

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 2024-2025)

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, immunology 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 MEDICAL MICROBIOLOGY

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 MICROBIOLOGY 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 (Medical Microbiology), 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 6 SEMESTER FOLLOWED BY 6 MONTHS INTERNSHIP as follows:-

B.Sc Medical Microbiology: Three Year (6 Semester) Programme with 6 months internship.				
Basic Structure: Distribution of Courses				
S. No	Type of Course	Total Courses	Credits per course (hour)	Total Credits
1	Core Course (CC)	08	4	32
2	Ability-Enhancement Compulsory Course (AECC)	03	2	06
3	Discipline Specific Course (DSC)	28	4	112
4	Skill Enhancement Course (SEC)	20	1	20
5	Discipline Specific Elective Course (DSEC)	02	2	04
6.	FC (Foundation Course)	01	2	02
	TOTAL CREDIT	62		168 (Excluding AECC & FC).

DISTRIBUTION OF MARKS TO VARIOUS DISCIPLINES
BMM Ist Semester

S.No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	CC-1	BMM-101	Human Anatomy & Physiology-I	4			4	40	60	100
2.	CC-2	BMM-102	Basic Pathology-I	4			4	40	60	100
3.	CC-3	BMM-103	Clinical Biochemistry-I	4			4	40	60	100
4.	CC-4	BMM-104	Preventive Medicine & Community HealthCare-I	4			4	40	60	100
5.	DSC-1	BMM-105	Fundamentals of Microbiology-I	4			4	40	60	100
6.	DSC-2	BMM - 106	Instrumentation Techniques in Medical Microbiology-I	4			4	40	60	100
7.	AECC-1	BMM - 107	English Communication Skills	2			2			
8.	FC	FC-101	Remedial Biology	2			2			
9.	SEC-1	BMM-P-108	Lab course based on CC 1&2			2	1	40	60	100
10.	SEC-2	BMM-P-109	Lab course based on CC 3			2	1	40	60	100
11.	SEC-3	BMM-P-110	Lab course based on DSC 1 & 2			2	1	40	60	100
							27			900

BMM IInd Semester

S.No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	CC-5	BMM-201	Human Anatomy & Physiology-II	4			4	40	60	100
2.	CC-6	BMM-202	Basic Pathology-II	4			4	40	60	100
3.	CC-7	BMM-203	Clinical Biochemistry-II	4			4	40	60	100
4.	CC-8	BMM-204	Preventive Medicine & Community HealthCare-II	4			4	40	60	100
5.	DSC-3	BMM-205	Fundamentals of Microbiology-II	4			4	40	60	100
6.	DSC-4	BMM-206	Instrumentation Techniques in Medical Microbiology-II	4			4	40	60	100
7.	AECC-2	BMM-207	Professional ethics in Health care	2			2			
8.	SEC-4	BMM-P-208	Lab course based on CC 5&6			2	1	40	60	100
9.	SEC-5	BMM-P-209	Lab course based on CC 7			2	1	40	60	100
10.	SEC-6	BMM-P-210	Lab course based on DSC 3 & 4			2	1	40	60	100
							27			900

BMM IIIrd Semester

S.No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	DSC-5	BMM-301	Bacterial Pathogens & Associated Diseases-I	4			4	40	60	100
2.	DSC-6	BMM-302	Systematic Bacteriology-I	4			4	40	60	100
3.	DSC-7	BMM-303	Misc. Microbes Fungal, Pathogens & Associated Disease-I	4			4	40	60	100
4.	DSC-8	BMM-304	Lab Diagnosis of Microbial Diseases-I	4			4	40	60	100
5.	DSC-9	BMM-305	Human Parasitology-I	4			4	40	60	100
6.	DSC-10	BMM-306	Applied Medical Microbiology-I	4			4	40	60	100
7.	AECC-3	BMM-307	Environmental Science	2			2			
8.	SEC-12	BMM-P-308	Lab course based on DSC 5& 6			2	1	40	60	100
9.	SEC-13	BMM-P-309	Lab course based on DSC 7& 8			2	1	40	60	100
10.	SEC-14	BMM-P-310	Lab course based on DSC 9 & 10			2	1	40	60	100
11.										
							27			900

