizopus)
- Phycomycetes Mucor, Epidermophyton
- Fungi imperfecti: (Trichophyton).

Unit III: Vegetative Structure (Morphology) of Fungi

4 hours

- Septate, aseptate, Plectenchyma, Prosenchyma, Pseudoparenchyma,
- Modification of Plectenchyma (Rhizomorph, Sclerotia, Stroma).

Unit IV: Mode of Nutrition of Fungi

3 hours

- Saprophytes:
- Parasites (Obligate parasite, Facultative parasite, Ecto-parasite, Endo-parasite)
- Symbionts: Lichen

Unit V: Pathogenic Group of Fungi

7 hours

- Opportunistic pathogens
- True pathogens
 - *Blastomyces dermatitidis*
 - *Cooccidioides immitis*
 - *Paracoccidioides brasiliensis*
 - *Histoplasma capsulatum*.
- **A. Dermatophytes** 4 hours
 - *Mycrosporum* (Hair, skin)
 - *Tricophyton* (Skin, hair, nail)

- *Epidermophyton* (Skin, nail)
- *Aspergillus spp.*
- **B. Dermatomycosis** (*Candida albicans*, *Cryptococcus neoformans*). **2 hours**

Unit VI: Predisposing Factor for Fungal Infection.

2 hours

Laboratory Practices

1. Organization of laboratory – Mycology
2. Preparation of different media, chemical and stain for fungus study.
3. Isolation and identification of different fungi of medical important.

References:

1. Chester. W. Emmons, *Medical Mycology 3rd edition*, Chapman-H. Binford, John P. Utz, K and K.J. Kwon-Chun.
2. Evan E. and Gentles J.C.; *Essentials of Medical Mycology*, Churchill Livingstone, New York 1995.

PHM 210-3 (Credit hours 3)

Public Health Microbiology I (B. Sc. Medical Microbiology: Second Year, Fourth Semester)

Course Objectives:

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

- Acquaint the student with basic concept of public health.
- Understand air and water born infectious diseases.

Course Contents:

Unit I: Introduction to Public Health:

8 hours

- Definition, scope, concept and importance of public health microbiology
- Roles of microbiologist in public health
- Concept of health and disease
- Indicators of health
- Microbial association of water, air and soil
- Basic concept on pollution (air, water, noise, radiation and waste pollution) and public health hazard in the community.

Unit II: Air Borne Infections:

20 hours

1. Introduction:

- Air and its composition,
- Microbial air pollution,
- Sources of air pollution & control
- Indicator of air pollution – WHO guide line (microbial pollution).

2. Air borne diseases:

- Transmission of pathogens,
- Respiratory infection (Viral, bacterial, fungal),
- Sources of infection, characters of organisms and controls of:
Bacterial pneumonia,
Diphtheria,
Tuberculosis,
Influenza,
Measles.

3. Method of measuring microorganisms in air

Unit III: Water Borne Infections:

20 hours

1. Introduction

- Definition of wholesome and safe water,
- Nature, cycle, sources, importance and quality (WHO guide line) of water.
- Water pollution and sanitation,

2. Microorganisms in water:

- Transmission of pathogens
- Water borne diseases (Viral, bacterial, protozoal),
- Sources of infection, characters of organisms and control of:

- Hepatitis
- Cholera,
- Typhoid,
- Amoebiasis
- Giardiasis,
- Poliomyelitis,

3. **Water Pollution Control.**
4. **Method of Measuring Microorganisms in Water.**
5. **Water Treatment, Control of Water Borne Diseases.**

Laboratory Practices

1. Selection, collection, preservation and transportation of samples from the community to the laboratory.
2. Isolation and Identification of microorganisms from air.
3. Isolation and Identification of microorganisms from water and evaluation of water quality.

References:

1. Ghimire P. & Parajuli K. *A Text Book of Microbiology*, 2005, Vidhyarthi Pustak Bhandar Publication, Kathmandu.
2. Brownson, RC., Baker, EA., Leet. TL., Follespie. KN., *Evidence Based Public Health*. Oxford University Press, 2003
3. Dixit H. *The Quest for Health, Educational Enterprises*, Kathmandu, 1999.
4. Friis, RH., and Sellers, TA, (1999) *Epidemiology for Public Health Practice*, 2nd Edition, Gaithersburg, MD: Aspen Publication, 1999.
5. Park JE and Park K., *Text Book of Social and Preventive Medicine*, 2000. Jay, J, H, *Modern Food Microbiology*, 3rd Edition CBS Publication and Distributors Delhi 1987.
6. Martin Alecender, *Introduction to Soil Microbiology*, Academic press, 1961.

SYLLBUS
for
Bachelor of Science in Medical Microbiology
(B. Sc. Medical Microbiology)

THIRD YEARS
(Fifth and Sixth Semester)

PHM 301-3 (Credit hours 3)

Public Health Microbiology II

(B. Sc. Medical Microbiology: Third Year, Fifth Semester)

Course Objectives:

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

- Acquaint on national health planning on public health.
- Understand food and insect born infectious diseases and roles of microbiologist on public health microbiology.

Course Contents:

Unit I Public Health Planning:

4 hours

- Public health and health planning,
- National health programs

Unit II: Food Borne Diseases:

16 hours

1. Introduction:

- Definition and importance of food hygiene,
- Types (meat and its product, milk and dairy product, eggs) adulteration, fortification, food additives and preservation of food.
- Microbial food contamination-primary sources of microorganisms in food contamination,
- Food poisoning (Microbial)
- Role of microorganisms in food spoilage and poisoning.

2. Food borne diseases:

- Transmission of pathogens from food, (virus, bacteria,, molds, yeasts
- Types of food borne diseases,
- Causal organism's characters, mode of infection and control:
 - Food poisoning and food intoxication.
 - Food born infection

4. Techniques used in the diagnosis of food borne infections.

Unit III: Insect Transmitted Diseases:

10 hours

1. Introduction:

- Vector and its types
- Mechanisms of transmission of the diseases

2. Vector transmitted diseases

- Transmission, character, and control of:
 - Kala-azar
 - Malaria
 - Arboviral diseases (JE, Dengue, etc.)
 - Plague

3. Techniques used in the diagnosis of vector borne infections

Unit IV: Sexual Transmitted Infections:

10 hours

1. Various sexual transmitted infections.
2. Characters of causal organisms and control of:
 - Syphilis

- HIV/AIDS
 - Herpes.
 - Hepatitis B and C
 - Gonorrhoea
3. Control of other sexual transmitted infections,
 4. Technique used for the diagnosis of sexually transmitted infection.

