ATAL BIHARI VAJPAYEE MEDICAL UNIVERSITY
LUCKNOW, UTTER PRADESH

COURSE CURRICULUM FOR BACHELOR OF MEDICAL MICROBIOLOGY

(4 year semester based system)

WITH EFFECT FROM DATED- BATCH 2021-2022

CURRICULUM COMMITTEE

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27/8/22

AIM/ OBJECTIVES OF THE COURSE

Bachelor of Medical Microbiology program deals with fundamental and applied aspects of Medical Microbiology which helps in laboratory diagnosis and prevention of infectious diseases. In this course students will learn about different basic disciplines of medical microbiology including Bacteriology, immunology, serology, parasitology, virology, mycology and applied microbiology. Students also exposed for basic knowledge of Anatomy, Physiology, Biochemistry for understanding Medical Microbiology in a best way along with good clinical laboratory practices, communication skills, medical law and ethics, Infection and control practices, healthcare associated infections and their surveillance, Disaster management, community health care and preventive medicine, quality and patient safety along with Environment science knowledge as a foundation course during first semester. Undergraduate and postgraduates qualified in microbiology can earn in hospital and laboratories run by various government and corporate hospital. They can be posted both in managerial and technical position as well as in academics they can pursue for higher qualifications like PhD in Medical Microbiology. Foreign countries are looking for expert in microbiology for research and technical advisor after Covid-19 pandemic. So many emerging diseases are coming and newer diagnostic tests, kits reagents are in huge demand day to day practices .Huge demand of microbiologist in drug industry also as quality experts. After completion of UG and PG they can be tutor or research associate in research laboratories also. Overall this Program may give students a platform to pursue in field of Medical Microbiology in future.

PROGRAM SPECIFIC OUTCOMES

1. To provide clinical care
2. Able to communicate to all levels
3. Membership of multidisciplinary health team
4. Can work ethically and have accountability at all levels
5. Commitment to professional excellence
6. Leadership and mentorship
7. Social accountability and responsibility
8. Scientific attitude and scholarship (PhD level)
9. Lifelong learner

25/8/22

SCOPE OF PROGRAM

1. Collection and receiving of specimens for various biochemical, pathological, microbiological, hematological and blood bank investigations.
2. To perform and validate various investigations for purpose of deferential diagnosis.
3. Calibration and standardization of glass wares, laboratory equipments.
4. Standardization and selection of tests analytical procedures.
5. Maintenance of supplies of laboratory kits, reagents and consumables.
6. Maintenance of quality control for reliability of lab reports.
7. Supervision, organization of work and lab management.
8. Maintenance of records and preparation of statistics.
9. Students can look for bacteria, parasites, other microorganisms and able to analyze body fluids, match blood for transfusion.
10. They can use automated instruments capable of performing investigations, culture and antibiotic sensitivity tests.
11. They can analyze the results and relay them to physicians.
12. In blood bank or immunohematology as technologists can collect, type and cross match blood and prepare its component for transfusion. They also able to analyze the blood for safe and infection free transfusion (HIV, Hepatitis, Syphilis, Malaria, etc.).
13. In immunology they can examine elements of the human immune system and its response to foreign body.
14. In molecular biology as technician can perform complex protein and nucleic acid testing on human samples.

ADMISSION CRITERIA –

As per norms of Atal Bihari Vajpayee University rules only

QUALIFYING EXAMINATION-

The candidates should have passed the qualifying examination i.e. 10+2 examination or equivalent conducted by Board/Councils established by state government/central government with Physics, chemistry, Biology or Vocational course in MLS/MLT and English as subjects.

MARKS-

1. Candidates must have passed in 10+2 examination with minimum 50% marks and must have secure 505 marks in PCB/ PCMB

2. In respect of candidates belonging to scheduled castes, scheduled tribes & OBC the marks obtained in Physics, Chemistry and Biology/Math together in qualifying examination is not less than 40% instead of 50% as above or as per Govt.

AGE-

A candidate seeking admission in BMM course should have completed seventeen years of age as on 31 October of the year of admission.

DURATION OF STUDY –

4 years (8 semesters) including 6 months internship duration in 8th semester. The maximum period for completion of program successfully should not exceed six years.

MEDIUM OF INSTRUCTION-

English only

ATTENDANCE-

1. A candidate is required to have 75% attendance in theory, tutorials and seminar along with 80% attendance in practicals individually to appear in university examination

2. Further relaxation to attendance to be given only in special circumstances only on compassionate or genuine ground only and Head of institution / Principal can permit it

3. No students should be allowed to appear in examination if do not ^{t} fulfill necessary criteria as per clause no 1 and 2

4. If students to be detained due to short attendance appear the examination after repeating the semester to complete the attendance and appear in the examination thereafter whenever/earliest /supplementary examination/within six months conducted by the university

5. The names of the students who are not eligible to appear in examination to be intimated to the controller of examination & students before to commencement of examination

6. The principal of college will ensure that attendance to post on the notice board of all the departments at suitable places.

ORGANIZATION OF PROGRAM-

1. Each academic year shall consists of two semester

2. There shall be 15/16 weeks to be devoted for academic activities & clinical activities excluding 3 weeks for examinations.

3. The academic and clinical activities to be carried out 40 hrs per week

4. The course delivery in each academic year shall be carried out in accordance with minimum hours assigned to each theory and practical subjects

5. Six month of internship mandatory in a government or institutional hospital in partial fulfillment of criteria of award of degree to candidates as per government norms.

6. Rotatory internship shall be around 34/36 weeks and shall mean 8 hours integrated clinical duty per day.

CURRICULUM AND CREDIT SYSTEM-

1. The 3 year curriculum divided into 6 semester in additional first semester as foundation course and last semester as mandatory internship. (Total 8 semesters). The teaching learning methods includes lecture, tutorials, seminars, projects, case studies, OSPE, as defined in curriculum in scheme of instructions and examinations and instructions issued by the university from time to time.

2. The curriculum also includes curricular, co-curricular activities and extracurricular activities planned by university time to time.

3. The degree will be awarded after six month of completion of internship only.

BMM program curriculum has several courses will be assigned certain weightage reflecting its weight and contact period per week.

1 Lecture – period (L) / week = 1 credit,

1 tutorial - Period (T) / week = 1 credit and

1 practical period 2 hrs (P) / week = 1 credit

Seminars, projects and training etc. will also be assigned credits as per contribution in the programme without regards of contact period.

The minimum credit score to be required for award of BMM degree is 150. The credits are distributed semester wise only as shown in syllabus manual. The courses will progress in sequence wise to make learner competent in therapeutic, diagnostic, curative, preventive and rehabilitations interventions

PROGRAM SPREADING-
Commencement of semester from SEPTEMBER
First semester
Second semester
Third semester
Forth semester
Fifth semester
Sixth semester
Seventh semester,
Eight semester

First Semester- 0-6 Months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-101	Basic Computer & Information Science	3	1	-	30	70	100	4
BMM-102	English Communication and soft skills	3	1	-	30	70	100	4
BMM-103	Introduction to Quality & Patient Safety	3	1	-	30	70	100	4
BMM-104	Medical Law & Ethics	3	1	-	30	70	100	4
BMM-105	Basic Preventive Medicine and Community Health Care	3	1	-	30	70	100	4
BMM-106	Environment Sciences	3	1	-	30	70	100	4
Total		18	6	24	180	420	600	24
Total Hours in Semester		**550**						

NOTE:
Abbreviations: **L** – Lecture **T** - Tutorials **P** - Practical
Considering four months per semester as working months, total contact hours per semester shall be 550.

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Second semester-6-12 months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-201	Human Anatomy and Physiology	3	1	-	30	70	100	4
BMM-202	General Medical Microbiology	3	1	-	30	70	100	4
BMM-203	Basic Haematology	3	1	-	30	70	100	4
BMM-204	Basic Clinical Biochemistry	3	1	-	30	70	100	4
BMM-205	Human Anatomy and Physiology (P)	-	-	4	30	70	100	2
BMM-206	General Medical Microbiology (P)	-	-	4	30	70	100	2
BMM-207	Basic Haematology (P)	-	-	4	30	70	100	2
BMM-208	Basic Clinical Biochemistry (P)	-	-	4	30	70	100	2
	Guest lecture / tutorial / seminar / visit to any research institution / clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		**550**						

NOTE:
Abbreviations: **L** - Lecture **T** - Tutorials **P** – Practical
Considering four months per semester as working months, total contact hours per semester shall be 550.

Third semester-12-18 months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-301	Enzyme & Biochemical metabolism	3	1	-	30	70	100	4
BMM-302	Immunology & Bacterial Serology	3	1	-	30	70	100	4
BMM-303	Blood transfusion & Blood Banking	3	1	-	30	70	100	4
BMM-304	Haematological diseases	3	1	-	30	70	100	4
BMM-305	Enzyme & Biochemical metabolism (P)	-	-	4	30	70	100	2
BMM-306	Immunology & Serology (P)	-	-	4	30	70	100	2
BMM-307	Blood transfusion & Blood banking (P)	-	-	4	30	70	100	2
BMM-308	Haematological diseases (P)	-	-	4	30	70	100	2
	Guest lecture / tutorial / seminar / visit to any research institution / clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

Abbreviations: **L** - Lecture **T** - Tutorials **P** - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550.

Fourth Semester- 18-24 months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-401	Systemic Bacteriology	3	1	-	30	70	100	4
BMM-402	Medical Parasitology & Entomology	3	1	-	30	70	100	4
BMM-403	Instruments, Reagents & Analytical Clinical Biochemistry	3	1	-	30	70	100	4
BMM-404	Haematology (Applied and advanced)	3	1	-	30	70	100	4
BMM-405	Systemic Bacteriology (P)	-	-	4	30	70	100	2
BMM-406	Medical Parasitology & Entomology (P)			4	30	70	100	2
BMM-407	Instrument & Reagents & Analytical Clinical Biochemistry (P)			4	30	70	100	2
BMM-408	Haematology (Applied and advanced) (P)			4	30	70	100	2
	Guest lecture / tutorial / seminar / visit to any research institution / clinical laboratory		2					2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

Abbreviations: **L** - Lecture **T** - Tutorials **P** - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550.

Fifth Semester- 24-30 months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-501	Histopathology & Cytopathology	3	1	-	30	70	100	4
BMM-502	Mycology	3	1	-	30	70	100	4
BMM-503	Virology	3	1	-	30	70	100	4
BMM-504	Applied Microbiology - 1	3	1	-	30	70	100	4
BMM-505	Histopathology & Cytology (P)	-	-	4	30	70	100	2
BMM-506	Mycology (P)	-	-	4	30	70	100	2
BMM-507	Virology (P)	-	-	4	30	70	100	2
BMM-508	Applied Microbiology - 1 (P)	-	-	4	30	70	100	2
	Guest lecture / tutorial / seminar / visit to any research institution / clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

Abbreviations: **L** – Lecture **T** - Tutorials **P** - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550.

