

SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]



SYLLABUS FOR Bachelor in Medical Microbiology With CO And PO Mapping School of Paramedical & Allied Health Sciences

(W.E.F 2023-2024)

BACHELOR IN MEDICAL MICROBIOLOGY

OUTCOME BASED EDUCATION

Programme outcome (POs)

Students will be able to

PO 1	Apply knowledge and technical skills associated with Medical Microbiology for delivering quality clinical investigations support.
PO2	Recognize routine clinical laboratory procedures within acceptable quality control parameters in medical microbiology lab (serology, virology, bacteriology, Immunology, Molecular microbiology).
PO3	Communicate technical skills, social behaviour and professional awareness for functioning effectively.
PO4	Apply problem solving techniques in identification and correction of pre analytical, post analytical & analytical variables.
PO5	Demonstrate an understanding of essential basic pathological process including cell death problems.
PO6	Identification of common pathogenic bacterial agents and associated disease, their specific mechanisms.
PO7	Develop an understanding of the patterns of clinical procedures of diagnosis of Microbial infections & infestations.
PO8	Demonstrate an understanding pathogenic viruses and associated diseases.
PO9	Function as a leader or team member in diverse professionals and medical research areas.
PO10	Apply knowledge about skills and tools associated with recombinant DNA technology and molecular biology.
PO11	Work on career enhancement by adapting to professional and social needs engaged in lifelong learning.
PO12	Practice professional and ethical responsibilities with high degree of credibility, integrity and social concern.

SHRI GURU RAM RAI UNIVERSITY DEHRADUN, (UTTARAKHAND)
REGULATION OF THE UNIVERSITY FOR THE AWARD OF THE
DEGREE OF BACHELOR OF SCIENCE – MEDICAL LAB.
TECHNOLOGY

An exercise of the powers conferred by section of S.G.R.R University Act, the academic Council of the Shri Guru Ram Rai University, Dehradun Uttarakhand hereby makes the following regulations: -

SHORT TITLE AND COMMENCEMENT

These regulations shall be called “THE REGULATIONS FOR THE BACHELOR OF SCIENCE – MEDICAL LABORATORY TECHNOLOGY OF THE SHRI GURU RAM RAI UNIVERSITY, DEHRADUN, UTTARAKHAND”.

- I. These Regulations and the syllabus shall come into force from the 2001-2002 academic session onwards.
- II. The regulations framed are subject to modification from time to time by the standing Academic Board of the University.
 - A) Graduate Allied Health Science curriculum is oriented towards training students to help the responsibilities of physician of first contact who is capable of looking after the Preventive, promotive, curative and rehabilitative aspects of medicine.
 - B) With wide range of career opportunities available today, an Allied Health Science graduate has a wide choice of career opportunities. The training though broad based and flexible should aim to provide an educational experience of the essentials required for health in our country.
 - C) To undertake the responsibilities of service situations which is a changing condition and of various types. It is essential to provide adequate placement training tailored to the needs of such services as to enable the Allied Health Science graduates to become effective instruments of implementation of those requirements. To avail of opportunities and be able to conduct professional requirements the graduate shall endeavour to have required basic training in different aspects of medical care.
 - D) The importance of the community aspects of health care and of rural health care service is to be recognized including rehabilitation. The aspect of education and training of Allied Health Science graduates should be adequately recognized in the prescribed curriculum. Its

importance has been systematically upgraded over the past years and adequate exposure to such experiences should be available throughout all phases of education and training. This has to be further emphasized and intensified by providing exposure to field practice areas and training during the internship period. The aim of the period of training during internship is to enable the fresh graduates to function efficiently under such settings.

- E)** As such all the basic concepts of modern scientific medical education allied with allied health sciences are to be adequately dealt with particularly the Physiotherapy and Physiotherapy areas.
- F)** There must be enough experience to be provided for self-learning. The methods and techniques that would ensure this must become a part of teaching-learning process.
- G)** The Allied Health Science graduate of modern scientific medicine shall endeavour to become capable of functioning independently under the supervision of a physician in both urban and rural environment. He / She shall endeavour to give emphasis on fundamental aspects of the subject taught and on common problems on health and disease.
- H)** The importance of social factors in relation to the problem of health and disease should receive proper emphasis throughout the course and to achieve this purpose, the educational process should also be community based particularly for occupational therapy and physiotherapy.
- I)** Adequate emphasis is to be placed on cultivating logical and scientific habits of thought, clarity of expression and independence of judgment, ability to collect and analyse information and to correlate them.
- J)** The educational process should be placed in a Laboratory/practical background as an evolving process and not merely as an acquisition of a large number of disjointed facts without a proper perspective.
- K)** Lectures alone are generally not adequate as a method of training and are a poor means of transferring/acquiring information and even less effective at skill development and in generating the appropriate attitudes. Every effort should be made to encourage the use of active methods related to demonstration and on first-hand experience, Students will be encouraged to learn in small groups through peer interactions so as to gain maximal experience. While the curriculum objectives often refer to areas of knowledge or science, they are best taught in a setting of clinical relevance and hands on experience for students who assimilate and make this knowledge apart of their own working skills.

- L)** The Allied Health Science graduate medical education in clinical subjects should be based primarily on outpatient teaching, other medical and surgical departments and within the community including peripheral health care institutions. The outpatient departments should be suitably planned to provide training to graduates in small groups and demonstration subjects of all the appropriate technique.
- M)** Clinics should be organized in small groups of preferably not more than 10 students so that a teacher can give personal attention to each student with a view to improve his skill and competence in handling of the patients.
- N)** Proper records of the work should be maintained which will form the basis for the students' internal assessment and should be available to the inspectors/examiners at the time of inspection/examination of the college.
- O)** Maximal efforts have to be made to encourage integrated teaching between traditional subjects areas using a problem based learning approach starting with clinical and exploring the relevance of various pre-clinical disciplines in both understanding and resolution of the problem. Every attempt be made to de-emphasize compartmentalization of disciplines so as to achieve both horizontal and vertical integration in different phases.
- P)** Every attempt is to be made to encourage students to participate in group discussions and seminars to enable them to develop personality, character, expression and other faculties which are necessary for Allied Health Science graduate to function either in solo practice or as a team leader when he begins his independent career. A discussion group should not have more than 20 students.
- Q)** Faculty members should avail of modern educational technology while teaching the students and to attain this objective.
- R)** To derive maximum advantage out of this, the vacation period to students in one calendar year should not exceed one month, during the 4 years of Bachelor of Allied Health Science Courses, which includes BPT, BOT, B.Sc (MLT), B.Sc (Medi. Micro), B.Sc (RD&IT), B.Sc (Nursing), B pharm. Etc

OBJECTIVES OF ALLIED HEALTH SCIENCE GRADUATE TRAINING PROGRAMME:

NATIONAL GOALS: At the end of undergraduate program, the Allied Health Science student shall endeavour to be able to:

- a) Recognize 'health for all' as national goal and health right of all citizens and by undergoing training for Allied Health Science profession fulfil his/her social obligations towards realization of this goal; learn every aspect of National policies of health and devote himself/herself to its practical implementation.
- b) To help to achieve competence in practice of holistic medicine encompassing promotive, preventive, curative and rehabilitative aspects of diseases particularly with Physiotherapy and Occupational Therapy;
- c) Develop scientific temper, acquire educational experience for proficiency in profession and promote healthy living; particularly in the field of rehabilitation.
- d) Become exemplary citizen by observation of medical ethics and fulfilling social and professional obligations, so as to respond to national aspirations.

INSTITUTIONAL GOALS:

In consonance with the national goals each Allied Health Science Institution should evolve institutional goals define the kind of trained manpower (or professional) they intend to produce.

The undergraduate students coming out of an Allied Health Science institute should:

Be competent in therapeutic techniques of common health problems of the individual and the community, associated with or concerned with Physiotherapy commensurate with his/her position as a member of the health team at the primary, secondary or tertiary levels using his/her clinical/technical skills based on history, physical examination and relevant investigation techniques and as per the advice of the attending physician.

Be competent to practice preventive, promotive, curative and rehabilitative medicine in respect to the all the applicable and encountered health problems with Occupational Therapy and Physiotherapy;

To help to appreciate rationale for different therapeutic modalities pertaining to the subjects of Physiotherapy.

To be able to appreciate the socio-psychological, cultural, economic and environmental factors affecting health and develop human attitude towards the patients in discharging one's professional responsibilities (Occupational Therapy and Physiotherapy;)

Possess the attitude for continued self-learning and to seek further expertise or to pursue research in any chosen area of Occupational Therapy and Physiotherapy;

Acquire basic management skills in the area of human resources, materials and resource management related to health care delivery;

Be able to identify community health problems and learn to work to resolve these by designing, instituting corrective steps and evaluating outcome of such measures (Occupational Therapy and Physiotherapy); in community rehabilitation.

Be able to work as a leading partner in health care teams and acquire proficiency in communication skills;

Be competent to work in a variety of health care settings.

Have personal characteristics and attitude required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.

ADMISSION, SELECTION, MIGRATION AND TRAINING ADMISSION TO THE B.Sc. Medical Microbiology COURSE

ELIGIBILITY CRITERIA

No Candidate shall be allowed to be admitted to the B.Sc. Medical Microbiology until:-

a) He/she has completed the age of 17 years on or before first day of July of the year commencing the prescribed academic session of the said course:

b) He/she has passed qualifying examination as under:

The Indian School Certificate Examination which is equivalent to 10+2 higher Secondary examination after a period of 12 years study, the last two years of Study comprising of Physics, Chemistry, Biology and Mathematics or any other elective subjects with English at a level not less than the core course for English as prescribed by the National Council for Educational Research and Training after the introduction of the 10+2+3 years educational structure as recommended by the National Committee on education.