Unit: V: Hospital-Acquired Infection

8 hours

1. Prophylactic immunization,
2. Disposal of infective hospital and laboratory materials,
3. Monitoring of sanitation in community
4. Technique used for the diagnosis of hospital acquired infection.

Laboratory Practices

1. Isolation and identification of microorganism from different food products: meat, canned juice, milk, cheese and ice cream.
2. Isolation and identification of microorganism transmitted through vector, insect.
3. Isolation and identification of microorganism (STIs)
4. Isolation and Identification of microorganisms (hospital acquired infection).

References:

1. Ghimire P. & Parajuli K. *A Text Book of Microbiology*, 2005, Vidhyarthi Pustak Bhandar Publication, Kathmandu.
2. Ghimire P, Basic Malaria Microscopy, EDCD/GFATM 2004
3. Brownson, RC., Baker, EA., Leet. TL., Follespie. KN., *Evidence Based Public Health*. Oxford University Press, 2003
4. Dixit H. *The Quest for Health, Educational Enterprises*, Kathmandu, 1999.
5. Friis, RH., and Sellers, TA, (1999) *Epidemiology for Public Health Practice*, 2nd Edition, Gaithersburg, MD: Aspen Publication, 1999.
6. Park JE and Park K., *Text Book of Social and Preventive Medicine*, 2000. Jay, J, H, *Modern Food Microbiology*, 3rd Edition CBS Publication and Distributors Delhi 1987.

PMB 302-3 (Credit hours 3)

Pharmaceutical Microbiology

(B. Sc. Medical Microbiology: Third Year, Fifth Semester)

Course Objectives:

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

- Understand basic principles of Pharmaceutical microbiology.
- Use different techniques in the production of Pharmaceutical products, quality assurance of different pharmaceutical preparations.

Course Contents:

Unit I: Introduction to Pharmaceutical Microbiology:	5 hours
<ul style="list-style-type: none">• Scope• Importance• Chemical disinfectants• Antiseptic• Antibiotics• Preservatives• Static and cidal activity (fungus, bacteria)• Germicidal activities	
Unit II: Types of Antibiotics and Synthetic Antimicrobial Agents	3 hours
<ul style="list-style-type: none">• Antibiotics• Types and Classification of antibiotics• Synthetic antibiotics• Antiviral drug	
Unit III: Manufacture of Antibiotics	3 hours
<ul style="list-style-type: none">• Production of penicillin• Production of streptomycin	
Unit IV: Assessment of New Antibiotics	4 hours
<ul style="list-style-type: none">• Parameters, determination of the usefulness of antibiotics (in vitro and in vivo)• Pharmacokinetics and Pharmacodynamics of Antimicrobial agents	
Unit V: Antibiotic Assay	4 hours
<ul style="list-style-type: none">• Microbiological method<ul style="list-style-type: none">○ Disc diffusion technique○ Dilution technique• Rapid method	
Unit VI: Mechanisms of Action of Antibiotics	4 hours
<ul style="list-style-type: none">• Cell wall synthesis inhibitors• Inhibitors of protein biosynthesis• Inhibitors of tetrahydrofolate• Disorganize the cytoplasm membrane.	
Unit VII: Mode of Action of Antibiotics and Bacterial Resistance to Antibiotics	8 hours

- Mode of action of antibiotics (cell wall cytoplasmic membrane, cytoplasm and compounds)
- Biochemical mechanisms of resistance
- Genetic basis of antibiotic resistance
- Problems in antibiotic therapy due to resistance

Unit VIII: Evaluation of Antibiotics and Non-antibiotics Agents **4 hours**

- Preliminary evaluation
- Evaluation of Static activity (fungus, bacteria)
- Evaluation of Germicidal activities (fungus, bacteria)

Unit IX: Microbial Spoilage and Preservation of Pharmaceutical Products. **3 hours**

Unit X: Sterilization: **4 hours**

- Principles of sterilization
- Sterile pharmaceutical products
- Sterilization control and sterility testing

Unit XI: Pharmaceutical Products of Microbial Origin. **4 hours**

Unit XII: Basic concept on: **2 hours**

- GMP
- GCP
- ISO

Laboratory Practices

1. Organize the laboratory.
2. Pre-reparation of chemical and reagent for antibiotic assay.
3. Antibiotic production in lab scale.
4. Antibiotic evaluation.

References:

1. W B Hugo and A D Russel, Pharmaceutical Microbiology, 2nd Edition
2. Ghimire P. Hand book of Practical Microbiology, 2003, Pravesh Publication, Kathmandu

IMB 303-3 (Credit hours 3)

Industrial Microbiology

(B. Sc. Medical Microbiology: Second Year, Fourth Semester)

Course Objectives:

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

- Understand various industrial microbiology associate to clinical microbiology.
- Understand fermentation equipments, techniques and product (processes).

Course Contents:

Unit I: Introduction to Industrial Microbiology:	2 hours
<ul style="list-style-type: none">• Introduction,• History,• Definition and scope.	
Unit II: Industrial Equipment and Uses.	4 hour
Unit III: Fermentation Process:	8 hours
<ul style="list-style-type: none">• Primary and secondary screening• Detection and assay of fermentation products<ul style="list-style-type: none">○ Physical and chemical assays○ Biological assay• Stock culture• Fermentation media• Inoculums preparation• Increasing products• Phage	
Unit IV: Typical Fermentation Process:	9 hours
<p>Antibiotic drug fermentation</p> <ul style="list-style-type: none">• Penicillin• Streptomycin• Bacterial insecticide• Other antibiotics<ul style="list-style-type: none">○ Acetone○ Lactic acid○ Brewing	
Unit V: Biological Waste Treatment / Bioremediation:	2 hours
<ul style="list-style-type: none">• Anaerobic fermentation	
Unit VII: Production of:	18 hours
<ul style="list-style-type: none">• Vitamin• Vaccines• Milk & Milk Products• Food<ul style="list-style-type: none">○ Bakers yeast○ Food and feed yeasts○ Mushrooms	

- Vinegar
- **Enzymes**
 - Amylase
 - Proteolytic enzyme
 - Pectinases
 - Invertase
 - Other enzymes

Unit VIII: Industrial effluent:

5 hours

- Introduction
- Industrial pollution,
- Microbiology of Domestic sewage
- Methods for the treatment of industrial effluent and sewage.