Sixth Semester- 30-36 months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-601	Immunopathology	3	1	-	30	70	100	4
BMM-602	Molecular Biology	3	1	-	30	70	100	4
BMM-603	Medical Laboratory management system	3	1	-	30	70	100	4
BMM-604	Biotechnology	3	1	-	30	70	100	4
BMM-605	Immunopathology (P)	-	-	4	30	70	100	2
BMM-606	Molecular Biology (P)	-	-	4	30	70	100	2
BMM-607	Medical laboratory management system (P)	-	-	4	30	70	100	2
BMM-608	Biotechnology (P)	-	-	4	30	70	100	2
	Guest lecture / tutorial / seminar / visit to any research institution / clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

Abbreviations: **L** – Lecture **T** - Tutorials **P** - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550.

Seventh Semester- 36 - 42 months

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMM-701	Microbial genetics	3	1	-	30	70	100	4
BMM-702	Research methodology	3	1	-	30	70	100	4
BMM-703	Biostatistics	3	1	-	30	70	100	4
BMM-704	Bioinformatics	3	1	-	30	70	100	4
BMM-705	Microbial genetics (p)	-	-	4	30	70	100	2
BMM-706	Research methodology (p)	-	-	4	30	70	100	2
BMM-707	Biostatistics (p)	-	-	4	30	70	100	2
BMM-708	Bioinformatics (P)	-	-	4	30	70	100	2
	Guest lecture / tutorial / seminar / visit to any research institution / clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

Abbreviations: **L** – Lecture **T** – Tutorials **P** - Practical

Considering four months per semester as working months ,total contact hours per semester shall be 550

Eighth Semester- 42-48 months

There shall be six months of internship after the completion of seventh semester for candidates declared to have passed the examination in all subjects. No candidates shall be awarded degree certificate without successfully completing six months of internship .The internship shall be rotatory and cover all clinical branches with Bachelor of Medical Microbiology course. The rotatory internship compulsorily to be completed from the Organization Hospital only (only under special circumstances / on compassionate ground the internship may be permitted from the Hospital outside the campus) or Medical College approved by the university. Every candidate after passing all the subjects of every semester will compulsorily undergo rotatory internship to the satisfaction of the college authorities and university concerned for a period of six month so as to be eligible for the award of degree of Bachelor of Medical Microbiology and registration.

Sl. No.	Laboratory	Days
1	Bacteriology Laboratory including Media lab	30 Days
2	Mycology Laboratory	30 Days
3	Virology Laboratory	30 Days
4	HIC Laboratory including infection control and CSSD	15 Days
5	Immunology and Serology Laboratory	15 Days
6	Parasitology Laboratory	15 Days
7	TB Laboratory	15 Days
8	Pathology Laboratory	15 Days
9	Biochemistry Laboratory	15 Days

Subject name: Basic computer and information system

Subject code-BMM -101

Unit-1 **(10 Hrs.)**

Introduction of computer, character of computer, block diagram of computer, generation of computer, computer languages, input (keyboard, point, draw devices, digitizer, electronic card reader, voice recognition device, vision input devices) and output devices (monitors, pointers, plotters, screen image projector, voice response systems)

Unit-2 **(10 Hrs.)**

Processor and memory, CPU, main memory, storage devices- sequential and direct access device, magnetic tape, magnetic disc, mass storage device

Unit-3 **(10 Hrs.)**

Introduction of window, history, features taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with window (opening, closing, moving, resizing, minimizing and maximizing etc.)

Introduction to MS word- introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document ,spell check, printing the document file, creating and editing of table, mail merge

Unit-4 **(10 Hrs.)**

Introduction to excel, introduction about worksheet, entering information, saving workbook and formatting printing the worksheet, creating graphs

Introduction to power point introduction, creating and manipulating presentation, views, formatting and enhancing text slide with graphs

Unit-5 **(10 Hrs.)**

Introduction to operating system- introduction, operating system concepts, types, computer networks, introduction, types of network (LAN, MAN, WAN, internet, intranet), network topologies

Unit-6 **(10 Hrs.)**

Internet and its application, definition, brief history, basic services 9 Email, file transfer protocol, telnet, the world wide web (www), www browser, use of internet, application of computer in clinical settings

Recommended books-

1. A first course in computers- Saxena Vikas publishing houses

2. Fundamentals of computer science M. afshar Alam

3. Fundamental of information technology by D. S. Yadav New age internatina

Subject Name: English Communication & Soft Skills

Subject code- BMM-102

Unit-1 **(10 Hrs)**

1. Basic language skills, grammar and usage
2. Business communication skills with focus on speaking- conversations, discussion, dialogues, short presentations and pronunciations,
3. Teaching the different method of writing letters, Email, report, case study, collecting the patient data etc.

Unit -2 **(10 Hrs)**

1. Basic composition, journals, with a focus on paragraph and organization
2. Basic concepts & principles of good communication
3. Special characteristics of health communication

Unit-3 **(10 Hrs)**

1. Types and process of good communication- verbal, nonverbal and written communication
2. Upward, downward and lateral communication
3. Therapeutic communication, empathy versus sympathy

Unit-4 **(10 Hrs)**

1. Communication method for teaching and learning
2. Communication method for patient education
3. Barrier of communication and how to overcome

Learning outcomes- student will realize significance of English for their carrier progression. Students will be able to understand district sounds and improve pronunciation. Students will improve their English vocabulary of daily usage. Students will be able to form simple sentences of talk about themselves, friends and relatives. Students will be imbibing the pre- requisites of personality development.

Suggested Reading:

1. Raman, Meenakshi & Sharma, Sangeeta, Technical communication

2. Konar, Nira. Communication skills for health professionals, PHI Learning Pvt Ltd-2011

3. Board of Editors. Written and spoken communication in English, University press 2007

4. Lata, Pushp & Kumar, Sanjay Communication or Cllapse. A Hand book of Effective Public Speaking, Group Discussions and interviews, PHI Learning Pvt Ltd 2011

5. Duck, Steve & Mcmahan, David T. The basic of communication; A Rationale Perspective, Sage Publication-2012

Subject Name- Introduction to Quality & Patient Safety

Subject Code- BMM-103

Learning Objectives- The subject will introduce the students to the basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system. It will sensitize them in basic emergency care, infection and prevention & control with knowledge of biomedical waste management and antimicrobial drug resistance.

Unit-1 **(10 hrs)**

1. Quality assurance and management
2. Concepts of quality of care
3. Quality improvement approaches, Standards and Norms, Quality Improvement Tools
4. Introduction to NABH guidelines

Unit-2 **(10 hrs)**

1. Fundamental aspect of BLS including immediate recognition of cardiac arrest and activation of emergency response system, early cardiopulmonary resuscitation and rapid defibrillation with automated external defibrillator
2. Initial recognition and response to heart attack and stroke are also considered part of BLS
3. Vital signs and primary assessment, Basic emergency care- first aid and triage, Ventilations including use of bag valve masks
4. Choking reuse breathing methods one and two rescuer CPR, Using an AED (Automated external defibrillator), managing an emergency including moving a patient

Unit-3 **(10 hrs)**

1. Biomedical waste management and environmental safety- Definition of biomedical waste, waste minimization, segregation, collection ,transportation, treatment and disposal including color coding), liquid BMW
2. Radioactive waste, Metals / Chemicals / Drug waste, BMW management & methods of disinfection
3. Modern technology for BMW management
4. Use of PPE, monitoring & controlling of cross infection (protective devices)

Unit-4 **(10 hrs)**

1. Infection prevention and control
2. Evidence based infection control principles and practices
3. Sterilization and disinfection, effective hand hygiene and use of PPE
4. Prevention and control of healthcare associated infections, components of effective infection control program and guidelines (NABH and JCI) for hospital infection control

Unit-5 **(10 hrs)**

1. History of antibiotics, how resistance happen and spreads
2. Types of resistance, intrinsic, acquired, passive, Trends in drug resistance, actions to fight resistance, bacterial persistence
3. Antibiotics sensitivity , consequences of antibiotic resistance
4. Antimicrobial stewardship- barriers and opportunities, tools and models in hospitals

Unit-6 **(10 Hrs)**

1. Disaster preparedness and management
2. Fundamentals of emergency management. Psychological impact management, resources management, preparedness and risk reduction
3. Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction)
4. Information management, incident command

Suggested Reading-

1. The essential of patient safety Charles Vincent
2. Laboratory quality and patient safety by De Gruyter

Subject Code- BMM-104

Learning objectives- legal and ethical consideration are firmly believed to be integral part of medical practices in planning patient care. Advances in medical science, growing sophistication of the modern society, legal framework, increasing awareness of human rights and changing moral principles of the community in large, now result in frequent occurrence of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

Unit-1 **(10 Hrs)**

1. Medical ethics definition, goal and scope
2. Introduction to code of conduct
3. Basic principles of medical ethics, confidentiality
4. Malpractice and negligence, rational and irrational drug therapy

Unit-2 **(10 Hrs)**

1. Autonomy and informed consent
2. Care of terminally ill Euthanasia
3. Organ transplantation
4. Medico-legal aspects of medical records

Unit-3 **(10 Hrs)**

1. Medico-legal case and type- Records and document related to MLC
2. Ownership of medical records- Confidentiality, Privilege communication
3. Release of medical information, unauthorised disclosure retention of medical records other various aspects
4. Professional indemnity, insurance policy

Unit-4 **(10 Hrs)**

1. Development of standardized protocol to avoid near miss or sentinel events
2. Obtaining an informed consent
3. Ethics in the profession of medical laboratory science

Suggested Reading-

1. Medical law and ethics by Bonnie F Fremgen
2. Medical law and ethics by Jonathan Herrings

Subject name- Community Health Care

Subject code-BMM-105

Learning Objectives- The student will learn about the knowledge of various type of diseases and functioning of various programmes. The course provides student s basic insight into the main features of Indian health care delivery system and how to compares with other systems of the world.