OR

The Intermediate examination in Science of an Indian University/Board or other recognized examining body with Physics, Chemistry and Biology which shall include a Practical test in these subjects and also English as a compulsory subject.

OR

The Pre-Professional or medical examination with Physics, Chemistry and Biology, after passing their higher secondary school examination, or the pre-university or an equivalent examination. The pre-Professional /pre-medical examination shall include a practical test in Physics, Chemistry and biology and also English as a compulsory subject.

OR

The first year of the three years degree course of a recognized University, with Physics, Chemistry and Biology, including a Practical test in these subjects provided the examination is a “University Examination” and candidate has passed 10+2 with English at a level not less than a core course.

OR

B.Sc. examination of an Indian University, provide that he/she has passed the B.Sc. examination with not less than two of the following subjects-Physics, Chemistry, Biology (Botany, Zoology) and further that he/she has passed the earlier qualifying examination with the following subjects-Physics, Chemistry, Biology and English (10+2 level).

OR

Any other examination which in scope and standard is found to be equivalent to the intermediate science examination of an Indian University/Board, taking Physics, Chemistry, Biology including a Practical test in each of these subjects and English.

Note: 10+2 with vocational training in Nursing/Medical Lab technology/Medical Microbiology are also eligible and 10+2 with Diploma in Medical Microbiology are also eligible for the respective course. Marks obtained in Mathematics are not to be considered for admission to the B.Sc. MLT Course. After the 10+2 course is introduced, the integrated courses should be abolished.

MIGRATION /TRANSFER OF CANDIDATES

Migration / Transfer of candidates from one recognized Institution to another Institution of this University or from another University will not generally be considered.

However, under extra ordinary circumstances, the Vice-Chancellor shall have the powers to place any migration / transfer he deems fit in the Governing Council and get its approval for grant of permission for migration / transfer to candidates undergoing courses of study in affiliated Institutions of this University.

TRAINING PERIOD AND TIME DISTRIBUTION

- 1) Every student shall undergo a period of certified study extending over. Three and a half academic years Or Six semesters, plus 6 months internship from the date of commencement of his study for these subjects comprising the B.Sc Medical Microbiology curriculum to the date of completion of examination and followed by compulsory rotating internship. Each academic year shall consist of 180days each Semesters of 90 days teaching of 8 hours each day college working time, including one hour of lunch.
- 2) The period of three & half year is divided into phased as follows:-
 - a) Phase-I – First year B.Sc Medical Microbiology (one Year Duration-two semesters)
 - i. Human Anatomy and Physiology
 - ii. Basic Pathology
 - iii. Clinical Biochemistry
 - iv. Preventive Medicine & Health Care
 - v. Fundamentals of medical Microbiology
 - vi. Instrumentation Techniques in Medical Microbiology
 - b) Phase-II- Second year B.Sc Medical Microbiology (one Year Duration two semesters)
 - I. Bacterial Pathogens & Associated Diseases
 - II. Systematic Bacteriology
 - III. Misc. Microbes, fungal Pathogens & Asso. Diseases

- IV. Lab. Diagnosis of Microbial Diseases
- V. Human Parasitology
- VI. Applied Medical microbiology
- c) Phase-III- Third year B.Sc Medical Microbiology (one Year Duration two semesters)
 - I. Pathogenic Viruses and Associated Diseases
 - II. Applied Immunology & Serodiagnosis
 - III. Advanced Diagnostic Technology
 - IV. Recombinant DNA Technology
 - V. Molecular Biology
- d) Phase-III- Fourth year B.Sc Medical Microbiology (Six Months duration) Internship.

DISTRIBUTION OF MARKS TO VARIOUS DISCIPLINES

Ist Year

S.No	Course	Course Code	Max. Marks		
			Internal	External	Total
I	Human Anatomy & Physiology	BMM 101	30	70	100
II	Basic Pathology	BMM 102	30	70	100
III	Clinical Biochemistry	BMM 103	30	70	100
IV	Preventive Medicine & Health Care	BMM 104	30	70	100
V	Fundamentals of Medical Microbiology	BMM 105	30	70	100
VI	Instrumentation Techniques in Medical Microbiology	BMM 106	30	70	100
VII	Lab: Human Anatomy & Physiology (Course based on Paper 1 & 2)	BMM 101 P	30	70	100
VIII	Lab: Clinical Biochemistry (Course based on Paper 3)	BMM 103 P	30	70	100
IX	Lab: Fundamentals of Medical Microbiology (Course based on Paper 5 & 6)	BMM 105 P	30	70	100
TOTAL MARKS			900		

IInd Year

S.No	Course	Course Code	Max. Marks		
			Internal	External	Total
I	Bacterial Pathogens & Associated Diseases	BMM 201	30	70	100
II	Systematic Bacteriology	BMM 202	30	70	100
III	Misc. Microbes Fungal, Pathogens & Asso. Disease	BMM 203	30	70	100
IV	Lab Diagnosis of Microbial Diseases	BMM 204	30	70	100
V	Human Parasitology	BMM 205	30	70	100
VI	Applied Medical Microbiology	BMM 206	30	70	100
VII	Lab: Bacterial Pathogens & Associated Diseases (Course based on Paper 1 & 2)	BMM 201 P	30	70	100
VIII	Lab: Misc. Microbes Fungal, Pathogens & Asso. Disease (Course based on Paper 3 & 4)	BMM 203 P	30	70	100
IX	Lab: Human Parasitology (Course based on Paper 5 & 6)	BMM 205 P	30	70	100
TOTAL MARKS			900		

IIIrd Year

S.No	Course	Course Code	Max. Marks		
			Internal	External	Total
I	Pathogenic Viruses and Associated Diseases	BMM 301	30	70	100
II	Applied Immunology & Serodiagnosis	BMM 302	30	70	100
III	Advanced Diagnostic Technology	BMM 303	30	70	100
IV	Recombinant DNA Technology	BMM 304	30	70	100
V	Molecular Biology	BMM 305	30	70	100
VII	Lab: Pathogenic Viruses and Associated Diseases (Course based on Paper 1 & 2)	BMM 301 P	30	70	100
VIII	Lab: Advanced Diagnostic Technology (Course based on Paper 3 & 4)	BMM 303 P	30	70	100
IX	Lab: Molecular Biology (Course based on Paper 5)	BMM 305 P	30	70	100
TOTAL MARKS			900		

Note: Results of all University examination shall be declared before the start of teaching for next semesters.

Note: Course structure (Teaching duration) will be of 2 hrs. /week for theory & 2 hrs. /week for practical for each paper.

1. The minimum pass marks will be 40% in individual subjects in theory and practical and 50% in aggregate
2. The theory and practical papers will be of equal weightage with 30% in sessional and 70% in final University Examination.
3. The division will be determined on the basis of the aggregate of the marks of all the course/subjects prescribed for the degree as under:
 - (i) Passed with honours will be rewarded on 75% and above only in first attempt.
 - (ii) First Division will be marked on 60% and above.
 - (iii) Second Division will be marked on 50% and above but less than 60%

Compartments/Supplementary/Back Paper

- (i) A student who obtain 40% of the marks individually but has failed in two papers shall be permitted to appear in those papers only at the two consecutive examinations and if he/she passes at either of those examination he/she will be deemed to have passed the examination and will be promoted to higher class (aggregate marks should be 50%)
- (ii) A student (s) appearing in back paper/supplementary shall be eligible to join the next higher class provisionally however any student who fails to pass Ist year would not be admitted in 3rd year course.

Theory Examination: All the paper in each year carrying 100 marks out of which 30 marks will be internal assessment and 70 marks for external assessment based on the question paper sent by the University the paper will be 3 hrs. Each paper will have 8 questions out of which the candidate will have to attempt 5 questions.

The practical examination will be held with the final Examination. The Practical and Viva Voice in each subject will carry 30% marks as internal & 70% marks as external assessment (according to examination scheme) prescribed for the year.

PHASE DISTRIBUTION AND TIMING S OF EXAMINATIONS:

Ist Annual examination (or at the end of second semester)

IInd Annual examination (or at the end of fourth semester)

IIIrd Annual examination (or at the end of sixth semester)

Six months internship after third annual examination.

EXAMINATION REGULATIONS.

Essentialities for qualifying to appear in professional examinations. The performance in essential components of training is to be assessed based on.

ATTENDANCE: 75% of attendance in a subject for appearing in the examination is compulsory provide he/she has 80% attendance in non lecture teaching i.e. seminars, group discussion tutorials, demonstrations, practicals Hospital (Tertiary, Secondary, Primary) postings and bed side clinics etc.

INTERNAL ASSESSMENT:

- (i) It shall be based on day today assessment (see note). Evaluation of student assignment, preparation for seminar, Clinical case presentation etc.
- (ii) Sessional examination shall be conducted throughout the course. The question of number of examinations is left to the institution.
- (iii) Day to day records should be given importance during internal assessment.
- (iv) Weightage for the internal assessment shall be 30% of total marks in each subject.

- (v) Student must secure at least 50% marks of the total marks fixed for internal assessment in particular subject in order to be eligible to appear in final university examination of that subject.

Note: - Internal assessment shall relate to different ways in which students participation in learning process during semesters is evaluated. Some examples are as follows:

- (i) Preparation of subject for students seminar
- (ii) Preparation of a clinical case for discussion.
- (iii) Clinical case study problem solving exercise.
- (iv) Participation in Project for health care in the community (planning stage to evaluation).
- (v) Proficiency in carrying out a practical or a skill in small research project.
- (vi) Multiple choice question (MCQ) test after completion of a system/teaching.

Each item tested shall be objectively assessed and recorded. Some of the items can be assigned as home work/Vocational work.

UNIVERSITY EXAMINATIONS:

Theory papers will be prepared by the examiners as prescribed Nature of question will be short answer type/objective type and marks for each part indicated separately.