Laboratory Practices

1. Observational visit to a beer/alcohol factory.
2. Observational visit to pharmaceutical, food and dairy industry.
3. Detection of Fermentation
4. Biological waste treatment.

References:

1. L. E. Casida, JR., *Industrial Microbiology*, 1991, Wiley Eastern Limited, New Delhi,

MBI 304-3 (Credit hours 3)

Microbial Biotechnology

(B. Sc. Medical Microbiology: Third Year, Fifth Semester)

Course Objectives:

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

- Understand the microbial biotechnology associate to clinical microbiology and medically important microorganisms.

Course Contents:

Unit I: Introduction to Biotechnology:

4 hours

- History, definition, scope and importance of biotechnology,
- Biotechnology component: central core, interdisciplinary nature,
- Biotechnology and the developing world.

Unit II: Cell and Tissue Culture:

12 hours

- Introduction,
- Preparation of various reagents, Media and Buffers,
- Cell and tissue culture techniques,
- Methods of separation and extraction of cell materials (antigens/ antibodies).

Unit III: Gene Transfer:

20 hours

- Introduction, Principle, and Application,
- Basic concept on restriction fragment length polymorphism (RFLP),
- Random amplification of polymorphic DNA (RAPD)
- General concept of gene transfer and gene expressions (based on microorganisms),
- DNA isolation and purification,
- DNA banking,
- Basic concept on Cloning.

Unit IV: Polymerase Chain reaction:

4 hours

- Basic concept to PCR
- Conventional PCR
- Real time PCR
- Nested and Semi-nested PCR

Unit V: Introduction to Genetic Engineering.

4 hours

Unit VI: Antibody Engineering:

4 hours

- Tagging
 - Conjugation
 - Purification

Laboratory Practices

1. Demonstration of Tissue Culture:

- Preparation of various reagents, Media and Buffers.
 - Cell and tissue culture techniques
- 2 Methods of separation and extraction of cell materials (antigens/ antibodies etc).
- 3 Gene Transfer and cloning: (Introduction, Principle, Application)
- General concept of gene transfer and gene expressions based on microorganisms
 - Technique of Cloning
4. Antibody engineering, Conjugation, etc

References:

IMM 305 (Credit hours 3)

Immunology

(B. Sc. Medical Microbiology: Third Year, Fifth Semester)

Course Objectives:

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

- Understand basic components and principles of immunity.
- Understand immunogens, immunoglobulins and compliment fixation system.

Course Contents:

Unit I: Introduction to Immunology	2 hours
<ul style="list-style-type: none">• Development and Functions of Immune System:<ul style="list-style-type: none">○ Anatomy of immune system	
Unit II: Antigens and Immunogenicity	4 hours
Unit III: Cells Involved in Immune System:	8 hours
<ul style="list-style-type: none">• Phagocytes• Natural killer cells• Mast cells and basophiles• Dendritic cells• Lymphocytes• Lymphoid tissue• Origin & maturation of immune cells, T-cells, B-cells,• Cytokines• Concepts on:<ul style="list-style-type: none">○ Innate Immunity○ Acquired Immunity○ T-Cell Mediated Immune Response○ B-Cell Mediated (Humoral) Immune Response• External defense mechanisms• Internal defense system.	
Unit IV: Antibodies (Immunoglobulins):	6 hours
<ul style="list-style-type: none">• Structure• Classes• Types: Allotype, Isotype, Idiotype• Development: Polyclonal and Monoclonal	
Unit V: Complement System:	4 hours
<ul style="list-style-type: none">• Classical• Alternative pathways	
Unit VI: Cytokine and chemokines	4 hours
<ul style="list-style-type: none">• Types and Working Mechanism.	
Unit VII: Introduction to Clinical Immunology:	6 hours

- Antigen-antibody reactions,
- Primary & Secondary Immune Response

Unit VIII: Hypersensitivity Reactions: Type I to Type V **4 hours**

Unit: IX: Immune Tolerance & Auto immunity **4 hours**

Unit: X: Immuno-Deficiency Diseases **3 hours**

- AIDS, Cancer

Unit XI: Basic Concepts on Vaccines and Immunization **3 hours**

- Types of vaccines
- Production
- Testing
- Immunization Schedules of common vaccines

Laboratory Practices

1. Antibody development in animal
2. Purification of antibody from immune Serum.
3. Antigen antibody reactions
4. Immunization practice in human and animals

References:

1. Ghimire P, Khatri Y, Parajuli K, Rajbhandari R, Test book of practical Immunology, Kathmandu
2. Ivan M. Roitt Ed. *Essential Immunology*, 8th Edition, Backwell Scientific Publication, UK 1991.
3. Dc Ddecker, *Toplely and Wilson's Principles of Bacteriology, Virology and Immunity Vol. 3*, Dc Ddecker Inc, USA.
4. Nandini Shetty. *Immunology: An Introductory Textbook*, New Age International P. Ltd. Publisher, 1999.
5. Deepak K Saini & Deepti Saini. *Basic Concepts of Immunology, an Illustrative Short Course*, Peepee Publishers & Distributors P. Ltd. 2004.
6. H. Hugh Fudenbertg, Damiel P. Stites, Joseph L. Coldwell and J. Vivian Ed. *Basic and Clinical Immunology* 2nd Edition, Wells, Published from Lange Medical Publication, USA 1978.

DBA 306-3 (Credit hours 3)

Diagnostic Bacteriology I

(B. Sc. Medical Microbiology: Third Year, Sixth Semester)

Course Objectives:

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

- Prepare reagents required for routine and special investigations
- Perform routine and special laboratory investigations (both cultural and non-cultural techniques); interpret the results and explain the underlying principles in each investigation.

Course Contents:

Unit I: Aerobic Culture:

3 hours

- Scope and importance of aerobic culture,
- Factors affecting aerobic culture,
- Various media and techniques of aerobic culture.

Unit IV: Laboratory Diagnosis of Enteric Infections:

10 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Enteric fever / Typhoid fever, Bacterial endocarditis,
- Bacteraemia, Septicemia, Pyrexia of unknown origin (PUO).

Unit IV: Laboratory Diagnosis of Respiratory Tract Infection (RTI):

8 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Lower RTI,
- Upper RTI.

Unit IV: Laboratory Diagnosis of Urinary Tract Infection:

6 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

Unit V: Laboratory Diagnosis of Oral, Thouroat and Stomach Infection:

9 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Gingivitis and anaerobic infection of oral cavity
- Peptic ulcer (with emphasis in mechanism of peptic ulcer caused by *Helicobacter pylori*).