Unit-1 **(10 Hrs)**

1. Introduction
   - **a)** Definition, concepts of health and important public health acts
   - **b)** Health problems of developed and developing countries
   - **c)** Definition and concepts of epidemiology, diseases, types and use of epidemiology
   - **d)** Basic emergency care and first aid
2. Communicable Diseases
   - **a)** Epidemiology, etiology, pathogenesis and control of communicable diseases like malaria and cholera
   - **b)** Tuberculosis, leprosy
   - **c)** Diarrhea, poliomyelitis
   - **d)** Viral hepatitis, measles, dengue, rabies, AIDS
3. National health policy and programs
   - **a)** National health policy and programs; DOTS, National AIDS control program (NACO)
   - **b)** National cancer control program, universal immunization program etc.
   - **c)** Nutrition and major nutritional problems, etiology, manifestations and prevention components of RCH care
   - **d)** Examination of water, food adulteration, role of regular exercise and yoga in prevention of many diseases
4. National population problem
   - **a)** Population, problem of population growth, birth rate
   - **b)** Death rate, fertility rates, MMR, CPR
   - **c)** Approaches and methods of contraception, Reproductive and child health
   - **d)** Hygiene and sanitation, sanitation barrier, excreta disposal

5. Immunization and family planning

   a) Immunization program, national immunization program and vaccine schedule

   b) Family welfare and planning, communicable and non-communicable diseases

   c) Health planning in India including committees, various national health policy and health goals

   d) Objectives of WHO, UNICEF, Indian red cross society, UNFPA, FAO, ILO

Suggested Readings:

1. K. Park & Sunder Lal (2015) text book of preventive social medicine , 3rd edition Bhanot Publication

Subject Name- Environmental science

Subject code- BMM-106

Learning Objectives- The students will be made aware of our environment in general, natural resources, ecosystem, environmental pollution and social issues related to ecosystem.

Unit-1 Natural resources, renewable and nonrenewable resources (10 Hrs)

1. Water resources use and overutilization of surface and ground water, floods, drought, conflicts over water, dams, benefits and problems
2. Mineral resources use, exploitation, environmental effects of existing and using mineral resources, case studies
3. Food resources; World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer, pesticides, water logging salinity ,case studies
4. Energy resources; Growing energy needs, renewable and non-renewable energy resources, use of alternate resources, case studies
5. Land resources; land as resources, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources equitable use of resources for sustainable life style

Unit-2 Ecosystem (10 Hrs)

1. Concepts of ecosystem, structure and function of ecosystem
2. Producers, consumer and decomposer
3. Energy flow in ecosystem
4. Ecological succession

Unit-3 Environmental pollution (10 Hrs)

1. Definition, causes, effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards
2. Solid waste management- causes ,effect and control measures of urban and industrial waste
3. Role of individual in prevention of pollution
4. Pollution case studies & disaster management, floods, earthquake, cyclones and land slides

Unit-4 social issues and environment (10Hrs)

1. Resettlement and rehabilitation of people, its problem, case studies
2. Environmental ethics, issue and possible solution

3. Green house effect and global warming, effect of acid rain and their remedial measure and ozone layer depletion

Unit-5 human population and & environment **(10 Hrs)**

1. Population growth variation among nation, population explosion, family welfare program
2. Environment and human health
3. Human rights
4. HIV/AIDS, women and child welfare
5. Role of information technology in environment and human health, case studies

Learning outcome: students will understand /evaluate/ develop technology on the basis if ecological principles and environmental regulations which in turn help in sustainable development

Suggested reading:

1. Agarwal K.C.2001 Environment Biology. Nidi PUBL Ltd .Bikaner
2. Jadhav, H & Bhosle VM 1995. Environment protection and laws Himalaya Pub House ,Delhi 284p
3. Principles of Environment Science by Cunnin ghan W.P
4. Essential of Environment science by Joseph
5. Environment pollution control Engineering bu Rao C.S.

SECOND SEMESTER

Subject Name- Human Anatomy and Physiology

Subject code-BMM- 201

Rationale- students will be able to learn the terminology of the subject and basic knowledge of cells, tissue, blood and to understand anatomy and physiology of human body. The subject will develop an understanding of the structure and functions of organs and organs systems in normal human body.

Unit-1 introduction to human anatomy and physiology

Unit -2 cell and cell organelles

structure and classification

Function

Cell division and (mitosis and meiosis)

1. Unit- 3 Tissues Introduction to human Anatomy and Physiology
2. Cell and cell organelles
   Structure and classification
   Function
   Cell division (Mitosis and Meiosis)
3. Tissues
   Definition
   Classification with structure and Functions
   Epithelial tissues
   Connective tissues
   Muscular tissues
   Nervous tissue
4. Blood
   Composition
   Function of blood
5. Muscular skeletal system
   Introduction
   Classification
   Structure and function of skeletal system, muscles and joints
   Various movements of body
6. Respiratory system
   Introduction
   Structure
   Function
   Mechanism of breathing and respiration
   Various terms involved in respiratory System

Vital capacity
Total Volume
Reserve volume
Total lung capacity

7. Cardiovascular system
   Anatomy and physiology of heart
   Blood circulation
   Arteries and veins
   Conductive system of heart
   Cardiac cycle
   Introduction to ECG
8. Lymphatic system
   Introduction
   Structure and function
   Lymph nodes
   Spleen
   Thymus gland, Tonsils
9. Structure and function of sense organ
   Eye
   Ear
   Nose
   Tongue

10. Body fluids and their significance: Important terms, types of body fluid, total body water, avenues by which water leaves and enters body, general principles for fluid balance, cardinal principle, How body fluids maintain Homeostasis, Electrolytes & ions Function of electrolytes, How electrolyte imbalance leads to fluid imbalance
11. Digestive system: Organization; accessory organs; structure & function (Mouth, Tongue, Teeth, Esophagus, Pharynx, Stomach, Intestine, Rectum, Anus); Digestive glands; physiology of digestion of carbohydrates, lipids & proteins
12. Liver: structure and function
13. Urinary system: Main-parts, Structure &function of kidney, structure of nephron, physiology ofexcretion & urine formation, urine, additional excretory organs
14. Genital system: Structure of male and female reproductive system, Gametogenesis in male& female, menstrual cycle. Placenta and extra embryonic membranes.
15. Nervous system: Parts, function & structure; brain, spinal cord, spinal & cranial nerves; all & none principle, role of neurotransmitters in transmission of nerve impulse
16. Endocrine system: Endocrine & exocrine glands, their location, structure & functions

Suggested readings:

1. Anatomy & Physiology- Ross and Wilson
2. Anatomy and Physiology: Understanding the Human Body by Clark
3. Anatomy and Physiology for nurses by Evelyn Pearce
4. Anatomy and Physiology for nurses by Sears
5. Anatomy and Physiology for nurses by Pearson
6. Anatomy and Physiology by N Murgesh

Subject Name- General Medical Microbiology

Subject code-BMM- 202

Rationale: This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Medical Microbiology and basic procedures done in a medical microbiology laboratory i.e. microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

1. Introduction to Medical Microbiology:
   Definition
   History
   Host - Microbe relationship
2. Safety measures in Clinical Microbiology
3. Glassware used in Clinical Microbiology Laboratory:
   Introduction
   Care and handling of glassware
   Cleaning of glassware
   Equipment used in clinical Microbiology Laboratory:
   Introduction
   Care and maintenance including calibration
4. Microscopy
   Introduction and history
   Types, principle and operation mechanism of following microscopes
   Light microscope
   DGI
   Fluorescent
   Phase contrast
   Electron microscope: Transmission/ Scanning
5. Sterilization:
   Definition
   Types and principles of sterilization methods
   Heat (dry heat, moist heat with special Reference to autoclave)
   Radiation
   Filtration
   Efficiency testing to various sterilizers
6. Antiseptics and disinfectants:
   Definition.
   Types and properties
   Mode of action - Uses of various disinfectants
   Precautions while using the disinfectants - Qualities of a good disinfectant
   Testing efficiency of various disinfectants
7. Biomedical waste management in a Medical Microbiology laboratory:
   Types of the waste generated – Segregation – Treatment – Disposal
8. General characteristics & classification of Microbes: (Bacteria &fungi)
   Classification of microbes with special reference to prokaryotes & eukaryotes
   Morphological classification of bacteria
   Bacterial anatomy (Bacterial cell structures)
9. Growth and Nutrition of Microbes:

General nutritional & other requirements of the bacteria
Classification of bacteria on the basis of their nutritional requirements
Physical conditions required for growth.
Normal growth cycle of bacteria (growth curve)
Types of microbial cultures: Synchronous, Static, continuous culture.

10. Culture media:
    - **10.0** Introduction
    - **10.1** Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched, enrichment, Selectivedifferential media, sugar fermentation media, transport media, preservation media and anaerobic culture media
    - **10.2** Quality control in culture media
    - **10.3** Automation in culture media preparation
11. Aerobic & anaerobic culture methods:
    - **11.1** Concepts
    - **11.2** Methods Used for aerobic cultures
    - **11.3** Methods used for anaerobic cultures
12. Introductions to Immunology
    - **12.1** Immunity
    - **12.2** Antigens and Antibodies
13. Care & handling of laboratory animals:
    - **13.1** Introduction
    - **13.2** General care & handling
    - **13.3** Ethics & legality in use of laboratory animals

Suggested Readings

1. Practical Medical Microbiology by Mackie and McCartney
2. Text book of Microbiology by Ananthanarayan
3. Medical Microbiology by Panikar& Satish Gupte
4. Medical laboratory Technology vol. I, II, III by Mukherjee
5. District Laboratory Practice in tropical countries Vol II Microbiology by Monica Cheesbrough
6. Text book of Microbiology by Prescott

Subject Name- Basic Haematology
Subject code-BMM- 203

Rationale: Students will be made aware of the composition of blood and methods of estimating different components of blood. Students will learn the basic concepts of Haematology & routine clinical investigations of Haematology laboratory.

1. Introduction to Haematology
   Definition
   Importance
   Important equipment used
2. Laboratory organization and safety measures in Haematology Laboratory
3. Introduction to blood, its composition, function and normal cellular components
4. Anticoagulants: types, mode of action and preference of anticoagulants for differenthematological studies
5. Collection and preservation of blood sample for various hematological investigations
6. Formation of cellular components of blood (Haemopoiesis)
   Erythropoiesis
   Leucopoiesis
   Thrombopoiesis
7. Hemoglobin: definition, types, structure, synthesis and degradation
8. Morphology of normal blood cells
9. Normal Hemostasis & physiological properties of coagulation factors
10. Radioactivity: definition, half-life, physical decay and units
11. Urine analysis
12. Quality assurance in Haematology
    - **12.0** Internal and external quality control including reference preparation
    - **12.1** Routine quality assurance protocol
    - **12.2** Statistical analysis i.e. Standard deviation, Co-efficient of variation, accuracy and precision

Suggested Readings

1. Text book of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K.L. Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's Clinical Haematology in Medical Practice

Subject Name- Basic Clinical Biochemistry
Subject code-BMM- 204

Rationale: The main objective of the subject is to impart the knowledge of apparatus, units, equipment, and volumetric analysis in the laboratory of clinical Biochemistry.