Practical/clinical will be conducted in the laboratories or hospital wards Objective will be to assess proficiency in skills. Conduct of experiment, interpretation of data and logical conclusion clinical cases should be preferably include common diseases not esoteric syndromes or rare disorders. Emphasis should be on candidate's capability in eliciting physical signs and their interpretation.

Viva/oral includes evaluation of management approach and handling of emergencies Candidates skill in interpretation of common investigation data also is to be evaluated.

The examinations are to be designed with a view to ascertain whether the candidate has acquired necessary for knowledge, minimum skills along with clear concepts of the fundamentals, which are necessary for him to carry out his professional day to day work competently. Evaluation will be carried out of an objective basis.

Question paper should preferable be of short structure/objective type.

Clinical cases/practical shall take into account common diseases, which the student is likely to come in contact in practice.

During evaluation (both external and internal) it shall be ascertained if the candidate has acquired the skills.

There shall be one main examination in a year and a supplementary to be held not later than 6 months after the publication of its result.

Note: Results of all University examinations shall be declared before the start of teaching for next semesters.

DURATION OF EXAMINATION & QUESTIONS

- (i) Each written will be of three hours duration having eight questions, only five questions to be attempted. No choice will be given in any questions.
- (ii) A clinical/practical examination in any subject for student shall not be for more than a day. In no case more than 20 students be examined for Clinical/practical & Oral in a day.

GENERAL

If Candidate obtains an aggregate of 75 percent in all the subject of any professional Examination, be will be declared to have passed that Examination with Honors, provided he/she passes in all subject in the first attempt.

INTERNSHIP

General

Internship is a phase of training wherein a graduate is expected to conduct actual practice of Medical Microbiology and acquire skills under supervision so that he/she may become capable of functioning independently.

SPECIFIC OBJECTIVE

At the end of internship training the graduate shall be able to:

- (i) Perform all the diagnostic techniques
- (ii) Use discretely the essential laboratory services
- (iii) Manage all type of clinical diagnostic methods
- (iv) Demonstrate skills in handling the modern equipment in Medical Microbiology
- (v) Develop leadership qualities to function effectively as a reader of the laboratory environment
- (vi) Render service to the laboratory set up and to communicate effectively with the Doctors and the hospital management.

INTERNSHIP TIME DISTRIBUTION

Main Objective: Development of skill and competency in data processing, reporting and maintenance of records, Laboratory investigations. Total Period of Internship: 6 Months

1.	Serology	1 month
2.	Bacteriology	1 month
3.	Sample Collection	15 days
4.	Haematology	15 days
5.	Clinical Biochemistry	15 Days
6.	Immunology	1 month
7.	Molecular Biology	1 month
8.	Mycology	15 days

OTHER DETAILS

- (i) All parts of internship shall be done as far as possible in the Hospitals of Medical College
- (ii) Every Candidate will be required after passing the final B.Sc (Medical Microbiology) Examination to undergo compulsory rotator internship to the satisfaction of the college Authorities and University concerned for a period of six months so as to be eligible for the award of the degree of Bachelor of Science in Medical Microbiology.
- (iii) The University shall issue a provisional B.Sc Pass Certificate on passing the final examination.
- (iv) The State medical faculty and council for allied health profession will grant provisional registration will be for a period of I year. In the event of shortage or unsatisfactory work, the period of provisional registration and the compulsory rotating internship may be suitably extended by the appropriate authorities.
- (v) The intern shall be entrusted with Laboratory responsibilities under direct supervision of Senior Medical Officer/Technician. They shall not be working independently.
- (vi) Interns will not issue certified Laboratory reports or other related documents under their signature.

ASSESSMENT OF INTERNSHIP

- (i) The interns maintain the record of work, which is to be verified and certified by the Senior Medical Officer/Technician under whom he/she works. Apart from scrutiny of the record of

work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and the end of the training. Based on the record work and date of evaluation the Director/Principal shall issue 'Certificate of Satisfactory Completion' of training following which the University shall award the B.Sc (Medical Microbiology) Degree of declare the candidate eligible for the same.

- (ii) Satisfactory completion shall be determined on the basis of the following:
- (a) Proficiency of knowledge required for each Laboratory Techniques
 - (b) The Competency in skills expected to manage each Laboratory Technique. Competency for performance of self-performance of having assistant in procedures of having observed
 - (c) Responsibility Punctuality work up of Laboratory Techniques involvement in procedure, follow of reports.
 - (d) Capacity to work in a team (behaviour with colleagues, nursing staff and relationship with Medical and Paramedical).
 - (e) Initiating, Participation in discussions, research aptitude.
 - (f) Full registration shall only be given by the State Medical faculty and council for Allied Health Professor on the award of B.Sc Medical Microbiology Degree by the University on its declaration that the candidate is eligible for it.

VACATION

There shall be a minimum 30 days vacations every year or as per session requirement settled by the University.

MEDIUM OF INSTRUCTION

English shall be the Medium of Instructions for all the subjects of study and for examinations of the Bachelor of Medical Microbiology course.

WORKING DAYS IN AN ACADEMIC YEAR

Each Academic year shall spread over a period of not less than 180 works.

CONDONATIONS OF LACK OF ATTENDANCE

As per the existing rules & regulations of the Shri Guru Ram Rai University.

SUBMISSION OF RECORD NOTE BOOKS

At the time of practical examination, each candidate shall submit to the examiners the records books duly certified by the Head of the School as a bonafide record of work done by the candidate.

CLASSIFICATION OF SUCCESSFUL CANDIDATES REVALUATION OF ANSWER PAPERS

The regulations as prescribed by the University for other Undergraduate Course shall be applicable.

AWARD OF MEDALS AND PRIZES

The University shall award at its convocation medals and prizes to outstanding candidates, as and when Instituted by the donors as per the schedule prescribed for the award.

UNIVERSITY RANKING

First, Second and third University ranks may be awarded to candidates, who have passed all the examinations in the first appearance and taking into consideration the aggregate marks obtained in all the subjects, in which the candidate had been examined during the entire course of study.

CURRICULUM (SUBJECT WISE)

SYLLABUS FOR MEDICAL MICROBIOLOGY

GOAL

The broad goal of teaching of B.Sc (Medical Microbiology) students in Allied Medical Science aims at providing comprehensive knowledge of structure, function and pathological changes of the organs and the basis for understanding the clinical correlation of diseases and the pathological basis for the disease presentation specially with respect to Physical Pathology.

Objectives:

(A) Knowledge:

At the end of course, student shall be able to comprehend the normal dispositions, clinically relevant interrelationship, functional Anatomy of various structures in the body. Correlate the structures with the functions as pre requisite for understanding the alter state in various disease processes specially with respect to Physical Pathology & Microbiological diagnosis.

(B) Skills:

At the end of the course, student shall be able to identify and locate all the structures of the body and mark the topography of the living Anatomy, identify the organs and tissues. Understand the principles of karyotyping, Understand clinical bases of common clinical procedures of diagnosis of Microbial infections and infestations.

(C) Integration:

From the integrated teaching of other basic sciences, students shall be able to comprehend the regulation and integration of the functions of the organs and systems in the body and thus interpret the pathological, bimolecular & microbiological basis of diseases including advanced diagnostic technology.

B.Sc Medical Microbiology

Course Name	: Human Anatomy & Physiology
Course Code	: BMM 101
Semester /Year	: 1 st year

	L	T	P	C
	02		01	03

L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

2hrs/Week

<p>Unit I</p> <ol style="list-style-type: none"> 1. Introduction to Medical Sciences. 2. Organization of human body and integrated physiology. 3. Cell organizations, fundamental tissues of body and organ systems. 4. Primary defense mechanisms of human body against pathogenic microbes. 5. Gross Anatomy and histology of organs or respiratory system, organs of respirations mechanism of respiration and factors controlling it. 6. Gross anatomy and histology of organs of alimentary system, organs of digestive systems, and various glands associated with the digestive system, mechanism and physiology of digestion and absorption. <p>Unit II:</p> <ol style="list-style-type: none"> 7. Cells and organs of immune system Morphology & their distribution. 8. Gross Anatomy and Physiology of reticulo – endothelial system. 9. Secondary immune response of human body to external stimuli. 10. Physiology of various body fluids: CSF, peritoneal, pericardial, Pleural and synovial fluids. 11. Gross Anatomy, histology & Physiology of excretory system. <p>Unit III</p> <ol style="list-style-type: none"> 12. Gross Anatomy and histology of musculo-skeletal system, classification & functions of bones and muscles. Physiology of muscular contraction and factor controlling them. Various types of joints and their physiology. 13. Gross Anatomy and histology of organs of nervous system, division of nervous system and mechanism of nerve impulse transmission & reflex arc, sensory and motor system, special sense organs. 14. Gross Anatomy and histology of organs of reproduction system, mechanism of reproduction and factors controlling it. 15. Gross Anatomy and histology of organs of endocrine system, different glands of the system and their distribution. Mechanism of hormone production, factors controlling it and their mechanism of action.