Unit IV: Laboratory Diagnosis of Eye Infection:

6 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Corneal ulcer,
- Conjunctivitis

Unit IV: Laboratory Diagnosis of Ear/Dental Infection:

6 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Mandibular abscess,
- Otitis media,
- External ear

Laboratory Practices

1. Practical sessions (Laboratory Practices) will be based in the Hospital Laboratory performing diagnostic tests available / requested, in Diagnostic Bacteriology laboratory.

References:

1. Cheesbrough M., *Medical Laboratory Manual for Tropical Countries, Vol. I & II*, Edition, ELBS.
2. Stoker, Edward Arnold, *Clinical Microbiology*, 1994
3. Lynnette, E. H., *Manual Clinical Microbiology*, 8th Edition, American Society for Microbiology, Washington DC.
4. Basic Bacteriology Laboratory manual, WHO, 2000.

DIM 307-3 (Credit hours 3)

Diagnostic Immunology

(B. Sc. Medical Microbiology: Third Year, Sixth Semester)

Course Objectives:

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

- Understand immuno-diagnostic techniques in diagnosis of infectious, non-infectious and autoimmune diseases.
- Interpret immuno-diagnostic test results in light of their sensitivity and specificity and use in country context and recent developments in immunology.

Course Contents:

Unit I: Anatomy and Hypersensitivity:

- Recall of Anatomy, development and functions of immune system **3 hours**
- Hypersensitivity Reactions: Type I to Type V **4 hours**
 - Tuberculin test
 - Other skin tests

Unit II: Immune Tolerance and Autoimmunity:

- Rumatoid arthouritis and its diagnosis **4 hours**
- Collagen diseases
- Other auto-immune disease and their diagnosis

Unit III Antigen - antibody Reactions:

- Antigen & antibody preparation **17 hours**
- Antigen antibody reactions
 - Agglutination
 - Precipitation
 - Flocculation
 - ELISA
 - IHA
 - RIA
 - Western blot

Unit IV: Immuno Deficiency Diseases & diagnosis

- HIV/AIDS – ELISA, ICT, Western Blot, CD4 cell count **8 hours**
- Cancers -
- Transplantation

Unit V: Laboratory Animals in immuno-diagnostics:

- Use of animals for diagnosis of human infections **12 hours**
- Animal inoculation for diagnosis of various microbial infections and
- Production of antibodies
- Animal houses and its equipments,
- Feeding and breeding methods,
- Stock recording to handling of animals'

Laboratory Practices

1. Practical sessions (Laboratory Practices) will be based in the Hospital Laboratory performing diagnostic tests available / requested, in Diagnostic Immunology laboratory.

References:

2. Ghimire P, Khatri Y, Parajuli K, Rajbhandari R. Text book of Practical Immunology.2003
3. Ivan M. Roitt Ed. *Essential Immunology* 8th Edition, Backwell Scientific Publication, UK 1991
4. Nanditi Shetty. *Immunology: An Introductory Textbook*, New Age International P. Ltd. Publishers, 1999.
5. Deepak K Saini & Deepti Saini. *Basic Concepts of Immunology: An Illustrative Short Course*, Peepee Publishers & Distributors P Ltd. 2004.
6. H Hugh Fudenberg, Daniel P. Stites, Joseph L. Coldwell and J. Vivian Ed. *Basic and Clinical Immunology* 2nd Edition, Wells, Published from Lange Medical publication, USA 1978.

DVI 308-3 (Credit hours 3)

Diagnostic Virology

(B. Sc. Medical Microbiology: Third Year, Sixth Semester)

Course Objectives:

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

- Understand diagnostic virology and able to diagnose the infections caused by viruses.

Course Contents:

Unit I: Laboratory Organization.

3 hours

- Room (space), Electricity, Water supply,
- Sterility

Unit II: Sampling in Diagnostic Virology:

4 hours

- Selection, collection, storage, transportation and processing of samples

Unit III: Electron Microscope:

2 hours

- Principle, importance and use

Unit IV: Laboratory Diagnosis of Viral Infections (Theory+Practical):

24 hours

- Virus isolation.
 - Inoculation in laboratory animal.
 - Egg inoculation.
 - Tissue culture.
 - Recognition of viral growth.
 - Cytopathic effect.
 - Haemadsorption (Hd)
 - Immunofluorescence or immunoperoxidase staining.
 - Interference.
 - Identification of virus
 - Neutralization (N).
 - Haemagglutination – inhibition (HI).
 - Immunofluorescence or immunoperoxidase staining.
 - Electronic microscope (EM).
 - Direct demonstration of virus or virus antigens
 - Serology - Immunofluorescence
 - Electronic Microscopy
 - Histological demonstration of inclusion bodies,
 - Serological tests:
 - Detection of viral antigen
 - Detection of anti viral antibodies. (Rising titer in paired sera: 4–fold or more,
 - Detection of IgM

Complement fixation (CF), Haemagglutination inhibition (HAI), Neutralization (N), Immuno-fluorescence (IFA), Enzyme immunoassay

(EIA) or ELISA, Radioimmunoassay (RIA), Single radial immunodiffusion (SRI).

Unit V: Laboratory Diagnosis of (Theory + Practical):

12 hours

a. DNA Viruses

- *Adenoviridae*,
- *Poxviridae*,
- *Herpesviridae*,
- *Papoviridae*
- *Parvoviridae*
- *Hepadnaviridae*

b. RNA Viruses:

- *Orthomyxoviridae*,
- *Paramyxoviridae*,
- *Picornaviridae*,
- *Coronaviridae*
- *Togaviridae*,
- *Rhabdoviridae*,
- *Retroviridae*
- *Coronaviridae*
- *Bunyaviridae*
- *Arenaviridae*
- *Filoviridae*
- *Reoviridae*
- *Calciviridae*

Unit VI: Antiviral Drugs

4 hours

Laboratory Practices

1. Practical sessions (Laboratory Practices) will be based in the Hospital Laboratory performing diagnostic tests available / requested, in Diagnostic Virology laboratory.

References:

1. Ghimire P. & Parajuli K. *A Text Book of Microbiology*, 2005, Vidhyarthi Pustak Bhandar Publication, Kathmandu.
2. Satish Gupte. *The Short textbook of Medical Microbiology*, 5th edition, 1993, Jaypee, India
3. RL Ichchupujani, Rajesh Bhatia, *Microbiology for Nurses*, 2nd edition, 2005, Jaypee India
4. Timbury, *Notes on Medical Virology*, Chourchill Living stone, 1994.
5. *Manual for Rapid Laboratory Diagnosis in Virology*, WHO Publication.
6. Furest R., Saunders W.B., *Microbiology in Health and Disease*, 1995.