1. Introduction to Medical lab. Technology
   Role of Medical lab Technologist
   Ethics and responsibility
   Safety measures
   First aid
2. Cleaning and care of general laboratory glass ware and equipment
   Steps involved in cleaning soda lime glass
   Steps involved in cleaning borosil glass
   Preparation of chromic acid solution
   Storage
3. Distilled water
   Method of preparation of distilled water
   Type of water distillation plants
   Storage of distilled water
4. Units of Measurement.
   S.I unit and CGS units
   Conversion
   Strength, molecular weight, equivalent weight
   Normality, Molarity, Molality
   Numerical
5. Calibration of volumetric apparatus
   Flask
   Pipettes
   Burettes
   Cylinders
6. Analytical balance
   Principle
   Working
   Maintenance
7. Concept
   of pH
   7.0 Definition
   7.1 Henderson Hassel batch equation
   7.2 Pka value
   7.3 pH indicator
   7.4 Methods of measurement of pH
   pH paper
   7.4.2 pH meter
   7.4.3 Principle, working, maintenance and calibration of pH meter
8. Volumetric analysis
   8.1 Normal and molar solutions
   8.2 Standard solutions

- **8.3** Preparation of reagents
- **8.4** Storage of chemicals

9. Osmosis
   - **9.1** Definition
   - **9.2** Types of osmosis
   - **9.3** Factors affecting osmotic pressure
   - **9.4** Vant Hoff's equation
   - **9.5** Applications of osmosis
   - **9.6** Dialysis

Suggested Readings

1. Text book of Medical Laboratory Technology by P. B. Godker
2. Medical Laboratory Technology by K.L. Mukherjee volume III
3. Practical Clinical Biochemistry by Harold Varley
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chatterjee, Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer

27/3/22

Subject Name- Human Anatomy and Physiology (PRACTICAL)
Subject Code- BMM-205

1. Demonstration of various parts of body
2. Demonstration of tissues of body
3. Demonstration of parts of digestive system
4. Demonstration of parts of respiratory system
5. Demonstration of parts of skin
6. Demonstration of parts of excretory system
7. Demonstration of various parts of circulatory system (Demonstration from models)
8. Examination of blood film for various blood cells from stained slides
9. Blood pressure estimation
10. Demonstration of various parts of nervous system (brain and spinal cord)(Model)
11. Structure of eye and ear (demonstration from models)
12. Demonstration of reflex action
13. Demonstration of structural differences between skeletal, smooth and cardiac muscles(permanent mounts)
14. Demonstration of various bones and joints
15. Demonstration of various parts of reproductive system (Male and female from modelsand charts)
16. To study circulatory system from charts and transverse section (TS) of artery and veinfrom permanent slides.
17. To study digestive system from charts and TS of liver, spleen and pancreas frompermanent slides.
18. Study of Urinary system (charts)
19. Study of Genital system (male & female) from charts and TS of testis and ovary frompermanent slides.
20. To study nervous system (From models / charts)
21. To study various body fluids.

Note: Demonstrations can be done with the help of models, charts and histological slides

Subject Name- General Medical Microbiology (PRACTICAL)

Subject Code- BMM-206

1. To demonstrate safe code of practice for a Microbiology laboratory
2. To prepare cleaning agents & to study the technique for cleaning & sterilization ofglassware.
3. To demonstrate the working & handling of Compound microscope.
4. To demonstrate the method of sterilization by autoclave including its efficacy testing.
5. To demonstrate the method of sterilization by hot air oven including its efficacy testing.
6. To demonstrate the method of sterilization of media/solution by filtration.
7. Demonstration of Antiseptics, Spirit, Cetrimide& Povidone-Iodine.
8. To demonstrate the use of disinfectants.
9. Demonstrate the precaution while using disinfectants.
10. To prepare working dilution of commonly used disinfectants.
11. In-use test
12. Rideal-walker phenol co-efficient test.
13. Kelsey-Sykes test
14. To demonstrate the different morphological types of bacteria
15. Preparation of one culture media from each type
16. To demonstrate aerobic culture
17. To demonstrate anaerobic culture
18. Visit to animal house & demonstrate about care of laboratory animals

Subject Name- Basic Haematology (PRACTICAL)

Subject Code-BMM- 207

1. Preparation of various anticoagulants :
   EDTA
   Sodium Citrate,
   Oxalate with Fluoride
2. Collection of blood sample for various Lab Investigations
3. Familiarization and working of routine Haematology Lab. Instruments
   Microscopes
   Haemocytometers
   Colorimeter
   Spectrophotometer
   Glass pipettes & Auto pipettes
   Glassware
   Sahli's Apparatus
4. Identification of Normal blood cells
5. Urine Analysis:
   Routine biochemistry of Urine for:
   pH
   Specific Gravity
   Glucose
   Ketones
   Bilirubin
   Albumin
   Microscopic Examination of Urine

Subject Name- Basic Clinical Biochemistry (PRACTICAL)

Subject Code- BMM-208

1. Cleaning of the laboratory glass ware (Volumetric and non-volumetric)
2. Preparation of distilled water
3. Principle, working and maintenance of pH meter.
4. To prepare 0.1 N NaOH solution.
5. To prepare 0.2N HCl solution.
6. To prepare 0.1 molar H2SO4
7. To prepare 0.2 Molar Sodium carbonate solution.
8. Demonstration of osmosis and dialysis.

THIRD SEMESTER

Subject Name- Enzymes and Biochemical Metabolism

Subject code- BMM-301

Rationale: This subject shall give information about all the major metabolic pathways occurringin our body. The students will learn the details about metabolism of carbohydrates, proteins, lipids, nucleic acids, enzymes & the deficiency diseases related to them.

1. Carbohydrate Metabolism

   Introduction, Importance and Classification

   Digestion and Absorption

   Metabolism: - Glycolysis, Citric acid cycle, Gluconeogenesis, Glycogenolysis, Glycogenesis

   Disorders of carbohydrate metabolism.

2. Protein Metabolism

   Introduction, Importance and classification

   Important properties of proteins

   Digestion & absorption of Proteins

   Protein synthesis

   Metabolism of proteins

   Disorders of protein metabolism and Urea Cycle

3. Lipid

   Introduction & Classification

   Digestion & absorption of fats

   Lipoproteins

   Fatty acid biosynthesis & fatty acid oxidation

4. Nucleic Acid

   Introduction

   Functions of Nucleic acid

   Functions of energy carriers

5. Enzymes

   Introductions, Importance & Classifications

   Properties of enzymes

   Mechanism of enzyme action

   Factors affecting enzyme action

   Enzyme kinetics & enzyme inhibiters

Suggested Readings

1. Practical Clinical Biochemistry by Harold Varley
2. Text book of Medical Laboratory Technology by P. B. Godker
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chaterjee, Shinde Principal of Biochemistry by Lehninger

Subject Name- Immunology and Bacterial serology
Subject code-BMM- 302

Rationale: This section will cover the basic aspects of immunity, antigens, antibodies, variousserological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.

1. History and introduction to immunology
2. Immunity
   Innate
   Acquired immunity
   Basic concepts about their mechanisms
3. Definition, types of antigens and determinants of antigenicity
4. Definition, types, structure and properties of immunoglobulin
5. Antigen-Antibody reactions
   5.1 Definition
   5.2 Classification
   5.3 General features and mechanisms
   5.4 Applications of various antigen antibody reactions
6. Principle, procedure and applications of under mentioned in Medical Microbiology:
   6.1 Complement fixation test
   6.2 Immuno- fluorescence
   6.3 ELISA
   6.4 SDS-PAGE
   6.5 Western blotting
7. Principle, procedure and interpretation of various serological tests:
   7.1 Widal
   7.2 VDRL
   7.3 ASO
   7.4 CRP
   7.5 Brucella tube agglutination
   7.6 Rose-Waaler
8. Complement system:
   8.1 Definition
   8.2 Basic concepts about its components
   8.3 Complement activation pathways
9. Immune response:
   9.1 Introduction
   9.2 Basic concepts of Humoral and Cellular immune responses
10. Hypersensitivity:
    10.1 Definition
    10.2 Types of hypersensitivity reactions
11. Basic concepts of autoimmunity and brief knowledge about autoimmune diseases
12. Automation in diagnostic serology
13. Vaccines:
    13.1 Definition
    13.2 Types
    13.3 Vaccination schedule

13.4 Brief knowledge about _Extended programme of immunization' (EPI) in India

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker& Satish Gupte
4. Medical laboratory Technology Vol. I ,II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol II Microbiology by MonicaCheesbrough
6. Immunology by Riot Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites

Subject name- Blood Transfusion and Blood Banking
Subject code-BMM-303

Rationale: Blood banking make students to learn about blood grouping and blood transfusion. The students will learn about concept of blood grouping, compatibility test in blood transfusion and screening of donars blood foe infectious diseases.

1. History and discovery of various blood group systems
2. ABO blood group system
3. Rh and other major blood group system
4. Sources of error in blood grouping and their elimination.
5. ABO grouping: Forward and reverse grouping. Causes of discrimination between forwardand reverse grouping
6. Rh grouping
7. Compatibility test in blood transfusion
   Collection of blood for cross matching from a blood bag
   - 7.2 Major cross matching
   - 7.3 Minor cross matching
   - 7.4 Use of enzymes in blood bank specially Papain
8. Complications and hazards of blood transfusion
9. Laboratory investigations of transfusion reactions and mismatched blood transfusion.
10. Precautions while procurement and storage of grouping antisera
11. Various anticoagulants used to collect blood for transfusion purposes
12. Selection of donor and procedure for collection of blood from a healthy donor
13. Preparation of various fractions of blood for transfusion and therapeutic purposes suchas:
    - 13.1 Packed red cells, washed red cells and FROZEN Red cells
    - 13.2 Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets.
    - 13.3 Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate
14. Brief introduction of blood substitute/artificial blood
15. Haemopheresis: pertaining to Leucocytes, platelets and plasma.
16. Quality control in blood bank

Suggested Reading:

1. Practical Haematology by J.B. Dacie
2. Transfusion Science by Overfield, Hamer
3. Medical Laboratory Technology by K.L. Mukherjee Volume-I
4. Mollison's Blood Transfusion in Clinical Medicine, 12th Edition by Harvey G. Klein

Subject Name- Haematological diseases

Subject code- BMM-304

Rationale: The students will be made aware of various diseases like anemia, quantitative disordersof Leucocytes, morphological alterations in blood cells, bleeding disorders.