Text Books:

Text Book of Human Anatomy B D Chourasia's V Edition

Reference Books:

Atlas Of Human Anatomy by Frank H. Netter VII Edition

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To outline introduction of medical science, organization and physiology of human body and primary defense mechanism of human body.
CO2	To interpret about gross anatomy and histology of respiratory system, digestive system, alimentary system, and physiology of digestion and absorption.
CO3	To examine morphology and distribution of cells and organs of immune system, Gross anatomy and physiology of reticulo-endothelial system and physiology of various body fluids.
CO4	To illustrate gross anatomy and physiology of excretory system, cardiovascular system.
CO5	To assess gross anatomy, histology and physiology of Musculo-skeletal system, nervous system.
CO6	To write about gross anatomy, histology and physiology of reproductive system, endocrine system.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	2	1	-	-	-	-	-	-
CO2	-	-	-	1	2	2	1	1	-	-	-	-
CO3	1	-	-	-	1	1	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-
CO6	1	2	-	1	1	-	2	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

B.Sc Medical Microbiology

Course Name	Basic pathology
Course Code	BMM 102
Semester /Year	1 st year

	L	T	P	C
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	02	01	03
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L - Lecture T – Tutorial P – Practical C – Credit

Course Contents

2hrs/Week

<p>Unit I:</p> <ol style="list-style-type: none"> 1. Introduction to hematology. Laboratory organization & Safety measures. 2. Formation, Composition and functions of blood. 3. Anticoagulants, mode of action of anticoagulants and their merits & demerits. 4. Collection, preservation, transport and handling and disposal of blood samples. 5. Basic haematology and estimation of haematocrit values, physiological variations, normal and absolute values and quality assurance in haematology. <p>Unit II</p> <ol style="list-style-type: none"> 1. Romanowsky dyes, preparation and staining procedures of blood smears, Morphology of blood cells and their identifications. 2. Haemo-globinometry: Various methods errors involved and standardization of instruments. 3. Haemi-cytometry: Procedure of cell count, visual as well as an electronic, red cells, leucocyte and platelet count. Errors involved and mean to minimize such errors. Determinations of innate immunity and its mechanism, phagocytosis, the compliment system, gross structure and development of cells concerned with antibody production, cellular processes involved in antibody formation. <p>Unit III</p> <ol style="list-style-type: none"> 1. Pathology of Inflammation in response to microbial invasion. Pathology of localized and systemic infections. Various routes of transport of Microbes to the human body and methods of defense. Invasive techniques for the diagnosis of acute and chronic microbial infections. 2. Pathology of specific chronic infective disorders: Tuberculosis, Leprosy, Syphilis, SABE (Subacute bacterial endocarditis) and Rheumatological disorders. 3. Study of microbes responsible for the pathogenesis of tumours and their oncogenesis. 4. Immuno-histopathology & Immuno-histochemistry (Basic Principles, Procedures and applications). 5. Introduction to blood banking technology.

TB1. Text Book of Pathology Harsh Mohan VIII Edition

TB2. Text Book of Pathology Dr. A K Mandal

Reference Books:

RB1. Clinical Pathology Hematology & Blood Banking IV Edition

Nanda Maheshwari

RB2. Exam Oriented Pathology

K Mukhopadhyay

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To describe the concepts of haematology.
CO2	To explain the basics of haematology and quality assurance.
CO3	To demonstrate the methods of histopathological staining, haemoglobinometry and haemo-cytoglobinometry.
CO4	To analyse the various types of immunity and mechanisms of antigen and antibody reactions.
CO5	To evaluate the pathology of microbial infections, pathogenesis of tumours and oncogenesis.
CO6	To develop an understanding of immunohistopathology, immunohistochemistry and blood banking technology.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	3	-	2	-	-	-	-	-
CO2	1	1	-	1	3	-	-	-	-	-	-	-
CO3	1	2	-	-	2	-	-	-	-	-	-	-
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	1	2	1	-	-	-	-	-
CO6	-	1	-	2	3	-	1	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

B.Sc Medical Microbiology

Course Name	Clinical Biochemistry
Course Code	BMM103
Year/ Semester	1 st year

	L	T	P	C
	02		01	03

Course Contents

2hrs/Week

<p>UNIT I</p> <p>Introduction to Clinical Biochemistry and role of medical Lab Technologist, ethics responsibility, safely measure and hazards in clinical biochemistry lab and first aid in laboratory accidents.</p> <p>Basic awareness of laboratory in respect to equipments & glassware's. (Unit of measurements and calibration of volumetric apparatus. Colorimetry, spectrophotometer, flame-photometry, Hot air oven, Water Bath, Incubator (Principles Instrumentations & applications)</p> <p>Preparation and storage of reagents, standard solutions, buffer solutions and pH determination. Biophysics, techniques – osmosis, dialysis, surface tension, sedimentation and viscosity – principles & applications.</p> <p>Henderson – Hassalbach equation and its clinical applications. Acid base disturbances and their clinical significance. Acid-base- buffer and pH – simple calculations. Concept of clinical sensitivity and specificity and factors affecting the clinical results.</p> <p>Collection of blood specimens avoiding Haemolysis, de- proteinization & separation of serum /Plasma. Biochemical composition of body fluids and their physiological variations.</p> <p><u>Physical and Biochemical Examination of Urine Samples:</u> Qualitative tests of inorganic Urinary ingredients: Chlorides, phosphate, sulphur compounds, sodium, Potassium, calcium and magnesium and their clinical significance.</p> <p>Qualitative tests for glycosuria, pentosuria, galactosuria, proteinuria, microalbuminuria and Bence Jones Proteinuria and their clinical significance. Qualitative test of urine for uric acid, urea and creatinine. Quantitative estimation of 24 hours urine for albumin and their clinical significance.</p> <p>Unit II</p> <ol style="list-style-type: none"> 1. <u>Carbohydrates:</u> Structure, classification and their function in biological system. 2. <u>Lipids:</u> General structure of Fatty Acids and classification of Lipids. 3. <u>Proteins:</u> Classification, structural organization and function of proteins. 4. <u>Enzymes:</u> Definition, classification of Enzyme, concept of active sites and general mode of action of enzymes. 5. <u>Nucleic acids:</u> Structure function and types of DNA and RNA. Nucleotides, Nucleosides, Nitrogen bases and role of Nucleic Acid.
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Text Book of Biochemistry DM Vasudevan IX Edition

Reference Books: U Satyanarayana & U Chakrapani

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To define concepts and principles of biochemistry, correlations of biomolecules: carbohydrates, proteins, lipids, Nucleic acids with cellular and molecular processes involved in health and in disease states for clinical problem solving.
CO2	To express fundamental aspects of enzymology with mode of action, clinical application.

CO3	To determine basics of clinical Biochemistry and medical lab technology in safety and hazards.
CO4	To correlate the normal ranges and abnormal ranges of biochemical components and Interpreting of principle of biochemical Clinical biochemistry tests, samples collection and rejection criteria's
CO5	To evaluate an analytical judgment, interpreting technical/principles of laboratory ins Colorimeters, analytical balance, flame photometer,
CO6	To devise the importance of Sterilization and disinfection and its application in clinic concept of application of biophysics, clinical sensitivity, specificity.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	2	1	-	-	-	-	-	-	-	2	2
CO4	-	1	1	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	2	2
CO6	-	-	-	-	-	-	-	-	-	-	2	2

Course Name	Preventive Medicine & Health care
Course Code	BMM104
Year/ Semester	Yearly

	L	T	P	C
	2		1	3

Course Contents

2hrs/Week

Unit I:

1. Water, air and noise pollution: Removal of water hardness, purification of water and standards of water quality. Air and noise pollution and their prevention. Housing and air conditioning.
2. Hygiene and Sanitation: Sanitation barriers, excreta disposal and disposal of hospital waste, Incineration and disinfection.
3. Infections and control: Microbial pathogenicity, source and spread of infections in community, Pathogenesis toxogenicity, invasiveness, variations and Virulence. Host factors controlling infections. Source of infections to men, mode of spread and their control by physical & chemical agents.

Unit II:

1. Epidemiology: Epidemiology, surveillance and control of community infections. Role of laboratory in community and hospital infections. Emergence of drug resistance. Methods of prevention & control- isolation of patients, quarantine & incubation periods of various infectious diseases. Management of patients in infectious disease hospital (IDH).
2. Prophylactic Immunization: Rationale of immunization, immune response and duration of immunity controlled studies of prophylactic Vaccines and hazards of immunization. Various national immunization programs and vaccine schedules.
3. Reproductive, Family planning & Child Health Care Programs.

Unit III:

1. Bacteriology of water, milk, food and air: Bacteriological examination of water- collection of specimens, presumptive coliform count, cloacal room test, colony count and interpretation of results, Bacterial examination of sewage and sewage effluents. Bacteriological examination and control of swimming bath, membrane filter technique and isolation of pathogens.
2. Bacteriological examination milk, bacterial standards and various tests for pasteurized milk. Bacterial examination of ice-cream, shellfish and canned foods, milk bottles, crockery and cutlery. Examination of food stuff in cases of out break of food poisoning, Bacteriological examination of air and environments dust.
3. Health care by balance diet and yoga: Normal constituents of diet, various diet programs, balance diet and factors responsible for etiology of various nutritional disorders. Carcinogens in food. Role of regular exercise & yoga in prevention & management of various diseases.
4. Health Planning & Management: Health planning, Planning Cycle, Malaria eradication & various other National Health policy & programs.

Text Books:

Text Book of Preventive & Social Medicine by K Park

Reference Books:

**RB3. Review of Preventive & Social Medicine
Vivek Jain XIII Edition**

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To Introduce the awareness about the air and noise pollution and their preventions.
CO2	To associating the microbial pathogenicity source and spread of infections in community.
CO3	To determine the Epidemiology, surveillance and control of community infections.
CO4	To divide Prophylactic Immunization and vaccines and hazards of immunization. Various national immunization programs and vaccine schedules.
CO5	To detect health care by balance diet and yoga.
CO6	To program health planning & management.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Fundamentals of Medical Microbiology
Course Code	BMM105
Year/ Semester	1 st year

	L	T	P	C
	2		1	3

Course Contents

2hrs/Week

Unit I:

1. Microbiology & Medicine: Introduction to Medical Microbiology. Discovery of micro-organisms. Contribution of Robert Koch, Antony Van Leeuwenhock, Louis Pasteur, Border, Paul Ehrlich, Alexander Fleming. Metchnikoff, Needham, Tyndall, Jenson, Joseph Lister, Karls Landsteiner etc. Scope & relevance and safety measures of Medical Microbiology. Role of medical microbiology in identification and management of various infectious diseases.
2. Morphology & Nature of Bacteria: Anatomy of bacterial cell, intracellular components and their functions bacterial reproduction, morphological study of bacteria and its appendages-flagella, fimbriae, pili, capsule, spore and cysts.
3. Classification and identification of bacteria: Biological groups, morphological and biological classification, DNA composition as a basis of classification system of identification- morphology, staining reactions, cultural characters, biochemical reactions & antigenic characters etc.
4. Sterilization and disinfection: Various physical methods of sterilization- heat, UV radiations, ionizing radiations, character affecting sterilizations, autoclave control and its compounds. Alcohol, halogen heavy metals and quaternary ammonium compounds, aldehyde, gaseous compound, Use and abuse of disinfectants.