DPA 309-3 (Credit hours 3)

Diagnostic Parasitology

(B. Sc. Medical Microbiology: Third Year, Sixth Semester)

Course Objectives:

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

- Understand the intestinal, blood and tissue parasites and diagnose medically important parasites.
- Diagnose the infections caused by parasites.

Course Contents:

Unit I: Laboratory Organization (Parasitology Lab): 2 hours

Unit II: Selection, Collection, Preservation and Transportation of Samples: 3 hours

Unit III: Laboratory Diagnosis, of the Intestinal and Vaginal Parasites: 28 hours
(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

Protozoa:

- *Entamoeba histolytica*,
- *Giardia lamblia*,
- *Trichomonas spp*
- *Cryptosporidium*
- *Cyclospora cayantensis*
- *Isospora*

Helminthes

- *Ascaris lumbricoides*
- Hook worm: *Anacyclostoma and Necator*,
- *Enterobius vermicularis*,
- *Trichuris trichuira*,
- *Strongyloides spp.*
- *Taenia spp.*
- *Echinococcus spp.*
- *Hymonolepis nana*

Tissue and Blood Parasites:

- Malaria sps
- Kalaazar
- *Wuchereria spp. Brugia, Loa loa*,
- *Oncocerca*,
- *Dracuhculus*
- *Paragonimus westermani/hertmani*

Unit IV: Quality Control in Diagnostic Parasitology

4 hours

Unit V: Laboratory Diagnosis of Various Parasites:	6 hours
<ul style="list-style-type: none"> • Direct method, • Indirect method, • Rapid methods. • Molecular Technique 	
Unit VI: Parasite Culture.	3 hours
Unit VII: Different Stains used in Diagnostic Parasitology.	2 hours

Laboratory Practices

1. Practical sessions (Laboratory Practices) will be based in the Hospital Laboratory performing diagnostic tests available / requested, in Diagnostic Parasitology laboratory

References:

1. Ghimire P, Basic Malaria Microscopy, EDCD/GFATM, 2004
2. Garcia LS, Bruckner DA. *Diagnostic Medical Parasitology*, 3rd edition. Washington DC: ASM Press; 1997
3. K. D. Chatterjee, *Parasitology: Protozoology and Helminthology*, 20th Edition, Chatterjee Medical Publishers, Calcutta 1998.
4. J B Sherchand & John Cross, WHO/FDA
5. Markell, Joh Krotoski, *Medical Parasitology*, 8th Edition, W. B. Saunders Co. Philadelphia, London, New Work.
6. Dickson D, Despommier, Robert W. Gwatz, Peter J. Hotez, *Parasitic Diseases*, Springer, Verlag, New York, London, Paris, Tokyo,
7. Lawrence R. Ash., Thomos C. Orihel, *Atlas of Human Parasitology*, 3rd Edition, ASCP Press. Chicago.

DMY 310-3 (Credit hours 3)

Diagnostic Mycology

(B. Sc. Medical Microbiology: Third Year, Sixth Semester)

Course Objectives:

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

- Understand diagnostic mycology and diagnose the infections caused by fungi.

Course Contents:

Unit I: Introduction to Diagnostic Mycology:

8 hours

- Medically important fungi
- Opportunistic Fungi

Unit II: Fungal Diseases: Mycoses

5 hours

1. Superficial mycoses:
2. Subcutaneous mycoses:
3. Cutaneous mycoses: Trichophytosis, Microsporiosis, Epidermophytosis.
4. Systemic mycoses: Histoplasmosis, Blastomycosis, Cryptococcosis, Coccidioidosis, Paracoccidioidosis.

Unit III: Pathogenesis and Laboratory Diagnosis of Mycotic Infections

20 hours

- a. *Aspergillus spp*,
- b. *Candida albicans*,
- c. *Fusarium spp*,
- d. *Cryptococcus neoformans*,
- e. *Histoplasma capsulatum*,
- f. *Sporothrix spp*,
- g. *Philophora spp*.
- h. *Trichophyton microsporum*,
- i. *Epidermophyton spp*.
- j. *Blastomyces dermatitidis*,
- k. *Coccidioides immitens*,

Unit IV: Isolation and Identification of Fungi (Laboratory Diagnosis):

A. Selection, collection and transportation of specimens

5 hours

Skin, Hair, Nail, Mucous membranes, Ear, eye, Corneal ulcer, Pus, Blood, Biopsy, Sputum, Urine, Vaginal and Cervical swab, Stool samples, Peritoneal and peritoneal fluid, Superficial, sub-cutaneous and cutaneous samples.

B. Smear Preparation:

2 hours

- KOH Preparation,
- 20% KOH with 20% Glycerol,
- KOH – DMSO (Dimethyl Sulphoxide) 100%
- Lactophenol Cotton Blue
- India ink preparation.

- C. Isolation of Fungi from Different Samples** **2 hours**
- Media, Agar-agar, and media preparation- Sabourauds Dextrose Agar (SDA), sterilization.

- D. Demonstration of fungi in tissue.** **2 hours**
- a. Macroscopic Morphology of Fungi
 - b. Microscopic (Structure examination on slide culture)
 - Microscopy: Slide Preparation
 - Culture. (Inoculation, incubation and identification)
 - Slide Culture (Microculture)
 - Germ tube test
 - Nutrition deficiency culture method Identification

- Unit V: Antifungal Sensitivity Test:** **2 hours**
- Antibiotics. Stock solution of drug Dilution technique
 - Sensitivity test by different method
 - Minimal inhibitory concentration (MIC) and Minimal fungicidal concentration (MFC)

- Unit VI: Serological Test: Identification of Antigen, Antibody and Metabolites in Body Fluid and Serum-.** **2 hours**

Laboratory Practices

1. Practical sessions (Laboratory Practices) will be based in the Hospital Laboratory performing diagnostic tests available / requested, in Diagnostic Mycology laboratory

References:

1. Chester. W. Emmons, *Medical Mycology 3rd edition*, Chapman-H. Binford, John P. Utz, K and K.J. Kwon-Chun,
2. Evan E. and Gentles J.C.; *Essentials of Medical Mycology*, Churchill Livingstone, New York 1995.