1. Anemia
   - Introduction
   - Classification
   - Microcytic hypochromic anemia
   - Macrocytic anemia
   - Normocytic normochromic anemia
2. Quantitative disorders of Leukocytes Cause and significance
   - Granulocytic and Monocytic Disorders
   - Lymphocytic Disorders
3. Morphologic Alterations in Neutrophils
   - Toxic granulation
   - Cytoplasmic vacuoles
   - Döhle bodies
   - May–Hegglin anomaly
   - Alder–Reilly anomaly
   - Pelger–Huët anomaly
   - Chédiak–Higashi syndrome
4. Bleeding disorders
   - Introduction Causes of bleeding disorders
   - Vascular defect
   - Platelet defect
   - Factor deficiency
   - Inhibitors
   - Hyper fibrinolysis
   - Types of bleeding disorders
   - Inherited bleeding disorders
   - Acquired bleeding disorders

5. Thrombosis
   Introduction
   Causes of thrombosis
6. Monitoring of Anticoagulants
   Oral anticoagulants by INR
   Heparin

Suggested Readings

1. Textbook of Medical Laboratory Technology by Praful B. Godkar
2. Medical Laboratory Technology by K L Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20thedition) by John BernardHenry
5. Atlas of Haematology by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice
7. Wintrobe's Clinical Haematology– 2013 by John P. Greer, Daniel A. Arber, Bertil E.Glader, Alan F. List

Subject Name- Enzymes and Biochemical Metabolism (PRACTICAL)

Subject code- BMM-305

1. To determine the presence of carbohydrates by Molisch test.
2. To determine the presence of reducing sugar by Fehling solutions
3. To determine the presence of reducing sugar by Benedicts method.
4. To determine starch by Iodine test.
5. Determination of Glucose in serum & plasma
6. Estimates of blood Glucose by Folin& Wu method
7. Determination of Urea in serum, plasma & urine.
8. Determination of Creatinine in serum or plasma
9. Determination of serum Albumin
10. Determination of Cholesterol in serum or plasma

Subject Name- Immunology and Bacterial serology (PRACTICAL)

Subject code-BMM- 306

1. Collection of blood sample by vein puncture, separation and preservation of serum
2. Performing Haemolysin titration for Rose-Waaler test
3. Preparation of Phosphate buffers, Verinol buffer, ASO buffer, Richardson's buffer, Buffers of different pH and Molarity, Tris buffer, Standardization of cell concentrationby Spectrophotometer
4. Performance of Serological tests i.e.
   Widal,
   Brucella Tube Agglutination,
   VDRL (including Antigen Preparation),
   ASO (Anti-Streptolysin _O')
   C-Reactive Protein (Latex agglutination)
   Rheumatoid factor (RF) Latex agglutination
   Rose Waaler test,
5. Demonstration of antigen/antibody determination by Immuno fluorescence (IF),Immunodiffusion, precipitation in Agarose gel (Ouchterlony), CCIEP, ELISA, SDS - PAGE and Western blotting.

Subject Name- Blood Banking and Blood transfusion (PRACTICAL)

Subject code- BMM-307

1. To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions
2. Screening of blood donor: physical examination including medical history of the donor
3. Collection and preservation of blood for transfusion purpose
4. Screening of blood for Malaria, Microfilaria, HBs Ag, Syphilis and HIV
5. To determine the ABO & Rh grouping
   Direct or preliminary grouping
   Indirect or proof grouping
   Rh grouping and determination of Du in case of Rh negative
6. To perform Direct and Indirect Coomb's test
7. To perform cross matching
   Major cross matching
   Minor cross matching
8. Preparation of various fractions of blood.

Subject Name- Haematological diseases (PRACTICAL)

Subject code-BMM- 308

1. Parts of microscope; its functioning and care
2. Parts of centrifuge; its functioning and care
3. Cleaning and drying of glassware
4. Preparation of various anticoagulants
5. Collection of venous and capillary blood
6. Cleaning of glass-syringes and its sterilization
7. Preparation of the stains and other reagents
8. Preparation of peripheral blood film (PBF)
9. Staining of PBF
10. Haemoglobin estimation methods (Sahli's, Oxyhaemoglobin, and cyanmethaemoglobin)
11. Differential leukocyte count (DLC)
12. Recognition and staining of various types of blood cells (normal and abnormal)
13. Preparation of thick and thin blood smear for malarial parasite (Leishman/Giemsa/JSB)
14. RBC counting
15. WBC counting
16. Platelet counting
17. Routine Examination of urine

FORTH SEMESTER

Subject Name- Systemic Bacteriology

Subject code-BMM- 401

Rationale: This subject will give information about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

1. Bacterial culture

   Instruments used to seed culture media

   Culture procedures – seeding a plate

2. Staining techniques in bacteriology

   Significance of staining in bacteriology

   Principle, Reagent preparation, procedures and interpretation of the following

   Simple staining

   Negative staining

   Gram stain

   Albert's stain

   Neisser's stain

   Ziehl –Neelsen staining

   Capsule staining

   Flagella staining

   Spore staining

   2.1.9 Fontana stain for spirochetes

3. Principle, procedures and interpretation of the following biochemical tests foridentification of different bacteria.

   3.1 Catalase

   3.2 Coagulase

   3.3 Indole

   3.4 Methyl Red

   3.5 VogesProskauer

   3.6 Urease

   3.7 Citrate

3.8 Oxidase

3.9 TSIA

3.10 Nitrate reduction

3.11 Carbohydrate fermentation

3.12 Huge and Leifson

3.13 Bile solubility

3.14 H 2 S production

3.15 Demonstration of motility

3.16 Decarboxylases

3.17 CAMP

3.18 Hippurate hydrolysis

3.19 Nagler's reaction

3.20 Cholera-red reaction

4. Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria

4.1 Staphylococcus

4.2 Streptococcus

4.3 Pneumococcus

4.4 Neisseria gonorrhea and Neisseria meningitis

4.5 Haemophilis

4.6 Corynebacterium

4.7 Enterobacteriaceae: Escherichia coli, Klebsiella, Citrobacter, Enterobacter, Proteus,Salmonella, Shigella, Yersinia enterocolitica and Yersinia pestis

4.8 Vibrio, Aeromones and Plesiomonas

4.9 Clostridia of wound infection

4.10 Mycobacterium tuberculosis complex, Atypical Mycobacteria and M. leprae

4.11 Spirochetes – Treponema, Borrellia and leptospira

4.12 Bordetella and brucella

4.13 Mycoplasma and Ureaplasma

4.14 Rickettsia

4.15 Chlamydia

4.16 Actinomycetes

4.17 Pseudomonas and Burkholderia

4.18 Brief introduction about non sporing anaerobic cocci and bacilli

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker& Satish Gupte
4. Medical laboratory Technology Vol. I, II, III by Mukherjee

Subject Name- Medical Parasitology and Entomology

Subject code-BMM- 402

Rationale

The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

1. Introduction to Medical Parasitology with respect to terms used in Parasitology.
2. Protozoology/ Protozoal parasites:

General characteristics of protozoa.

Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba sp.

Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Intestinal and vaginal flagellates i.e. Giardia, Trichomonas sp.

Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of blood and tissue flagellates i.e. Plasmodium and Toxoplasmasp.

3. Helminthology/ Helminthic parasites:

General characteristics of Cestodes, Trematodes and Nematodes

Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of :

Taeniasolium and saginata

Echinococcusgranulosus

Hymenolepis nana

Schistosoma haematobium and mansoni

Fasciola hepatica and buski

Trichuristrichura

Trichinellaspirales

Strongyloidesstercoralis

Ancylostomaduodenale

Enterobiusvermicularis

Ascarislumbricoides

Wuchereriabancrofti

Dracunculusmedinensis

4. Diagnostic procedures:

   Examination of Stool for parasites

   For intestinal protozoal infections

   General rules for microscopic examination of stool samples

   Collection of stool samples

   Preparation of material for unstained and stained preparations

   Staining methods i.e. Iodine staining and permanent staining

   For Helminthic infections

   Introduction, direct smear preparation and examination

   Concentration techniques i.e. Flotation and sedimentation techniques

   Egg counting techniques

   Examination of blood for parasites

   Preparation of thin and thick blood film

   Leishman staining

   Examination of thick and thin smear

   Field's stain

   JSB stain

5. Examination of blood film for Malarial parasite and Microfilariae
6. Collection, Transport, processing and preservation of samples for routine parasitologicalinvestigations
7. Morphology, life cycle and lab-diagnosis of Giardia and Entamoeba
8. Morphology, life cycle and lab-diagnosis of Roundworms and Hookworms
9. Morphology, life cycle and lab-diagnosis of T. solium and T. saginata
10. Morphology, life cycle and lab-diagnosis of Malarial parasite with special reference toP.vivax and P. falciparum
11. Laboratory diagnosis of hydated cyst and cysticercosis
12. Concentration techniques for demonstration of Ova and Cysts (Principles andapplications)

Suggested Readings

1. Parasitology in relation to Clinical Medicine by K D Chhatterjee
2. Medical Entomology by A.K. Hati, Pub. Allied Book Agency
3. Medical Parasitology by D.R. Arora
4. Clinical Parasitology by Paul Chester Beaver

Subject Name- Instruments, Reagents and analytical clinical biochemistry

Subject code BMM- 403

Rationale

The students will learn basic principles/mechanisms, procedures and various types of techniques commonly performed in analytical biochemistry such as:

1. Spectrophotometry and colorimetry

   Introduction

   Theory of spectrophotometry and colorimetry

   Lambert`s law and Beer`s law

   Applications of colorimetry and spectrophotometry

2. Photometry

   Introduction

   General principles of flame photometry

   Limitations of flame photometry

   Instrumentation

   Applications of flame photometry

   Atomic absorption spectroscopy – Principle & applications

3. Chromatography

   3.1 introduction

   3.2 Types of chromatography

   3.3 Paper Chromatography: Introduction, principle, types, details for qualitative andquantitative analysis, application

   3.4 Thin layer chromatography: Introduction, experimental techniques, application ofTLC, limitations, High performance thin layer chromatography

   3.5 Column chromatography: Introduction, principle column efficiency, application ofcolumn chromatography

   3.6 Gas chromatography: Introduction principle, instrumentation, application

   3.7 Ion exchange chromatography: Introduction, Definition, principle,cation and anion exchange,application

   Gel Chromatography: Introduction Principle and method, application and advantages

4. Electrophoresis

4.1 introduction

Principle

4.2.1 Instrumentation

4.2.2 Applications

4.3 Types of electrophoresis

4.3.1 Paper electrophoresis

4.3.2 Gel electrophoresis

Suggested readings

1. Practical Clinical Biochemistry by Harold Varley
2. Text book of Medical Laboratory Technology by P. B. Godker
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chatterjee, Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer

Subject Name- Haematology (Applied and Advanced)

Subject code-BMM- 404

Rationale: The students will be made aware of the methods of estimating different components of blood. Students will learn the basic concepts of staining and coagulation in Haematology laboratory.

1. Haemoglobinometry: Different methods to measure Haemoglobin with merits anddemerits
2. Haemocytometery: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors.
   RBC Count,
   Total leucocytes count(TLC)
   Platelet Count.
   Absolute Eosinophil count
3. Principle mechanism and different methods with merit and demerits for the measuringErythrocyte Sedimentation Rate(ESR) and its significance
4. Different methods with merit and demerits for packed cell volume/Haematocrit value
5. Preparation of blood films
   Types, Methods of preparation (Thick and thin smear/film) and utility
6. Staining techniques in Haematology (Romanowsky'sstains)
   :Principle,
   composition,preparationofstainingreagentsandprocedureofth
   efollowing
   Giemsa'sstain
   Leishman'sstain
   Wright'sstain
   Field's stain
   JSBstain.
7. Differential leucocytes count(DLC)
8. Normal and absolute values in Haematology
9. Physiological variations in Hb, PCV,TLC and Platelets
10. Macroscopic and microscopic examination of seminal fluid

11. Examination of CSF and other body fluids for cytology i.e. pleural, peritoneal and synovialfluid etc.
12. Preparation of Reagents for coagulation studies:
    - **12.0** M/40 Calcium chloride
    - **12.1** Brain Thromboplastin
    - **12.2** Cephalin
    - **12.3** Adsorbed Plasma
13. Screening Tests for coagulation Studies and their significance

Applied Haematology-2

Rationale: The students will be made aware of the safety precautions in Haematology, basic concepts of Automation, quantitative assay of coagulation factors, Karyotyping etc. and will learn about concepts such as safety precautions, quality assurance, biomedical waste management and automation in haematology. It will also cover bone marrow examination, red cell anomalies, disorder of leucocytes, L.E. cell phenomenon.