Unit II

1. Cultural Media: Liquid and solid media, containers for media, distribution of media in tubes, bottles and petri dishes. Common ingredients of cultural media. Synthetic media, peptone water, nutrient agar and broth, chocolate and blood agar, meat extract broth, milk agar etc. Special media for neisseria, corynebacterium, mycobacterium & enterobacteriaceae group etc.
2. Cultivation of bacteria: Instruments used, inoculation hood, laminar flow, culture procedure, incubation (Aerobic and Anaerobic). Isolation of pure culture and its preservation. Suspending media for freeze drying of bacteria. Blood culture.
3. Pure Culture: Maintenance & Preservation of pure cultures. Collection, transport processing & storage of clinical samples for Microbiological Analysis.
4. Growth and Nutrition of Bacteria: Typical growth curve, various phases of growth, physiology of bacteria-catabolism and anabolism, Nutrition of microbes and physical condition required for growth. Effect of Carbon, Nitrogen, Growth factors. Vitamins, temperature, pH Osmotic pressure. Oxygen and Carbon Dioxide on microbial growth.

Unit III

1. Introduction & scope of Immunology: Immunological principles, antigens, antibodies and antigen antibody reaction: Antigen and antigenic specificity antigenic determinate, general properties of antigens, immunoglobulin's, their structure and functions, Types of immunity and its determinants. Tissue involved in immune response. Structure and function of immune response.
2. Introduction to Virology, Mycology & Parasitology: Characteristic, morphology, classification, nomenclature pathogenesis.
3. Antimicrobial agents and antibiotic: Disinfectants, antiseptics, chemotherapeutic agents, chemotherapeutic index, development of chemotherapy, antibiotics and effect of antibiotics on protein, nucleic acid and cytoplasmic membrane. Future development of chemotherapy

Text Books: Text Book of Microbiology by Dr. C P Baveja VIII Edition

TB3. Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

Reference Books: Prescott's Microbiology by Joanne Willey ,Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela & Dipti

Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To Introduce the Discovery of micro-organism. Contribution of various scientist.
CO2	To associating the anatomy of bacterial cell, bacterial reproduction, morphological study of bacteria.
CO3	To determine the culture media and its type (liquid and solid media). Common ingredients of cultural media. Cultivation of bacteria.
CO4	To divide Maintenance & Preservation of pure cultures. Collection, transport processing & storage of clinical samples for Microbiological Analysis.
CO5	To measure immunological tests, antigen test, antibodies reaction and antigen antibody reaction.
CO6	To Formulate disinfectants, antiseptics chemotherapeutic agents: Future development of chemotherapy.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	2	2	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-
CO6	1	-	-	-	-	-	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Instrumentation Techniques In Medical Microbiology
Course Code	BMM106
Year/ Semester	1 st year

	L	T	P	C
	2		1	3

Course Contents

2hrs/Week

Unit I

1. Microscopy: Study of Compound microscope-magnification, numerical aperture, resolution and compounds of microscope. Dark ground illumination care of microscope and common difficulties. Micrometry Study of Phase contrast, interference, fluorescent an electron microscope. Preparation of smear for electron microscope.
2. Study of pH in Microbiology: Methods for measurements pH meter, Preparation dilution and chemistry of suspension fluids. Oxidation – reduction (redox) potential.
3. Preparation of Stains: Making of films, staining methods, mounting media, Grams stain- preparation of stain and staining methods. Special stains for AFB, diphtheria spores, capsule, intracytoplasmic lipids, polysaccharides nuclear material, Fields Stain for amoebae, fungi and rickettsiae.

Unit II

1. Study of instruments used in Medical Microbiology.
2. General instruments: Distillation plant, Centrifuge Machine, Analytical Balance, Hotplate, Magnetic Stirrer, water Bath, Automatic Dispensers and diluters. Deionizer etc.
3. Microbiological Instruments: Autoclave, Incubator, Hot air oven, Laminar Air Flow, Colony Counter. Muffle furnace. Refrigerator, inoculators, Mac-intos field- jar etc.
4. Instruments used in immunology: Electrophoresis, immunodiffusion, starplate, chromatography, ELISA reader, automatic washer and RIA equipment etc.
5. Safety measures in Microbiology Laboratory: Occurrence of lab infections, route of infection in laboratory, safety measures precautions in use of Pathogens in teaching lab organization, management, recording of results and quality control in Medical Microbiology.
6. Culture and Drug sensitivity tests: Culture, isolation and identification of Pathogens from urine, pus and sputum and recording of their results.

Text Books: Text Book of Microbiology by Dr. C P Baveja Edition

TB4. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB4. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB5. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To define the study of Microscope & its types.
CO2	To describe preparation of Stains, making of Films, Staining Methods, Mounting Media, Stains (Gram stains, AFB Stains, Capsule, Spores Stains.)
CO3	To operate the various Microbiological Instruments. Instruments used in Immunology.
CO4	To discuss the principle and working of significant instrumentation.

CO5	To select the safety Measure in Microbiology Laboratory.
CO6	To investigate the culture, Isolation & Identification of Pathogens & Drug Sensitivity test.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	2	2	-	-	-	-
CO2	3	2	1	-	-	-	2	-	-	-	-	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

BMM 1st year

Course code	: BMM-101 P
Course Name	: Human Anatomy & Physiology (Lab course based on Paper 1 & 2)
Semester /Year	: 1st year

	L	T	P	C
	-	-	02	01

L - Lecture T – Tutorial P – Practical C – Credit

S. No	Practical
1.	Demonstration of Major organs through models.
2.	Demonstration of parts of circulatory system from models.
3.	Demonstration of parts of respiratory system from models.
4.	Demonstration of digestive system from models.
5.	Demonstration of excretory system from models.
6.	Demonstration of nervous system from models.
7.	Demonstration of structural differences between skeletal, smooth and cardiac muscles.
8.	Demonstration of various bones.
9.	Demonstration of various joints.
10.	To measure blood pressure.
11.	Demonstration of microscope.
12.	To perform Hemoglobin by Sahli's method.
13.	To perform Hemoglobin by CMG method.
14.	To perform Total RBC count.
15.	To perform total leucocyte count.
16.	To perform differential leucocyte count.

* Course Outcomes of the above practical is covered their respective theory course.

BMM 1st year

Course code	: BMM-103 P
Course Name	: Clinical Biochemistry (Lab course based on paper 3)
Semester /Year	: 1st year

	L	T	P	C
	-	-	02	01

L - Lecture T – Tutorial P – Practical C – Credit

S. No	Practical
1.	Demonstration of Biochemistry lab
2.	To make 1.0 M solution of NaCl
3.	To identify abnormal constituents of the urine
4.	To identify normal constituents of the urine
5.	Demonstration of colorimeter
6.	To identify the type of carbohydrate in the given sample
7.	To identify between protein and amino acid

* Course Outcomes of the above practical is covered their respective theory course.

BMM 1st year

Course Name	Fundamentals of Medical Microbiology (Lab Course Based on Paper 5& 6)
Course Code	BMM 105 P
Year/ Semester	1 st year

	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours

2hrs/Week

S.No	Practical
1.	Safety rules of working in microbiology lab.
2.	Demonstration of working of microbiology laboratory instruments.
3.	To perform simple staining.
4.	To perform Gram's staining.
5.	To perform negative staining.
6.	To perform AFB/ ZN staining.
7.	To perform spore staining.
8.	To perform capsule staining.
9.	Media preparation and its sterilization (selective/differential Regular). a) Nutrient Agar b) Chocolate Agar c) MacConkey Agar d) UTI Agar e) SDA Agar
10.	To perform motility Test by hanging drop method.

* Course Outcomes of the above practical is covered their respective theory course.

Course Name	BACTERIAL PATHOGENS & ASSOCIATED DISEASES
Course Code	BMM 201
Year/ Semester	2 nd year

	L	T	P	C
	2		1	3

Course Contents

2hrs/Week

Unit I

Normal microflora of human body: Skin, Respiration system Gastrointestinal, and Genitourinary tracts. Source of infections, mode of spread and portals of entry.

Description, pathogenicity, mode of infection, incubation period and toxigenicity of:-

1. Staphylococcus
2. Streptococcus
3. Pneumococcus
4. Neisseria
5. Bordetella
6. Haemophilus

Unit II

Host Parasite interaction in bacterial infections. Pathogenic of bacteria (colonization of surface, invasion of tissue, production of exo and endo toxins). Antibacterial defence of the host.

Description Pathogenicity, mode of infection, incubation period and toxigenicity of:-

1. Corynebacteria, Erysipelothrix, Listeria,
2. Mycobacteria
3. Atypical Mycobacteria
4. Anthrax bacillus
5. Brucella
6. Yersenia, Pasteurella & Francisella.

Unit III

Physiology & Biochemistry of bacteria: Protein, Carbohydrate, lipid, and nucleic acid as antigens.