SYLLBUS
for
Bachelor of Science in Medical Microbiology
(B. Sc. Medical Microbiology)

FOURTH YEARS
(Seventh and Eighth Semester)

DBA 401-3 (Credit hours 3)

Diagnostic Bacteriology II

(B. Sc. Medical Microbiology: Fourth Year, Seventh Semester)

Course Objectives:

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

- Prepare reagents required for routine and special investigations
- Perform routine and special laboratory investigations using cultural /and non-cultural techniques, interpret the results based upon the underlying principles in each investigation.

Course Contents:

Unit I: Anaerobic Culture:

4 hours

- Scope and importance of anaerobic culture,
- Factors affecting anaerobic culture,
- Various media and techniques of anaerobic culture.
- Inoculation, isolation and identification of anaerobic microorganisms.

Unit II: Laboratory Diagnosis of Pus:

8 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Drain,
- Gas gangrene (with emphasis in rapid diagnosis)
- Pus for different parts, body tissue,
- Bone infection (aerobic and anaerobic culture)

Unit III: Laboratory Diagnosis of Mycobacterium Infection:

10 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

Mycobacterium tuberculosis,
Leprosy,
Atypical mycobacterium infection

Unit IV: Laboratory Diagnosis of Venereal Diseases:

10 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Bacterial vaginosis,
- Pelvic inflammatory disease,
- Gonorrhoea,
- Syphilis,
- Chlamydia, and other sexually transmitted diseases and infection syndrome,

Unit V: Laboratory Diagnosis of GI Tract:

12 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Food poisoning,
- Traveler's Diarrhoea,

- Cholera
- Other infections

Unit VI: Laboratory Diagnosis of Meningitis and Encephalitis:

4 hours

(Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods)

- Neisseria, Streptococcus, Haemophilus, Mycobacterium
- Other organisms.

Laboratory Practices*

References:

1. Cheesbrough M., *Medical Laboratory Manual for Tropical Countries*, Vol. II, 2nd Edition, ELBS & I, 1994.
2. Stoker, Edward Arnold, *Clinical Microbiology*, 1994
3. Lynnette, E. H., *Manual Clinical Microbiology*, 3rd Edition, American Society for Microbiology, Washington DC.

DMB 402-3 (Credit hours 3)

Diagnostic Microbiology

(B. Sc. Medical Microbiology: Fourth Year, Seventh Semester)

Course Objectives:

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

- Perform managerial work, supervision of subordinates, and preparation of periodic charts and maintain inventory.
- Interpret the laboratory results
- Logistic management of the laboratory including instruments, consumable, reagents.

Course Contents:

Unit I: Laboratory Organization and Management:	8 hours
<ul style="list-style-type: none">• Role & responsibilities of different personals in Laboratory (TOR)• SOP• SSP• GLP• Counseling• Quality control of microbial laboratory• Laboratory safety	
Unit II: Handling of Clinical Specimen for Microbial Study:	8 hours
<ul style="list-style-type: none">• Selection of sample collection area• Collection, transport and storage of specimen for microbiological examination	
Unit III: Performance of different Tests	10 hours
<ul style="list-style-type: none">• Optical methods for laboratory diagnosis of infectious diseases• Cultivation and isolation of viable pathogens• Conventional and rapid microbiological method for identification of bacteria• Non-traditional methods for identification• Principle of automated methods used in clinical microbiology methods for testing anti-microbial effectiveness and recent advances in medical microbiology.	
Unit IV: Rapid Diagnostic Tests	6 hours
Unit V: Molecular Tests	8 hours
Unit VI: Interpretation of Test Results	5 hours
Unit VII: Test reporting	2 hours

Laboratory Practices*

References:

1. Ghimire P. & Parajuli K. *A Text Book of Microbiology*, 2005, Vidhyarthi Pustak Bhandar Publication, Kathmandu.
2. Thomas D. Brock and Michael T. Madigan: *Biology of Microorganisms*, Prentice-Hall International, (1998).
3. Roger Y. Stanier, Edward A. Adelberg and John L. Ingraham: *General Microbiology*, the Macmillan Press Ltd. (1998).
4. Chester W. Emmons, *Medical Mycology 3rd edition*, Chapman-H. Binford, John P. Utz, K and K.J. Kwon-Chun.
5. Evan E. and Gentles J.C.; *Essentials of Medical Mycology*, Churchill Livingstone, New York 1995.
6. Isenberg H. D., and Albert *Clinical Microbiology Procedure Hand Book Vol. I & II*, American Society for Microbiology, Einstein College of Medicine, New York, Washington DC.
7. Parker MT., & Collier L. H., *Topley & Wilson's Principle of Bacteriology, Virology & Immunity Vol. I, II III & IV*, 8th Edition, 1990.
8. Colle J. G., Fraser A. G., Marmion B. P., Simmou A., *Mackie & McCartney: Practical Medical Microbiology*, 4th Edition, Churchill Living Stone, New York, Melbourne, Sans Francisco, 1996.
9. Geo. F. Brook, Janet S. Butel & Stephen A. Mores, *Jawetz, Melnick and Adel berg's Medical Microbiology*, 21st Edition, Appleton & Lance, Co. Stamford Connecticut, 1998.
10. Barron G. I. & Felthani R. K., *Conan & Steel's Manual for the Identification of Medical Bacteria*, 3rd Edition, 1993, Cambridge University Press.
11. K. D. Chatterjee, *Parasitology: Protozoology and Helminthology*, 20th Edition, Chatterjee Medical Publishers, Calcutta 1998.
12. Markell, Joh Krotoski, *Medical Parasitology*, 8th Edition, W. B. Saunders Co. Philadelphia, London, New York.
13. Dickson D, Despommier, Robert W. Gwatz, Peter J. Hotez, *Parasitic Diseases*, Springer, Verlag, New York, London, Paris, Tokyo,
14. Lawrence R. Ash., Thomos C. Orihel, *Atlas of Human Parasitology*, 3rd Edition, ASCP Press. Chicago.

RME 403-3 (Credit hours 3)

Research Methodology

(B. Sc. Medical Microbiology: Fourth Year, Seventh Semester)

Course Objectives

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

- Identifying the problems and conducting health research following research methodology, collect appropriate data analyze available data, write a report, prepare a research proposal.

Course Contents

Unit I: Introduction to Research Methodology:

4 hours

- **Meaning and Nature of Research**
 - Meaning, definition and characteristics of health research
 - Importance of health research in nursing field.
- **Foundation of Scientific Research**
 - Scientific Thinking, Research Idea and the thought Process: Reasoning, Deduction, Induction, Combining Induction and Deduction, and Reflective thinking and the Scientific Method, Scientific Research.