1. Safety precautions in Haematology
2. Basic concepts of automation in Haematology with special reference to:
   Blood cell counter
   Coagulometer
3. Bone marrow examination
   Composition and functions
   Aspiration of bone marrow (Adults and children)
   Processing of aspirated bone marrow (Preparation & staining of smear)
   Brief knowledge about examination of aspirated bone marrow (differential cell countsandcellular ratios)
   Processing and staining of trephine biopsy specimens
2. Red cell anomalies
   Morphological changes such as variation in size shape & staining character.
3. Reticulocytes: Definition, different methods to count, Absolute reticulocyte count andIRF (Immature reticulocyte fraction) and significance of reticulocytes.
4. Lupus Erythematosus (L.E) cell phenomenon.

4.1 Definition of L.E. cell.

4.2 Demonstration of L.E. cell by various methods.

4.3 Clinical significance.

5. Correction studies for Factor deficiency

6. Quantitative assay of coagulation factors

6.1 Principle

6.2 Procedure

7. Screening of inhibitors

7.1 Inhibitors against coagulation factors

7.2 APLA

8. Karyotyping: Chromosomal studies in hematological disorders (PBLC and Bone marrow)

9. Cyto-chemical staining: Principles, method and significance

10. Biomedical waste management in Haematology laboratory (Other than Radioactivematerial

2. Advanced Haematology

The students will be made aware of different anemia, Leukemia, chromosomal studies, bleeding disorders and radiation hazards

1. Laboratory diagnosis of Iron deficiency anemia
2. Laboratory diagnosis of Megaloblastic anemia & Pernicious anemia
3. Classification and Laboratory diagnosis of Hemolytic anemia
4. Definition, classification and laboratory diagnosis of Leukemia
5. Chromosomal studies in various hematological disorders and their significance.
6. Laboratory diagnosis of bleeding disorders with special emphasize to
   Hemophilia A, B & Von-Willebrand disease
   DIC
   6.3 Platelet disorder (Qualitative and quantitative)
7. Laboratory approach for investigating thrombosis.
8. Using radioisotopes measurement of:
   - **8.0** Blood volume
   - **8.1** Determination of Red cell volume and Plasma volume
   - **8.2** Red cell life span
   - **8.3** Platelet life span
   - **8.4** Radiation hazards and its prevention
   - **8.5** Disposal of radioactive material

Suggested Readings

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Practical Haematology by JB Dacie
4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John BernardHenary
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice
7. Postgraduate Haematology by Hoffbrand

Subject Name- Systemic Bacteriology (PRACTICAL)

Subject code- BMM-405

1. To demonstrate the instruments used to seed culture media
2. To learn techniques for Inoculation of bacteria on culture media
3. To isolate specific bacteria from a mixture of organisms.
4. To demonstrate simple staining (Methylene blue)
5. To prepare India ink preparation to demonstrate negative staining.
6. Bacterial identification: To demonstrate reagent preparation, procedure and interpretationfor

   Gram stain

   Albert stain

   Neisser's staining

   Z-N staining

   Capsule staining

   Demonstration of flagella by staining methods

   Spore staining

   To demonstrate spirochetes by Fontana staining procedure
7. To prepare the reagent and demonstrate following biochemical tests with positive andnegative control bacteria:

   Catalase

   Coagulase

   Indole

   Methyl Red (MR)

   VogesProskauer (VP)

   Urease

   Citrate

   Oxidase

   TSIA

   7.9 Nitrate reduction

   7.10 Carbohydrate fermentation

   7.11 Huge and Leifson

7.12 Bile solubility

7.13 H2S production

7.14 Demonstration and motility

7.15 Decarboxylases

7.16 CAMP

7.17 Hippurate hydrolysis

7.18 Nagler's reaction

8. To demonstrate various characteristics (morphological, cultural and biochemical) ofbacteria commonly isolated from clinical samples i.e.

8.1 Staphylococcus

8.2 Streptococcus

8.3 Corynebacterium

8.4 Escherichia coli

8.5 Klebsiella

8.6 Citrobacter

8.7 Enterobacter

8.8 Proteus

8.9 Salmonella

8.10 Shigella

8.11 Vibrio cholera

8.12 Mycobacterium tuberculosis

8.13 Pseudomonas

Subject name- Medical Parasitology and Entomology (PRACTICAL)

Subject code-BMM-406

1. Routine stool examination for detection of intestinal parasites with concentrationmethods:
   - Saline preparation
   - Iodine preparation
   - Floatation method
   - Centrifugation method
   - Formal ether method
   - Zinc sulphate method
2. Identification of adult worms from models/slides:
   - Tapeworm
   - Tapeworm segments
   - Ascaris (Round worm)
   - Hookworms
   - Pinworms
3. Malarial parasite:
   - Preparation of thin and thick smears
   - Staining of smears
   - Examination of smears for malarial parasites (P. vivax and P. falciparum)

Subject name- Instrument, Reagent & Analytical Biochemistry (PRACTICAL)

Subject code-BMM-407

1. To demonstrate the principle, working & maintenance of spectrophotometer.
2. To demonstrate the principle, working & maintenance of colorimeter.
3. To demonstrate the principle, working & maintenance of flame photometer.
4. To demonstrate the principle, procedure of paper chromatography.
5. To demonstrate the principle & procedure of Gas chromatography.
6. To demonstrate the principle & demonstration of TLC.
7. To demonstrate the principle & procedure of column chromatography.
8. To demonstrate the principle & procedure of Electrophoresis

Subject name- Haematology (Applied and Advanced) (PRACTICAL)

Subject code-BMM-408

1. HbEstimation
   Sahli'smethod
   Cyanmethahaemoglobinmethod
   Oxyhaemoglobinmethod
2. Totalleukocytecount
3. Plateletscount
4. AbsoluteEosinophil count
5. PreparationofsmearandstainingwithGiemsaandLeishmanstain.
6. ESR(WintrobeandWestergrenmethod)
7. Packedcellvolume(Macro&Micro)
8. CytologicalexaminationofCSF andotherbody fluids
9. Physical andMicroscopic examinationof seminalfluidincludingsperm count
10. Perform normal DLC
11. Preparation of M/40 Calcium chloride
    11.0 Brain thromboplastin and standardization
    11.1 Cephalin
    11.2 Adsorbed plasma
12. Perform BT, CT, Hess test, PT and APTT
    1. Review the morphology of Normal and abnormal RBCs
    2. Review the morphology of normal and immature WBCs
    3. WBCs anomalies
    4. Calculating INR and determining the ISI of thromboplastin
    5. Quantitative Factor assays:
       Factor VIII
       Factor IX
       Factor VII
       Factor X
       Factor V
    6. Quantification of inhibitors (Bethesda method)

7. APLA : Lupus Anticoagulant (LA)
8. Anti-cardiolipin antibodies (ACA)
9. Perform Euglobulin clot lysis test (ELT)
10. Urea clot solubility test for factor XIII.

1. Study and interpretation of Histogram of Automated Blood cell counter
2. To estimate serum iron and total iron binding capacity.
3. Screening tests for enzymes deficiency: Pyruvate Kinase, G6PD
4. To estimate Hb-F, Hb-A2 in a given blood sample.
5. To estimate plasma and urine Hemoglobin in the given specimens.
6. To demonstrate the presence of Hb-S by Sickling and Solubility tests.
7. Perform Hb electrophoresis (alkaline)
8. Perform osmotic red cell fragility.
9. Detection of Fibrin degradation products (FDPs)
10. To perform various platelet function tests such as whole blood clot retraction test, prothrombin consumption index (PCI) Platelet adhesion, aggregation and PF3 availability test.
11. Estimation of Protein C, S
12. Peripheral Blood Lymphocyte Culture for chromosome studies in Leukemia.

FIFTH SEMESTER

Subject Name- Histopathology & Cytopathology

Subject code-BMM-501

Histopathology

Rationale: In this section students will be made aware of term inologyusedinhistotechnology ,various instruments and their maintenance and also learn the processing of various samples for histopathological investigations.

1. Introduction to Histotechnology
2. Compound microscope:

   Optical system, magnification and maintenance

   Microscopy:

   Working principle

   Applications of various types of microscopes i.e. dark field, polarizing, phase contrast, interference and fluorescent microscope
3. Care and maintenance of laboratory equipment used in histotechnology
4. Safety measures in a histopathology laboratory
5. Basic concepts about routine methods of examination of tissues
6. Collection and transportation of specimens for histological examination
7. Basic concepts of fixation
8. Various types of fixatives used in a routine histopathology laboratory
   - **8.1** Simple fixatives
   - **8.2** Compound fixatives
   - **8.3** Special fixatives for demonstration of various tissue elements
9. Decalcification
   - **9.1** Criteria of a good decalcification agent
   - **9.2** Technique of decalcification followed with selection of tissue, fixation, anddecalcification, neutralization of acid and thorough washing
   - **9.3** Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Useof Ion-exchange resigns and Electrophoretic decalcification and treatment of hard tissueswhich are not calcified
10. Processing of various tissues for histological examination
    - **10.1** Procedure followed by Dehydration, Clearing, Infiltration and routine

timingschedule for manual or automatic tissue processing.

10.2 Components & principles of various types of automatic tissue

10.3 Processors

10.4 Embedding:

10.4.1 Definition

10.4.2 Various types of embedding media

11. Section Cutting

11.1 Introduction regarding equipment used for sectioning

11.2 Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, varioustypes of microtome and their applications

11.3 Freezing Microtome and various types of Cryostats.

11.4 Faults in paraffin section cutting with reason and remedy, spreading the sections andattachment or mounting of sections to glass slides.