Description, Pathogenicity, mode of infection, incubation period and toxigenicity of:

1. Salmonella
2. Shigella
3. Proteus
4. Pseudomonas, Loefflerella
5. Vibrio
6. Escherichia coli
7. Clostridia

Text Books:

TB5. Text Book of Microbiology

Dr. C P Baveja Edition

TB6. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB6. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB7. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To memorize the characters of normal microflora of Human Body (Skin, Respiratory, Gastrointestinal, Genitourinary tract).
CO2	To recognize the level of pathogenicity and mode of infection of <i>Staphylococcus</i> , <i>Pnemococcus</i> etc.,
CO3	To study the Host Parasite relationship in blood infection.
CO4	To test the pathogenicity and mode of infection of <i>Corynebacterium</i> , <i>Anthrax bacillus</i> , <i>Atypical Mycobacterium</i> etc.,
CO5	To explain the physiology and biochemistry of bacteria.
CO6	To compile t

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	2	2	-	-	-	-	-
CO3	-	1	-	-	-	2	2	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	-
CO5	-	-	-	-	-	1	1	-	-	-	-	-
CO6	1	-	-	-	-	2	2	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Systematic Bacteriology
Course Code	BMM202
Year/ Semester	2 nd year

	L	T	P	C
	2		1	3

Course Contents

2hrs/Week

Unit I

The role of laboratory in the diagnosis and control of infections: Management and quality control of medical microbiology laboratory.

- a) Specimen Collection from patients, clinics, and hospitals
- b) Specimen collection for epidemiological investigations.
- c) Training of medical microbiologist to handle epidemics, Morphology, staining, Cultural Character of Bacteria, Selective cultural media, identification by special tests, biochemical reactions and sero-typing of:
 - a) Grams positive cocci: - Cluster forming, chain forming and diplococci.
 - b) Neisseria, Bordetella and Haemophilus.

Unit II

Isolation of pure culture and its preservation.

Morphology, Staining, Cultural Character, selective cultural media, identification by special tests, biochemical reactions and scrotyping of:-

1. Corynebacterium.
2. Mycobacterium.
3. Atypical Mycobacterium.
4. Anthrax bacillus.
5. Brucella.
6. Yersenia and Pasteurella.

Unit III

Microbial drugs sensitivity tests and its clinical interpretation

Morphology, Staining, Cultural character, Selective cultural medias, identification by special tests, biochemical reactions and serotyping of:-

- | | |
|----------------|---------------------|
| 1. Salmonella | 5. Vibrio |
| 2. Shigella | 6. Escherichia coli |
| 3. Proteus | 7. Clostridia |
| 4. Pseudomonas | |

TB7. Text Book of Microbiology

Dr. C P Baveja Edition

TB8. Text Book of Microbiology**Apurba S Sastry & Sandhya Bhat****Reference Books:****RB8. Prescott's Microbiology****Joanne Willey ,Kathleen Sandman XI Edition****RB9. Essentials of Microbiology & Immunology****S K Mohanty & K Sai Leela & Dipti Pattanaik****Course outcomes (COs):****Upon successful completion of the course a student will be able to**

CO1	To repeat the role of Laboratory in the diagnosis and control of Infection.
CO2	To Classify the management and Quality control of Medical Microbiology laboratory.
CO3	To examine the specimen Collection from Patients, Epidemiological investigations.
CO4	To study the isolation of Pure Culture and its Preservation.
CO5	To select the morphology of bacteria, stain cultural character, selective cultural media, biochemical reaction.
CO6	To explain the Drug sensitivity test and its clinical interpretation.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	2	-	1	1	1	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	-	1	-	-	-	-	-
CO6	1	2	-	-	-	-	-	-	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Miscellaneous Microbes, Fungal Pathogens and Associated Diseases.
Course Code	BMM 203
Year/ Semester	2 nd Year

	L	T	P	C
	2		1	3

Course Content:

Unit I

Principle and mode of action of antibiotics, antifungal and antiviral agents.

Description, Pathogenicity, mode of infection, incubation period and toxigenicity of:-

1. Bacteroides, Streptobacilli, Donovanias.
2. Lactobacillus.
3. Actinomyces, nocardia.
4. Leptospira.
5. Treponema, Borrelia.
6. Mycoplasma.

Unit II

Clinical presentation and pathology of miscellaneous microbial infections.

Description, pathogenicity mode of infection, incubation period and toxigenicity of:-

1. Chlamydia.
2. Rickettsiae.
3. Yeast, Yeast like organism and Candidiasis.
4. Dermatophytes and Superficial fungal infections.
5. Systematic fungi-Aspergillosis

Unit III

Pathogenic & Nonpathogenic fungi: - Clinical features and pathology.

Description, classification, Pathogenicity, mode of infection, incubation period and toxigenicity of:-

1. Pathogenic fungi: cryptococci, Blastomyces, Coccidioides, Paracoccidioides etc.
2. Superficial and deep fungal infections of Eye, Ear and skin.
3. Entomology: Insects: Mosquitoes, housefly, sand fly, fleas, lice, ticks and mites, Cyclops, bed bugs and cockroaches, rodents: Rats and mice.

Text Books:

TB9. Text Book of Microbiology

Dr. C P Baveja Edition

TB10. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB10. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB11. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To examine the principle and mode of action of antibiotics.
CO2	To classify the pathogens in terms of their pathogenesis, mode of infection and toxigenicity.
CO3	To demonstrate the clinical presentation and pathology of miscellaneous microbial pathogens.
CO4	To explain the pathogenic features of spirochetes and fungal microbes.
CO5	To evaluate the clinical characters and pathology of pathogenic and non-pathogenic fungi.
CO6	To develop an understanding of the classification, pathogenicity and diagnosis of pathogenic fungus and various insects.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1			-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	2	2	-	2	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	2	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	3	3	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Lab Diagnosis of Microbial Diseases
Course Code	BMM 204
Year/ Semester	2 nd Year

	L	T	P	C
	2		1	3

Course Outcomes

Unit I

Itiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Osteomyelitis, sore throat, scarlet fever, rheumatic fever, acute glomerulonephritis, Pneumonia, whooping cough, respiratory infections, meningitis, gonorrhoea, rat bite fever actinomycosis dental caries and leptospirosis.

Unit II

Itiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Diphtheria, tuberculosis, skin, ulcers and leprosy, malignant pustules and isortiers diseases, brucellosis, plague, genital infections, typhus, oral thrush, ringworms and mycetoma.

Unit III

Itiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Typhoid and paratyphoid fever, bacterial food poisoning, bacillary dysentery, gastroenteritis, choleraangrene, tetanua, botulism, wound infections, Aspergillosis, Blastomycosis etc.

Text Books:

TB11. Text Book of Microbiology

Dr. C P Baveja Edition

TB12. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB12. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB13. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To examine the etiopathogenesis, pathology, clinical features and Lab diagnosis of osteomyelitis, sore throat, scarlet fever, acute glomerulonephritis, pneumonia, rheumatic fever and whooping cough.
CO2	To classify the Gram-positive and Gram-negative bacterial infections causing bacteria in terms of pathogenesis, clinical features and Lab diagnosis.
CO3	To illustrate the clinical importance of the disease: Diphtheria, Tuberculosis, skin, ulcers and leprosy, malignant pustules and isortiers disease.
CO4	To analyse pathogenic features and lab diagnosis of brucellosis, plague, genital infections, typhus, oral thrush, ringworms and mycetoma.
CO5	To assess the laboratory identification methods of typhoid and paratyphoid fever, bacterial food poisoning, bacillary dysentery, gastroenteritis, and cholera.
CO6	To develop the understanding of disease with the help of pathogenesis, pathology, clinical features and lab diagnosis of Tetanua, botulism, wound infections, aspergillosis and blastomycosis.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	3	3	2	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	3	1	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Human Parasitology
Course Code	BMM 205
Year/ Semester	2 nd Year

	L	T	P	C
	2		1	3

<p>Course Outcomes</p> <p>Unit I Protozoology- Introduction and Classification. Phylum – Protozoa a) Class Rhizopoda-Amoeba. b) Class Mastigophora-Intestinal, oral and vaginal flagellates trypanosome and leishmania. c) Class Sporozoa – black water d) Class Ciliata.</p> <p>Unit II Protozoa of uncertain classification- Sacocysts, Pnemocystis and toxoplasma. Phylum-platyhelminthes a) Class-Cestoidea b) Class-Trematoda</p> <p>Unit III Phylum nemathelminths- Class- Nematoda. Lab Diagnostic procedures and special methods of demonstration of human parasites in blood, stool, tissue and other body fluids.</p>

Text Books: Text Book of Microbiology by Dr. C P Baveja Edition

TB13. Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

Reference Books:

- RB14. Prescott’s Microbiology**
Joanne Willey, Kathleen Sandman XI Edition
- RB15. Essentials of Microbiology & Immunology**
S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To describe the introduction and classification of Protozoa.
CO2	To classify the phylum Protozoa with reference to classes: Rhizopoda, Mastigophora. Sporozoa and Cilliata.
CO3	To demonstrate the clinical importance of Sacocysts, Pneumocystis and Toxoplasma.

CO4	To analyse pathogenic features and lab diagnosis of brucellosis, plague, genital infections, typhus, oral thrush, ringworms and mycetoma.
CO5	To evaluate the lab diagnosis, pathogenesis of Nematodes and their plan of treatment.
CO6	To generalize the lab diagnostic procedures and analysis of clinical samples.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	2	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	2	1	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	2	-	-	-	-	-
CO6	-	2	-	-	-	-	-	-	-	-	3	3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Applied Medical Microbiology
Course Code	BMM 206
Year/ Semester	2 nd Year

	L	T	P	C
	2		1	3

Unit I

1. Preparation of container and swabs for collections of specimens for microbial examinations.
2. Portal regulation and transport of specimen.
3. Flowchart of Lab diagnostic procedures.
4. Documentation of specimen in Laboratory.
5. Preservation of Micro-Organisms: Periodic subculture methods, cold Storage, freezing, deep freezing, lyophilize on methods. Total and viable counts of bacteria.