Unit II: Identification and Analysis of Research Problem:

4 hours

- Selection of a problem,
- Sources Criteria, Defining a problem, Characteristics of a problem,
- Criteria of good research questions,
- Steps in analyzing the research problem.

Unit III: Proposal Development:

2 hours

- Basic steps involved in the health research proposal development process

Unit IV: Literature Review:

2 hours

- Importance and Sources,
- Strategies for gaining access to information, Library search, Computer search.

Unit V: Research Title and Objectives

2 hours

- Criteria for selecting a research title
- Formulation of research objectives
- Types of research objectives
- Qualities of research objective

Unit VI: Research Hypothesis:

2 hours

- Definition
- Qualities of research hypothesis
- Importance and types of research hypothesis.

- Unit VII: Variables** **2 hours**
- Definition, Importance, Qualitative and Quantitative variables
 - Dependent and Independent variables
 - Confounding variables, Background variables,
 - Operational definition (defining variables), Indicator.
- Unit VIII: Research Design** **10 hours**
- Purpose of research design
 - Types of study designs: Interventional study design - Exploratory, Descriptive (case study / case series, cross-sectional, longitudinal), Analytical (case control, cohort) study designs; Non Interventional study design - Pre experimental (pre test post test), Quasi experimental, True experimental (Completely Randomized, Completely Randomized Block, Factorial, Time Series) study designs.
- Unit IX: Sampling Design and Procedure** **8 hours**
- Definition, Importance, Characteristics of a good sample
 - Qualities of sampling frame, Population concept and parameter, Types of sampling units,
 - Types of Sampling – Non probability sampling (purposive, quota, convenient, snowball etc.), Probability sampling (simple random, systematic, stratified, cluster, multistage, PPS etc.)
 - Techniques to choose appropriate sampling procedure, Sampling errors, Sample size, Testing reliability of sample
- Unit X: Qualitative and Quantitative Techniques used in Health Research Process.** **2 hours**
- Unit XI: Test Instruments** **8 hours**
- Types of questionnaire and types of questions, Steps in designing a questionnaire
 - Types of observation, Observation check list preparation,
 - Types of Interview, Steps to carry out an interview,
 - Techniques to carry out focus group discussion (FGD),
 - Nominal Group Technique
 - Delphi Technique,
 - Rapid Appraisal Technique.
- Unit XII: Data Collection Methods:** **6 hours**
- Secondary method of data collection (data from office records of institutions, journals, bulletins, annual reports, Med-line, Pop-line, Internet etc)
 - Primary method of data collection (observation, Interview thorough questionnaire, Group interview, FGD)
 - Techniques to choose appropriate data collection technique
- Unit XIII: Pre-testing Data Collection Tools and Making Work Plan:** **2 hours**
- Preparation of working schedule
 - Gantt chart.
- Unit XIV: Data Processing and Analysis** **4 hours**
- Coding/decoding, Editing
 - Preparation of master tables
 - Master field books, Dummy table preparation
 - Data processing and analysis plan – Selection of appropriate statistical techniques.

Unit XV: Research Ethics and Research Proposal Format

2 hours

- Principles of research ethics,
- National ethical guidelines of health research.

Laboratory Practices*

References:

1. WHO, Health Research Methodology: A guide for training in research Methods, 2nd Edition, WHO-WIPRO, 2001
2. Clough P and Nutbrown C. *A Student's Guide to Methodology*. Sage Publication, 2002.
3. C.R. Kothari. *Research Methodology – Methods and Techniques*. 2nd Edition, New age International publication, 2005.
4. Kumar R. *Research Methodology – A Step-By-Step Guide for Beginners*. Sage Publication, 1999.
5. *National Ethical Guidelines for Health Research in Nepal*, Available at Nepal Health Research Council, July 2001.
6. Saps ford R, *Survey Research*. Sage Publication, 1999.
7. Smith PG, Morrow. *Field Trials of Health Interventions in Developing Countries*. 2nd Edition, 1996.

BDM 404-3 (Credit hours 3)

Bio-statistics and Data Management

(B. Sc. Medical Microbiology: Fourth Year, Seventh Semester)

Course Objectives:

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

- Use statistical tools in bio-medical research
- Manage and present the data using various statistical tools.
- Furnish the basic techniques on the use of computer and statistical programs for data analysis.

Course Contents:

Unit I: Introduction to Bio-statistics

3 hours

- Definition of Bio-statistics,
- Role of Statistics in Microbiology
- Sample and population
- Types of data, sources of data, types of variable, tools of measurement in statistics (Rate, Ratio, and Proportion),
- Limitation and misinterpretation of statistics.

Unit II: Data, Diagrams and Graphs:

5 hours

- General concept of Diagrams, graphs, and tables
- Ordered array
- Stem and Leaf display
- Frequency distribution
- Cumulative distribution
- Relative frequency and
- Percentage distribution
- Summary table
- Contingency table
- Diagrams and Graphs
 - Bar diagrams
 - Pie charts
 - Pictogram
 - Cartogram
 - Histogram
 - Frequency polygon and
 - Cumulative frequency curve

Unit III: Describing Numerical Data:

6 hours

- Measures of central tendency
 - Mean
 - Median
 - Mode
 - Geometric Mean
- The shape (Skewness)

- Measures of variation
 - Range,
 - IQR,
 - Standard Deviation,
 - Coefficient of Variation,
- The five number summary,
- Box-Whisker Plot

Unit IV: Basic Probability Concepts:

7 hours

- Introduction
- Terms used in probability
- Views of probability (Subjective and Objective Probability)
- Laws of probability (Additional Law and Multiplicative Law)
- Conditional probability
- Baye's Theorem
- Screening test
- Sensitivity & specificity
- Predictive value positive and negative

Unit V: Probability Distribution:

8 hours

- Discrete probability distribution
- Binomial distribution
- Poisson distribution
- Continuous probability distribution
- Normal distribution

Unit VI: Sampling:

4 hours

- Introduction
 - Population
 - Census vs. sample
 - Reasons for sampling
- Sampling unit
- Sampling frame
- Sampling fraction
- Probability and non probability sampling
- Parameters and statistics
- Determination of minimum sample size (Mean & proportion)
- Methods of probability and non probability sampling
 - Simple random sampling
 - Stratified sampling
 - Systematic sampling
 - Cluster sampling
 - Multistage sampling
 - Purposive sampling
 - Snowball sampling
 - Quota sampling