12. Staining, Impregnation and Mountants

12.1 Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry

12.2 Stains and Dyes and their uses

12.3 Types of Stains, Chemical Staining Action, Mordants andAccentuators,Metachromasia

12.4 Use of Controls in Staining Procedures

12.5 Preparation of Stains, solvents, aniline water and buffers etc.

12.6 Commonly used mountants in histotechnology lab

12.7 General Staining Procedures for Paraffin Infiltrated and Embedded tissue

12.8 Nuclear Stains and Cytoplasmic stains

12.9 Equipment and Procedure for manual Staining and Automatic Staining Technique

12.10 Mounting of Cover Slips, Labeling and Cataloguing the Slides

13. Routine Staining Procedures

Haematoxylin and Eosin Staining, various types of Haematoxylins 13.2Mallory's Phosphotungstic Acid Haematoxylin (PTAH

Suggested Readings

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft

Cytolopathology

Rationale: The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures &handling & testing of various cytological specimens.

1. Cryostat sectioning, its applications in diagnostic cytopathology
2. Enzyme Cytochemistry:

   Diagnostic applications

   Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases
3. Vital staining for Sex Chromatin
4. Aspiration cytology:

   Principle

   Indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics
5. Exfoliative cytology (Papanicolaou technique for the staining of cervical smears)

   Cervical cytology

   Fluid Cytology

   Urine

   CSF

   Body Fluids (Pleural, Pericardial, Ascitic)
6. Automation in cytology
7. Liquid based cytology: Principles and preparation, Cytocentrifuge, molecular cytology, CellBlock and Immune-cytochemistry

Suggested Readings

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft
5. Diagnostic Cytology by Koss Volume -II

Subject name- Mycology

Subject code-BMM-502

Rationale

The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various Medically important Viruses

1. Introduction to Medical Mycology
2. Basic concepts about superficial, subcutaneous mycosis, deep Mycoses and opportunistic mycosis
3. Taxonomy and classification and general characteristics of various medicallyimportant fungi
4. Normal fungal flora
5. Morphological, cultural characteristics of common fungal laboratory contaminants
6. Culture media used in mycology
7. Direct microscopy in Medical mycology laboratory
8. Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids
9. Techniques used for isolation and identification of medically important fungi
10. Methods for identification of yeasts and moulds
11. Dimorphism in fungi
12. Antifungal susceptibility tests
13. Preservation of fungal cultures
14. Routine myco-serological tests and skin tests

Suggested Readings

1. Practical Medical Microbiology by Mackie &MacCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Panikar& Satish Gupte
4. Medical laboratory Technology Vol. I ,II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol. II Microbiology by MonicaCheesbrough
6. Medical Mycology by Dr. JagdishChander

Subject name- Virology

Subject code-BMM-503

Rationale

The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various Medically important Viruses.

Virology:

1. Introduction to medical virology
2. Introduction to medically important viruses including DNA viruses, RNA viruses, Arbo viruses, HIV, HBV, HCV, Corona virus and oncogenic viruses
3. Structure and Classification of viruses.
4. Multiplication of viruses
5. Collection, transportation and storage of sample for viral diagnosis
6. Staining techniques used in Virology
7. Processing of samples for viral culture (Egg inoculation and tissue culture)
8. Rapid diagnosis of viral infections with special reference to HIV, HBV and HCV
   EIA
   Immunofluorescence
   PCR

1. Practical Medical Microbiology by Mackie & MacCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Panikar& Satish Gupte
4. Medical laboratory Technology Vol. I ,II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol. II Microbiology by MonicaCheesbroug

Subject name- Applied Microbiology

Subject code-BMM-504

Rationale: This part will cover the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing. This will also cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections. Further it will make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.

1. Laboratory strategy in the diagnosis of various infective syndromes: Samples of choice, collection, transportation and processing of samples for laboratory diagnosis of the following complications:

   Septicemia and bacteremia

   Upper Respiratory tract infections

   Lower respiratory tract infections

   Wound, skin, and deep sepsis

   Urinary tract infections

   Genital Tract infections

   Meningitis

   Gastro intestinal infections

   Enteric fever

   1.9 Tuberculosis (Pulmonary and Extra-pulmonary)

   1.10 Pyrexia of unknown origin

2. Antibiotic susceptibility testing in bacteriology

   2.1 Definition of antibiotics

   2.2 Culture medium used for Antibiotic susceptibility testing

   2.3 Preparation and standardization of inoculum

   2.4 Control bacterial strains

   2.5 Choice of antibiotics

   2.6 MIC and MBC: Concepts and methods for determination

   2.7 Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method

3. Basics of Nucleic acid techniques in diagnostic microbiology with special reference toPolymerase chain reaction (PCR)
4. Automation in bacterial culture detection and antimicrobial susceptibility testing:Principles and importance.
5. Bacteriological examination of water, milk, food and air
   - **5.1** Examination of water
     Collection and transportation of water sample
     - **5.1.2** Presumptive coliform count
     - **5.1.3** Eijkman test
     - **5.1.4** Introduction and importance of other bacteria considered as indicators of fecalcontamination
     - **5.1.5** Membrane filtration tests
     - **5.1.6** Interpretation of results
   - **5.2** Examination of Milk and milk products
     - **5.2.1** Basic Concepts regarding gradation of milk
     - **5.2.2** Various tests for Bacteriological examination of milk
   - **5.3** Examination of food articles
     - **5.3.1** Basic Concepts regarding classification of food like frozen food, canned food,raw food, cooked food etc.
     - **5.3.2** Various tests for Bacteriological examination with special reference to foodpoisoning bacteria
   - **5.4** Examination of Air
     - **5.4.1** Significance of air bacteriology in healthcare facilities
     - **5.4.2** Settle plate method
     - **5.4.3** Types of air sampling instruments
     - **5.4.4** Collection processing and reporting of an air sample
6. Sterility testing of I/v fluids
   - **6.1** Collection, transportation and processing of I/v fluids for bacterial contamination
   - **6.2** Recording the result and interpretation
7. Nosocomial Infection:
   - **7.1** Introduction, sources and types of nosocomial infections.

7.2 Surveillance of hospital environment for microbial load.

7.3 Role of microbiology laboratory in control of nosocomial infections

8. Epidemiological markers:

8.1 Introduction

8.2 Types

8.3 Serotyping

8.4 Phage typing and

8.5 Bacteriocin typing

9. Preservation methods for microbes

9.1 Basic concepts of preservation of microbes

9.2 Why do we need to preserve bacteria?

9.3 Principle and procedures of various short term and long term preservation methodswith special reference to Lyophilization

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker& Satish Gupte
4. Medical laboratory Technology Vol. I ,II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol II Microbiology by MonicaCheesbrough
6. Hospital Acquired Infections-Power strategies for clinical practice by Dr. V Muralidharand SumathiMurlidhar
7. Control of Hospital infection-A practical Handbook by GajAyliffe, A.P. Fraise, A.M.Geddes, K. Mitchell

Subject name-Histopathology & Cytopathology (PRACTICAL)

Subject code-BMM-505

1. Demonstration of instruments used for dissection
2. Use of antiseptics, disinfectants and insecticides in a tissue culture processing laboratory
3. Reception and labeling of histological specimens
4. Preparation of various fixatives

   Helly's fluid

   Zenker's fluid

   Bouin's fluid

   Corney's fluid

   10% Neutral formalin

   Formal saline

   Formal acetic acid

   Pereyn's fluid
5. Testing of melting point of paraffin wax and perform embedding of given tissue inparaffin block
6. To process a bone for decalcification
7. To prepare ascending and descending grades of alcohol from absolute alcohol
8. Processing of tissue by manual and automated processor method
9. To demonstrate various part and types of microtome
10. To learn sharpening of microtome knife (Honing and stropping technique), and types ofdisposable blades in use (High and Low Profile).
11. To perform section cutting (Rough and Fine)
12. To practice attachment of tissue sections to glass slides
13. To learn using tissue floatation bath and drying of sections in oven (60-65C)
14. To perform & practice the Haematoxylin and Eosin staining technique
15. To perform & practice the Mallory's Phospho tungstic Acid Haematoxylin (PTAH)
16. To learn mounting of stained smears

Cytopathology –

1. To perform Papnicolaou's stain on cervical smear
2. To perform Guard's staining for demonstration sex chromatin (Barr bodies on a buccalsmear)
3. To perform Shorr's staining for Hormonal assessment
4. To cut frozen sections of Gynaec tissue
5. To perform CSF sample and body fluids by cytospin
6. Should know the various stains used in Cytology lab:|| May Grunwald Giemsa, H&E,PAS, Grocott's.

Subject name- Mycology (PRACTICAL)

Subject code-BMM-506

1. To prepare culture media used routinely in mycology
2. To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.
3. To identify given yeast culture by performing various identification techniques studied in theory.
4. To identify given mould culture by performing various identification techniques studied in theory.
5. To demonstrate dimorphism in fungi
6. To collect and process clinical samples for laboratory diagnosis of fungal infections i.e.

   Skin

   Nail

   Hair

   Body fluids and secretions

Subject name-Virology (PRACTICAL)

Subject code-BMM--507

1. To demonstrate structure of viruses and their multiplication from charts etc.
2. To perform Giemsa stain, Seller's stain, immunofluorescent staining procedures fordiagnosis of viral infections
3. Demonstration of fertilized hen egg
4. Demonstration of various inoculation routes in fertilized hen egg

Subject name-Applied Microbiology (PRACTICAL)

Subject code-BMM-508

1. Inoculation of different culture media
2. Isolation of pure cultures
3. Processing of following clinical samples for culture and identification of bacterialpathogens:
   - Blood
   - Throat swab
   - Sputum
   - Pus
   - Urine
   - Stool for Salmonella, Shigella and Vibrio cholerae
   - C.S.F. and other body fluids
4. Demonstration of PCR
5. Demonstration of automation in bacterial culture detection and antimicrobialsusceptibility testing
6. Antimicrobial susceptibility testing
   - Introduction and terms used
   - Preparation and standardization of inoculum
   - To demonstrate reference bacterial strains
   - To determine MIC and MBC of known bacteria against a known antibiotic
   - To perform antibiotic susceptibility testing of clinical isolates by using
   - Stokes method
   - Kirby-Bauer method
7. Collection, transportation and processing of following articles for bacteriologicalexamination:
   - Water
   - Milk
   - Food and
   - Air
8. To demonstrate sterility testing of intravenous fluid with positive and negative controls
9. Demonstration of serotyping and bacteriocin typing
10. Demonstration of lyophilization and other available preservation methods

SIXTH SEMESTER

Subject name- Immunopathology

Subject code-BMM-601

Rationale: The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the immune disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important cells of immune system, lymphoid organs, antigen, antibody, Ag-Ab. reactions, transplant immunology etc. & automation techniques.