Unit II

1. Infection syndromes and diagnostic procedures.
2. Strategy of anti-microbial therapy.
3. Epidemiology markers of microorganisms: Serotyping and Bacteriophage.
4. Prophylactic mass immunization.
5. Nosocomial infection and sterility testing of I.V. fluids and processing of various samples for various hospital infections.

Unit III

1. Diagnosis, treatment and control of common infections and infestations.
2. Cell, tissue and organ culture.
3. Specific serological methods of diagnosis.
4. Test of sensitivity to antimicrobial agents and their preparation.
5. Specific culture and drug sensitivity methods.

Text Books:

TB14. Text Book of Microbiology

Dr. C P Baveja Edition

TB15. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB16. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB17. Essentials of Microbiology & Immunology**S K Mohanty & K Sai Leela & Dipti Pattanaik****Course outcomes (COs):****Upon successful completion of the course a student will be able to**

CO1	To examine the microbial specimens, their collection technique and lab diagnostic procedures.
CO2	To describe the process of documentation and preservation of microorganisms.
CO3	To illustrate the significance of infective syndromes their diagnostic procedures and the strategy of antimicrobial therapy.
CO4	To analyze in detail the epidemiology markers of micro-organisms, passive prophylactic mass immunization and nosocomial infections.
CO5	To evaluate the diagnosis, treatment and control of common infections and manifestations.
CO6	To design the specific serological methods for diagnosis and drug sensitivity methods.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	2	-	3	3
CO2	-	-	-	-	-	-	-	-	2	2	3	3
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	-	-	1	-	-
CO6	-	1	-	-	-	-	-	2	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Bacterial Pathogens & associated Diseases (Lab Course Based on Paper 1& 2)
Course Code	BMM 201 P
Year/ Semester	1 st year

	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours

2hrs/Week

S.No	Practical
1.	Safety rules of working in microbiology lab.
2.	Isolation of normal micro flora from human body.
3.	Identification of bacteria by Gram's Staining.
4.	Isolation of bacterial pathogens from pus sample
5.	Isolation of bacterial pathogens from sputum.
6.	Isolation of Bacteria from urine sample.
7.	Isolation of pathogens from hospital, Ward, Instrument, Hospital bed, patient wounds and cotton pads and their biochemical characterization.
8.	Characterization of bacteria using IMViC test.
9.	To perform urine/ Pus culture.
10.	To perform motility Test by hanging drop method.
11.	To perform Drug Susceptibility testing.

* Course Outcomes of the above practical is covered their respective theory course.

Course Name	Miscellaneous Microbes, Fungal Pathogens and Associated Diseases (Lab Course Based on Paper 3& 4)
Course Code	BMM 203 P
Year/ Semester	1 st year

	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours

2hrs/Week

S.No	Practical
1.	Safety rules of working in microbiology lab.
2.	Isolation of normal micro flora from various clinical samples.
3.	Identification of bacteria using different Staining techniques.
4.	Isolation of bacterial pathogens from pus, sputum, Urine samples.
5.	Characterization of Bacterial isolates using biochemical test.
6.	Isolation of fungal pathogens from clinical samples.
7.	Isolation of pathogens from hospital, Ward, Instrument, Hospital bed, patient wounds and cotton pads and their biochemical characterization.
8.	To perform antibiotic susceptibility tests using Kirby Bauer Method.
9.	To perform antibiotic susceptibility tests using Agar Well Diffusion Method.
10.	To perform antibiotic susceptibility tests using MIC and MBC assay.

* Course Outcomes of the above practical is covered their respective theory course.

Course Name	Human Parasitology (Lab Course Based on Paper 5& 6)
Course Code	BMM 205 P
Year/ Semester	1 st year

	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours		2hrs/Week
S.No	Practical	
1.	Safety rules of working in microbiology lab.	
2.	To perform Drug susceptibility against bacterial sample.	
3.	To perform Drug susceptibility against fungal sample.	
4.	To examine stool samples and vomitus samples for the identification of parasites	
5.	Isolation and identification of dermatophytes.	
6.	Isolation of pathogens from hospital, Ward, Instrument, Hospital bed, patient wounds and cotton pads and their biochemical characterization as nosocomial pathogens.	
7.	Slide preparation for parasites amoebae	
8.	Examination and procedures for human parasite blood/ stool/ tissue and other body fluids.	
9.	To perform antibiotic susceptibility tests using Agar Well Diffusion Method.	
10.	To perform antibiotic susceptibility tests using MIC and MBC assay.	

* Course Outcomes of the above practical is covered their respective theory course.

Course Name	Pathogenic Viruses and Associated Diseases
Course Code	BMM 301
Year/ Semester	3 rd Year

	L	T	P	C
	2		1	3

Course Outcomes

Unit I

1. Pox-Viruses: Smallpox, Vaccinia, Molluscum contagiosum.
2. Herpes Virus: H Simplex, Chickenpox-Zoster, CMV, IMN and burkitt's Lymphomas.
3. Adenoviruses: Pharyngeal infections, Respiratory infections and conjunctival infection

Unit II

4. Orthomixoviruses (Influenza Type A, B, C etc): Influenza.
5. Paramyxovirus: Respiratory Infections, mumps and measles.
6. Miscellaneous Viruses: Rubella, Corona, Arena viruses: Rubella, common cold is lymphocytic meningitis.
7. Picorna Viruses: Enteroviruses, Poliomyelitis Aseptic and Epidemic Myalgia.
8. Rhinoviruses-Common Cold.

Unit III

1. Hepatitis Viruses: Infectious and serum Hepatitis
2. Arbo Viruses: Encephalitis, Yellow fever, Dengue fever
3. Rhabdo Viruses: Rabies
4. Slow and oncogenic Virus: Scrapie, Kuru and animal virus tumors
5. Cell culture and observation of effect of viruses on cell. Technique, Procedure and interpretation of results.

Text Books:

TB16. Text Book of Microbiology

Dr. C P Baveja Edition

TB17. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB18. Prescott's Microbiology

Joanne Willey , Kathleen Sandman XI Edition

RB19. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To describe the pathogenesis, life cycle and treatment of Pox and Herpes virus.
CO2	To explain the pathogenicity and treatment of adenoviruses.
CO3	To demonstrate the patterns of orthomyxovirus and paramyxovirus disease causing abilities and interventions to prevent the infection.
CO4	To classify miscellaneous viruses, Picorna viruses and rhinoviruses in terms of their pathogenesis.
CO5	To summarize the clinical manifestations and treatment plan of Hepatitis viruses, arbo viruses and rhabdo viruses,
CO6	To develop an understanding of slow and oncogenic viruses and cell culture studies.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	1	-	-	-	-
CO3	-	2	-	-	-	2	2	2	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	2	1	1	-	-	-	-
CO6	-	-	-	-	-	-	-	1	-	-	-	-

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Applied Immunology & Serodiagnosis
Course Code	BMM 302
Year/ Semester	3 rd Year

	L	T	P	C
	2		1	3

Course Outcomes

Unit I

1. Basic Concept: Antigen, antibody complements and immune complexes. Immune reactions and laboratory tests for detection of antigen and antibodies.
2. Electrophoresis & Chromatography: Principles, technique and application. Gas – Liquid chromatography (GLC), Ion Exchange Chromatography, exclusion chromatography (TLC). Polyacrylamide Gel- Electrophoresis (PAGE), SDS-PAGE. Agarose Gel Electrophoresis and Immuno Electrophoresis.
3. Spectroscopic I & Centrifugation techniques: Visible & UV Spectroscopy, Electron spin resonance (ESR), Nuclear Magnetic resonance (NMR). Basic Principles of sedimentation and applications of analytical centrifuges.
4. Antibody production by microbial agents and its clinical significance.
5. Hepatitis markers: HbsAg, anti HBC Igm, HbeAg/anti Hbe Ag, HDV, anti HBs, HBVvDNA and Hv RNA: Technique and interpretation of results. Clinical significance of Hepatitis markers.

Unit II

6. Autoimmune disorders: Pathogenesis and clinical feature, Autoimmune disorders markers: C3, C4, ANCA, ANA, antismooth muscle antibodies, immune complexes, HLA B0-27, anti sperm antibody, clinical significance, Autoimmune disorders: Anti mitochondrial, anti SCl-70. Anti parietal cell antibody, lupin anticoagulants.
7. ELISA and allied techniques: Radio Immuno assay and polymerase chain reaction, principle technique and applications.

Unit III

8. Serological tests: Widal, ASO, CRP, Rose Wallet, Brucella-Agglutination, Cold agglutination, VDRL, TPHA and STS.
9. HIV 1 & 2 screening and western blot.
10. Tumor markers: Various tumor markers and their clinical significance Automation and advance technology in various surface markers: Principles and Applications.
11. Preparation of antibiotics and antimicrobial agents: Principles and significance, Preparation of Vaccine and experimental study of immunogenicity.