Unit VII: Sampling Distribution and Estimation:**4 hours**

- The concept of sampling distribution
- Standard error of mean and proportion
- Precision
- Point and interval estimation
- The central limit theorem
- Confidence interval estimation for the mean
- Confidence interval estimation for the proportion

Unit VIII: Hypothesis Testing:**11 hours**

- Types of hypothesis
- Level of significance
- Regions of rejection and non rejections
- Errors in hypothesis testing
- One tailed tests:
 - Z-test of hypothesis for the mean and for the proportion
 - t-test of hypothesis for the mean
- Comparing two samples:
 - t -test for difference between two means
 - Z test for difference between two means
 - Paired sample t-test
 - The p-value approach
 - A connection between confidence interval and hypothesis testing
- Chi-square test:
 - Tests of Independence
 - Yates's correction
- Analysis of variance (ANOVA) test

(Note: All examples are from health related field and computer based)

Laboratory Practices***References:**

1. Altman DG. *Practical Statistics For Medical Statistics*, 1st Edition, Chapman & hall / CRC, London, 1991.
2. Epi-Info: *Epi-Info 2000 manual*, CDC, USA.
3. Lwanga SK, Tye CY, Ayeni O. *Teaching Health Statistics*, 2nd Edition, World Health Organization, Geneva, 1999.
4. Mahajan BK. *Methods in Bio-statistics*, Jaypee Brothers, Medical Publishers P. Ltd., G-16, EMCA House, 23/23B, Ansari Road, Daryaganj, Post Box: 7193, New Delhi 110 002, India, 1991.
5. Rosner B. *Study Guide: Fundamentals of Bio-statistics*, 5th Edition, Duxbuey Thomson Learning, 2000.

6. SPSS. SPSS Base 10.0 Application Guide, SPSS Inc, Chicago, 1999.
7. Swinscow TDV. Statistics at square one, 9th edition, Brit Med J Publishing group, London, 1997.
8. Wayne W. Daniel, *Biostatistics: a foundation for analysis in the health sciences*, 7th edition, Wiley
9. Yule and Kendall, *An introduction to theory of statistics*, Oliver and Bloyd, London.

MML 405-3 (Credit hours 3)

Management of Microbiology Laboratory

(B. Sc. Medical Microbiology: Fourth Year, Seventh Semester)

Course Objectives:

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

- Perform managerial work, supervision of subordinates, and preparation of periodic charts and maintain inventory.
- Perform hands on testing of the samples received during absence of the junior colleagues.
- Plan for Logistic supply, costs of the tests and benefits to the costumers and agency.
- Coordinate with the small-scale laboratories for sample collection, storage, transportation and providing results of the tests back.
- Coordinate with the physicians for appropriate samples and expedition of lab results back to the concerned parties.

Course Contents:

Unit I: Introduction

3 hours

- Scope and Importance
- Class of management
- Professional ethics

Unit II: Laboratory Management

7 hours

- Human resources
- Logistics & supply
- Test performance
- Data Management
- Resource tapping
- Instruments
- Water and Sources of light and electricity
- Room, Table and benches

Unit III: Instruments Used in Laboratory

8 hours

Unit IV: Rules and Regulation in the Laboratory

6 hours

Unit V: Laboratory Quality Control Assessment

10 hours

- Internal quality control and
- External quality control

Unit VI: Maintaining Reference Bacteria and their Culture

6 hours

- Organisms bank

Unit VII: Laboratory waste disposal system

8 hours

- National and International Guidelines.

Laboratory Practices*

(Seventh Semester)

* **Field Based Sample Collection, Storage, Transportation, Testing, QC, Data Analysis and Dissemination of results** (Diagnostic Microbiology, Diagnostic Bacteriology, Diagnostic Immunology, Research Methodology, Bio-statistics and Data Management):

1. Selection, collection, isolation, identification of the microorganisms from different clinical specimens and antibiotic susceptibility testing of the isolated organisms.
2. Selection, collection, storage and transportation of samples for immunological tests from different types of laboratory settings (field, PHC/HP/SHP, district, Zone, Region, Central, National) and interpretation of the results.
3. Data collection from a particular subject and an area using research methodological tools then data manage and test by using bio-statistics tools using computer.
4. Each student needs to present a seminar/Journal club on the specified topic by the mentor faculty.

ITR 1.6 (Credit hours 6)

Hospital/Factory Internship Training (B. Sc. Medical Microbiology: Fourth Year, Eighth Semester)

Course Objectives:

Students will be exposed to professional work environment to acquire the knowledge, independent working capacity and leadership so that at the end of the course they will be able to manage the laboratory and research work with full responsibility and reliability.

Internship Training Guide Line:

1. Internship will be conducted in an institute under the supervision of supervisor/s accredited/ recognized / registered by concerned professional councils.
2. Thoree to six months Internship should be completed within the last semester and it is as a partial fulfillment of the B. Sc Medical Microbiology degree.
3. Semi residential Internship will be conducted in subject related areas in the hospital / factories. The students have to work on a rotational basis (as per roaster set by the Supervisor) without any public holiday.
4. During the Internship, students should record his/her work and submit to the supervisor and department. A report of Internship work should be submitted to the department upon completion of the work certified by the concerned supervisor of the institute/hospital/factory.
5. Internship work will be evaluated as per Pokhara University rules & regulations.

DIS 1.6 (Credit hours 6)

Thesis / Dissertation

(B. Sc. Medical Microbiology: Fourth Year, Eighth Semester)

Course Objectives

This course is designed to provide students the knowledge and practice of public health research activity, to enable them to carry out researches and solve research related problems and to help them in writing thesis and defend their work. Upon successful completion of the course, the students shall be able to:

- Search relevant scientific literature
- Develop a research proposal
- Employ appropriate data collection techniques and tools
- Manage collected data
- Analyze data with appropriate statistical techniques
- Write thesis
- Defend the findings

Proposal Development:

At the beginning of fourth year (Seventh Semester), students in a group of five in consultation with designated faculties and extensive literature survey will develop research proposal during the initial 3 months period.

Data Collection/ Thesis Writing

Students will carry out data collection, data management, data analysis, and thesis writing during the remaining period (Seventh and Eight Semester).

The Dissertation should have following format:

1. Title
2. Introduction
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion
7. Recommendation
8. References
9. Appendix

Evaluation:

Internal: 50% weight

Thesis Defense and Viva: 50% weight