1. Introduction to Immunology
2. Cells of the immune system
3. Types and Mechanisms of immune response
4. Lymphoid organs of the Immune system
5. MHC I & II
6. HLA Typing & Cross matching
7. Transplant Immunology
8. Hypersensitivity: Definition, Types, Mechanisms
9. Autoimmunity
10. Immune tolerance : Basic concepts

Subject Name- Molecular Biology

Subject code-BMM--602

Rationale: Molecular biology concerns the molecular basis of biological activity between biomolecules in the various systems of a cell, including the interactions between DNA, RNA and proteins and their biosynthesis, as well as the regulation of these interactions. A basic introduction of molecular biology and its techniques like PCR, RTPCR etc. will also be rendered to sensitize students to take up future molecular biology challenge

1. Introduction to Molecular Biology

2. Relationship of Mol. Biology with other Science

3.Molecular Biology Techniques : Principle, Reagents used, procedure and applications inMedical diagnostics

3.1 Polymerase Chain Reaction and its advanced versions

3.2 Gel electrophoresis

3.3 Western blotting

4.Chemical composition of DNA

4.1 DNA replication

4.2 DNA damage and repair

4.3 Regulation of prokaryotic and eukaryotic gene expression

4.4 Cell Cycle

Suggested Readings

1. Immunology by Ivan Roitt, JonathaanBrostoff and David Male
2. Immunology by Kuby
3. Medical Immunology by Daniel P Stites
4. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites
5. Elements of Biotechnology by PK Gupta
6. Watson Molecular Biology of Gene
7. Advanced Molecular Biology by R Twyman
8. Principal of Biochemistry by Lehninger

Subject name- Medical laboratory management System

Subject code-BMM-603

The course is intended to provide knowledge about the basic principles of Management listed below, in addition to MLS management:

1. Introduction to management
2. Strategic Management
3. Foundations of Planning
4. Planning Tools and Techniques
5. Decision Making, conflict and stress management
6. Managing Change and Innovation
7. Understanding Groups and Teams
8. Leadership
9. Time Management
10. Cost and efficiency

Rationale:

The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab. In addition they will understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

1. Ethical Principles and standards for a clinical laboratory professional
   Duty to the patient
   Duty to colleagues and other professionals
   Duty to the society
2. Good Laboratory Practice (GLP) Regulations and Accreditation
   Introduction to Basics of GLP and Accreditation
   Aims of GLP and Accreditation
   Advantages of Accreditation
   Brief knowledge about National and International Agencies for clinical laboratoryaccreditation
3. Awareness / Safety in a clinical laboratory

General safety precautions

HIV: pre- and post-exposure guidelines

Hepatitis B & C: pre- and post-exposure guidelines

Drug Resistant Tuberculosis

4. Patient management for clinical samples collection, transportation and preservation
5. Sample accountability

   Purpose of accountability

   Methods of accountability
6. Sample analysis

   Introduction

   Factors affecting sample analysis
7. Reporting results

   Basic format of a test report

   Reported reference range

   Clinical Alerts

   Abnormal results

   Turnaround time

   Results from referral laboratories

   Release of examination results

   Alteration in reports
8. Quality Management system

   Introduction

   Quality assurance

   Quality control system

   Internal and External quality control
9. Biomedical waste management in a clinical laboratory
10. Introduction and importance of calibration and Validation of Clinical Laboratoryinstruments
11. Laboratory Information system (LIS), Hospital Information system (HIS) and financialManagement

    11.0 Introduction

    11.1 Functions of a laboratory management system

    11.2 Standards for laboratory management system

11.3 Introduction and awareness of financial management in a clinical laboratory

12. Ethics in Medical laboratory Practice

12.1 Understanding the term _Ethics'

12.2 Ethics in relation to the following:

Pre-Examination procedures

12.2.1 Examination procedures

12.2.2 Reporting of results

12.3 Understanding the term _Ethics'

12.4 Ethics in relation to the following:

12.4.1 Pre-Examination procedures

12.4.2 Examination procedures

12.4.3 Reporting of results

12.5 Preserving medical records

12.6 Access to Medical laboratory Records

13. Procurement of equipment and Inventory Control

13.1 Audit in a Medical Laboratory

13.2 Introduction and Importance

13.3 Responsibility

13.4 Planning

13.5 Horizontal, Vertical and Test audit

13.6 Frequency of audit

13.7 Documentation

Subject name- Biotechnology

Subject code-BMM-604

Unit 1: Introduction to biotechnology and basic DNA cloning

Milestones in genetic engineering and biotechnology. Simple cloning of DNA fragments, Vectors: Definition and properties. *E. coli* expression vectors-lac, tac and T7 promoter based vectors. Yeast expression vectors - pET yeast vectors, YIp, YEp and YCp vectors. Baculovirus based vectors. Ti based vectors (Binary and Cointegrated vectors) and cloning using linkers and adaptors. Transformation of DNA by chemical method and electroporation.

Unit 2

(A). **Construction of genomic libraries:** Genomic and cDNA libraries: Preparation and uses. Screening of libraries by colony hybridization and colony PCR.

(B). **DNA sequencing and product of DNA technology:** Maxam-Gilbert's and Sanger's method. Automated sequencing.Human genome sequencing project. Human protein replacements-insulin, hGH and Factor VIII. Human therapies - tPA, interferon, antisense molecules. Bttransgenics-rice, cotton, brinjal

Subject name- Immunopathology (PRACTICAL)

Subject code- BMM-605

1. Peripheral blood mononuclear cell (PBMC) isolation by gradient centrifugation
2. T and B cell separation
3. Immunofluorescence

Anti- Nuclear Antibody (ANA)

Anti- Neutrophil Cytoplasmic Antibody (ANCA)

4. AIDS Immunology and Pathogenesis (AIP)
5. Molecular Typing Thyroid Microsomal antigen (TMA)- Agglutination reactions
6. Electrophoresis
7. Gel diffusion
8. Nephlometery
9. HLA

   Typing Serology & Cross match
10. Nitro blue Tetrazolium Chloride Test (NBT)
11. FACS for CD4 and CD8
12. ELISA for lab. diagnosis of AIDS

Subject name- Molecular Biology (PRACTICAL)

Subject code-BMM - 606

1. Polymerase Chain Reaction and its advanced versions
2. Gel electrophoresis
3. Western blotting
4. Isolation of DNA and RNA
5. Estimation of DNA and RNA
6. Determination of molecular weight and quantification of DNA using agarose gelelectrophoresis

Subject name- Laboratory Management System (PRACTICAL)

Subject code-BMM--607

1. Clinical sample collection e.g.
   Blood
   Urine
   Stool
   Saliva
   Sputum
   Semen analysis
2. Sample accountability
   Labeling of sample
   Making entries in Laboratory records
3. Reporting results
   Basic format of a test report
   Release of examination results
   Alteration in reports
4. Quality Management system
   Quality assurance
   Internal and External quality control
   Quality improvement
5. Biomedical waste management in a clinical laboratory - Disposal of used samples, reagentsand other biomedical waste
6. Calibration and Validation of Clinical Laboratory instruments
7. Ethics in medical laboratory practice in relation to the following:
   Pre-Examination procedures
   Examination procedures
   Reporting of results
   Preserving medical records
   Access to medical laboratory records
8. Audit in a Medical Laboratory -Documentation

Subject name- Biotechnology (PRACTICAL)

Subject code-BMM-608

1. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
2. Ligation of DNA fragments.
3. Demonstration of PCR.
4. Demonstration of DNA sequencing.
5. Interpretation of sequencing gel electropherograms.

SEVENTH SEMESTER

Subject name- Microbial Genetics

Subject code-BMM-701

1. Continuity of life-heredity, variation;
2. Mendel's laws of inheritance,
3. Chromosomal basis of inheritance; other patterns of inheritance- incomplete dominance,multi parallelism, quantitative inheritance.
4. Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination;
5. Molecular genetics: DNA as a genetic material- its structure and replication; structure ofRNA and its role in protein synthesis, Vectors, plasmids
6. Human Genetics
7. Microbial genetics

Suggested Reading-

1. Genes by Benjamin Lewin
2. Genetics by B.D. Singh
3. Principals of Genetics by Gardner
4. Instant Noteson Genetics by PC Winter, GI Hickey and HL Fletcher

Subject name- Research Methodology

Subject code-BMM-702

Rationale: The objective of this module is to help the students understand the basic principles ofresearch and methods applied to draw inferences from the research findings. The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables.

Research Methodology:

1. Introduction to research methods
2. Identifying research problem
3. Ethical issues in research
4. Research design
5. Basic Concepts of Biostatistics
6. Types of Data
7. Research tools and Data collection methods
8. Sampling methods
9. Developing a research proposal

Subject name- Biostatistics

Subject code-BMM-703

Rationale: The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables.

Biostatistics:

1. Need of biostatistics
2. What is biostatistics: beyond definition
3. Understanding of data in biostatistics
4. How & where to get relevant data
5. Relation between data & variables
6. Type of variables: defining data set
7. Collection of relevant data: sampling methods
8. Construction of study: population, sample, normality and its beyond (not design of study,perhaps)
9. Summarizing data on the pretext of underlined study
10. Understanding of statistical analysis (not methods)

Suggested readings

1. Statistical Methods by S. P. Gupta
2. Methods in biostatistics for medical students by B. K. Mahajan
3. RPG Biostatistics by Himanshu Tyagi

Subject name- Bioinformatics

Subject code-BMM-704

Learning Objective:

The course aims to provide an advanced understanding of the core principles and topics of Bioinformatics and their experimental basis, and to enable students to acquire a specialised knowledge and understanding of bioinformatics.

1: Inculcate sound practical interdisciplinary skills at pursuing in advances of relevance to bioinformatic approaches founding living systems.

2: Capacity to create and apply bioinformatic tools and approaches to extract information from different types of biobig data (gene, protein, disease, and so on).

3: Develop an understanding of algorithms of sequence alignment (pair-wise and multiple) and scoring algorithms.

4: Inquisitiveness on how bio bigdata is stored and retrieved from various biological databases.

Subject name- Microbial Genetics (PRACTICAL)

Subject code-705

1. To determine the ABO & Rh grouping
   Direct or preliminary grouping
   Indirect or proof grouping
   Rh grouping and determination of Du in case of Rh negative
2. To perform Direct and Indirect Coomb's test
3. To perform cross matching
   Major cross matching
   Minor cross matching

Subject name- Research Methodology (PRACTICAL)

Subject code-BMM-706

1. To give a small research project to students/ Collection of data

Subject name- Biostatistics (PRACTICAL)

Subject code-707

1. To practice problems on various biostatistics tools.

Subject name- Bioinformatics (PRACTICAL)

Subject code-708

1. Introduction to different operating systems - UNIX, LINUX and Windows
2. Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ,Uniprot, PDB
3. Sequence retrieval using BLAST
4. Sequence alignment & phylogenetic analysis using clustalW & phylip
5. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool
6. Protein structure prediction: primary structure analysis, secondary structure prediction using psi- pred, homology modeling using Swiss model. Molecular visualization using jmol, Protein structure model evaluation (PROCHECK)
7. Prediction of different features of a functional gene

Suggested reading-

1-Introduction to different operating systems - UNIX, LINUX and Windows

2-Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ, Uniprot,PDB

3-Sequence retrieval using BLAST

4-Sequence alignment & phylogenetic analysis using clustalW & phylip