Text Books:

TB18. Text Book of Microbiology

Dr. C P Baveja Edition

TB19. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB20. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB21. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To describe the basic concepts of immunology and analytical techniques.
CO2	To explain the mechanisms of antibody production, its clinical significance and various viral markers for identification.
CO3	To demonstrate the importance of autoimmune disorders, pathogenesis, clinical features and its markers.
CO4	To explain the concept of immunological techniques with principle and applications.
CO5	To summarize the methods and principle of serological tests and HIV I & 2 screening.
CO6	To develop an understanding of tumor markers, their clinical significance, antibiotic preparation and vaccine production.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	-	2	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	2	-
CO5	-	-	-	-	-	-	-	-	-	2	2	2
CO6	-	-	-	-	-	-	1	2	-	2	3	3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Advanced Diagnostic Technology
Course Code	BMM 303
Year/ Semester	3 rd year

	L	T	P	C
	2		1	3

Course Outcomes

Unit I

1. Bacteriophages: Classification, morphological groups and applications of Bacteriophages in Medical Microbiology
2. DNA, Replication, translation and transduction: Principles, technology and applications in diagnosis.
3. TORCH-Profile: Technique and interpretation of results.
4. Anti A-60Mycobacterium IgG and mycodot, Technique and interpretation of results.

Unit II

12. IgM to HB core antigen (HBCAg): Technique and interpretation of results.
13. IgG to Hepatitis C virus (HCV): Technique and interpretation of results.
14. IgG to Hepatitis A Virus (HAV): Technique and interpretation of results.
15. BHs Ag (ELFA): Technique and interpretation of results.
16. Cy: stercosisIgG (DLISIA): Technique and interpretation of result.

Unit III

1. HIV P-24 Antigen test: Technique and interpretation of results.
2. Anti ds DNA test: Technique and interpretation of results.
3. ChlamydiaIgM: Technique and interpretation of results.
4. Dengue IgM: Technique and interpretation of results.
5. IgG, IgA, IgM: Technique and interpretation of results.
6. Steller test and total IgE: Technique and interpretation of results.

Text Books:

TB20. Text Book of Microbiology

Dr. C P Baveja Edition

TB21. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB22. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB23. Essentials of Microbiology & Immunology

S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To memorize the clinical significance of bacteriophages and concept of DNA and Protein synthesis mechanisms.
CO2	To explain the importance of TORCH profile and kit based study to identify the <i>M.tuberculosis</i> .
CO3	To demonstrate the identification techniques of Hepatitis A, B, C virus immunoglobulins.
CO4	To explain the concept of viral serological techniques: ELFA, DLISIA.
CO5	To assess the presence of HIV, autoimmune disorder and chlamydia serologically.
CO6	To compile the serological diagnostic tests used for the identification of Dengue, Steller test and important immunoglobulins.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	2	2	-	-	-	-	-
CO4	-	-	-	-	-	1	2	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Recombinant DNA Technology
Course Code	BMM 304
Year/ Semester	3 rd year

	L	T	P	C
	2		1	3

Course Content:

UNIT I

Molecular tools and applications- restriction enzymes, ligases, polymerases, alkaline phosphatase. Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication, Principle and applications of Polymerase chain reaction (PCR), primer-design, and RT- (Reverse transcription) PCR.

UNIT II

Sequence Detection, Amplification and Modification Techniques. Blotting techniques (Methodologies and applications): Southern, Northern and Western blotting; Probe labelling and hybridization; DNA sequencing (Chemical, enzymatic and automated methods); Sequence assembly for whole genome analysis.

UNIT III

Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Gene shuffling, production of chimeric proteins, Protein engineering concepts and examples (any two).

UNIT IV

Principles and Tools of Gene Cloning: Isolation of nucleic acids; Enzymes used in genetic engineering; Restriction endonucleases; Cloning vectors: Characteristic features and applications of vectors based on plasmids (E. coli and yeast), phages (λ and M13 bacteriophage), Cosmids, phasmids, artificial chromosome vectors (BAC,PAC and YAC), vectors for animal cells and shuttle vectors.

Unit V:

Strategies of Gene Cloning : Steps of cloning, Formation of DNA fragments using linkers, adaptors and homopolymer tails, Introduction of DNA into host cells (Bacteria, plant and animal cells).

Text Books: Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.

Clark DP and Pazdernik NJ. (2009). *Biotechnology-Appling the Genetic Revolution*. Elsevier Academic Press, USA.

Reference Books:

Glick, B.R., Pasternak, J.J. (2003). *Molecular Biotechnology- Principles and Applications of recombinant DNA*. ASM Press, Washington

Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7 the edition. Blackwell Publishing, Oxford, U.K.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To memorize the enzymes and molecular tools used in Recombinant DNA technology.
CO2	To explain the different types of blotting techniques.
CO3	To Discuss about the types of mutagenesis and concepts of protein engineering
CO4	To explain the tools and principles of Gene Cloning.
CO5	To understand the strategies of Gene Cloning.
CO6	To develop an understanding of identification methods of gene cloning.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	1	2	2
CO2	-	-	-	-	-	-	-	-	2	-	2	2
CO3	-	-	-	-	-	-	-	-	2	1	-	3
CO4	-	-	-	-	-	-	-	-	-	1	-	3
CO5	-	-	-	-	-	-	-	-	2	-	-	3
CO6	-	-	-	-	-	-	-	-	3	3	2	3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Molecular Biology
Course Code	BMM305
Year/ Semester	3 rd year

	L	T	P	C
	2		1	3

Course Content

Unit I

1. Determination of Blood Glucose by various methods. Glucose tolerance test, Glycosylated haemoglobin: Interpretation of results & Clinical Co-relation.
2. Profile test: Serum Cholesterol, HDL, LDL, Triglycerides. Lipoproteins & lipids.
3. Determination of liver function tests: Serum bilirubin (Total, Direct & Indirect) SGOT (AST). SGPT (ALT), serum proteins, A/G ratio, Alkaline Phosphatase, Prothrombin Time (procedure. Interpretation & clinical correlation of results).

UNIT II

1. Function test: Blood urea, Serum Creatinine, Uric acid and various ice test.
2. Cardiac profile (CK – MB and LDH and Electrolyte (Sodium, Potassium chloride & Bicarbonates).
3. Cerebrospinal and other body fluids analysis. (Normal & Abnormal values & Clinical significance).

Unit III

1. ABO & RH blood Group System: Technique of Grouping & Cross Matching, components, preparation & uses. Quality assurance and safety measures in Blood Banking Organization. Operation and administration of the Bank.
2. Static Mechanism: Theories of Blood Coagulation & Diagnostic procedures for coagulation disorders.
3. Antiglobulin (COOBM'S) test: Principle procedure and application. Direct indirect coomb's test.
4. Anemia & Leukemia: Definition, Classification, Pathogenesis and Diagnostic Procedures.

Text Book of Microbiology by Dr. C P Baveja Edition

Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

Reference Books: Prescott's Microbiology by Joanne Willey ,Kathleen Sandman XI Edition

Essentials of Microbiology & Immunology by S K Mohanty & K Sai Leela & Dipti Pattanaik

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To list the Determination of Blood Glucose by various methods. Glucose tolerance test.
CO2	To describe the Function test, Blood urea, Serum Creatinine, Uric acid and various ice test.
CO3	To operate the spinal and other body fluids analysis. (Normal & Abnormal values & Clinical significance).
CO4	To question the Quality assurance and safety measures in Blood Banking Organisation. Operation and administration of the Bank.
CO5	To select the Tissue Processing Dehydration, clearing & impregnation in wax & Decalcification.
CO6	To investigate the Exfoliative cytology, FNAC and cervical cytology, Techniques, applications and interpretation of results.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	2	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	2
CO5	-	-	-	-	-	-	-	-	-	-	-	2
CO6	-	-	-	-	-	-	-	-	-	2	2	3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Name	Pathogenic Viruses and associated Diseases (Lab Course Based on Paper 1& 2)
Course Code	BMM 301 P
Year/ Semester	III rd year

	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours

2hrs/Week

S.No	Practical
1.	Safety rules of working in microbiology lab.
2.	To perform Drug susceptibility against bacterial sample.
3.	To perform Drug susceptibility against fungal sample.
4.	To examine stool samples and vomitus samples for the identification of parasites
5.	Isolation and identification of dermatophytes.
6.	Isolation of pathogens from hospital, Ward, Instrument, Hospital bed, patient wounds and cotton pads and their biochemical characterization as nosocomial pathogens.
7.	Slide preparation for parasites amoebae
8.	Examination and procedures for human parasite blood/ stool/ tissue and other body fluids.
9.	To perform antibiotic susceptibility tests using Agar Well Diffusion Method.
10.	To perform antibiotic susceptibility tests using MIC and MBC assay.

* Course Outcomes of the above practical is covered their respective theory course.

Course Name	Advanced Diagnostic Technology (Lab Course Based on Paper 3& 4)
Course Code	BMM 303 P

Year/ Semester	III rd year
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	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours

2hrs/Week

S.No	Practical
1.	Safety rules of working in microbiology lab.
2.	To perform TORCH profile.
3.	To perform Dengue (Serological identification).
4.	To isolate DNA from Blood sample.
5.	To perform Agarose Gel Electrophoresis.
6.	To perform Plasmid DNA isolation.
7.	Serological identification of immunoglobulins using commercial available kit.

* Course Outcomes of the above practical is covered their respective theory course.

Course Name	Molecular Biology (Lab Course Based on Paper 5)
Course Code	BMM 305 P
Year/ Semester	III rd year

	L	T	P	C
			02	01

L - Lecture T – Tutorial P – Practical C – Credit

Credit hours

2hrs/Week

S.No	Practical
1.	Safety rules of working in microbiology lab.
2.	Estimation of Blood Glucose by GOD-POD method
3.	Estimation of Serum total Cholesterol by CHOD – POD method
4.	Estimation of serum bilirubin.
5.	Estimation of serum SGOT activity.
6.	Estimation of serum SGPT activity.
7.	Estimation of Serum total protein.
8.	To perform ABO blood grouping test.
9.	To perform Coomb’s test (Direct & Indirect).
10.	To perform general Blood picture and study.
11.	To perform PT & APTT.

* Course Outcomes of the above practical is covered their respective theory course.