BMM IVth Semester

S.No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	DSC-12	BMM-401	Bacterial Pathogens & Associated Diseases-II	4			4	40	60	100
2.	DSC-13	BMM-402	Systematic Bacteriology-II	4			4	40	60	100
3.	DSC-14	BMM-403	Misc. Microbes Fungal, Pathogens &Asso. Disease-II	4			4	40	60	100
4.	DSC-15	BMM-404	Lab Diagnosis of Microbial Diseases-II	4			4	40	60	100
5.	DSC-16	BMM-405	Human Parasitology-II	4			4	40	60	100
6.	DSC-17	BMM-406	Applied Medical Microbiology-II	4			4	40	60	100
8.	SEC-17	BMM-P-407	Lab course based on DSC 12 &13			2	1	40	60	100
9.	SEC-18	BMM-P-408	Lab course based on DSC 14 &15			2	1	40	60	100
10.	SEC-19	BMM-P-409	Lab course based on DSC 16& 17			2	1	40	60	100
							27			900

BMM Vth Semester

S.No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	DSC-18	BMM-501	Pathogenic Viruses and Associated Diseases-I	4			4	40	60	100
2.	DSC-19	BMM-502	Applied Immunology & Serodiagnosis-I	4			4	40	60	100
3.	DSC-20	BMM-503	Advanced Diagnostic Technology-I	4			4	40	60	100
4.	DSC-21	BMM-504	Recombinant DNA Technology-I	4			4	40	60	100
5.	DSC-22	BMM-505	Clinical Biochemistry	4			4	40	60	100
6.	DSC-23	BMM-506	Clinical Lab Technology-I	4			4	40	60	100
8.	DSEC-1	BMM-P-507	Elective Course* 1. Microbial Genetics-I 2. Basic Bioinformatics	2			2	40	60	100
9.	SEC-23	BMM-P-508	Lab course based on DSC 18 & 19			2	1	40	60	100
10.	SEC-24	BMM-P-509	Lab course based on DSC 20 & 21			2	1	40	60	100
16.	SEC-25	BMM-P-510	Lab course based on DSC 22, 23 & DSEC 1			2	1	40	60	100
17.	SEC-30	BMM-P-511	Clinical Posting*			2	1	40	60	100
							30			1100

BMM VIth Semester

S.No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	DSC-24	BMM-601	Pathogenic Viruses and Associated Diseases-II	4			4	40	60	100
2.	DSC-25	BMM-602	Applied Immunology & Serodiagnosis-II	4			4	40	60	100
3.	DSC-26	BMM-603	Advanced Diagnostic Technology-II	4			4	40	60	100
4.	DSC-27	BMM-604	Recombinant DNA Technology-II	4			4	40	60	100
5.	DSC-28	BMM-605	Immunology	4			4	40	60	100
6.	DSC-29	BMM-606	Clinical Lab Technology-II	4			4	40	60	100
7.	DSEC-2	BMM-P-607	Elective Course* 1. Microbial Genetics –II 2. Advanced Bioinformatics	2			2	40	60	100
8.	SEC-31	BMM-P-608	Lab course based on DSC 24 & 25			2	1	40	60	100
9.	SEC-32	BMM-P-609	Lab course based on DSC 26 & 27			2	1	40	60	100
10.	SEC-33	BMM-P-610	Lab course based on DSC 28 & 29			2	1	40	60	100
14.	SEC-37		Clinical Posting			2	1	40	60	100
							30			1100

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 4 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 40% in sessional and 60% 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 OF EXAMINATION:

1. Ist End Semester examinations at the end of Ist sem
2. IInd End Semester Examination at the end of IInd sem.
3. IIIrd End Semester Examination at the end of IIIrd sem.
4. IVth End Semester examinations at the end of IVth sem
5. Vth End Semester Examination at the end of Vth sem.
6. VIth End Semester Examination at the end of VIth sem.
7. Six months Internship after VIth End Semester Examination

EXAMINATION CRITERIA:

A student should obtain 40% of the marks individually in each paper, including Internal and external, whereas a requirement of total of aggregate marks should be 50% and will be considered to be passed the semester examination and will be promoted to next semester.

There shall be two internal examination and one end semester examination in each semester system.

All the examination criteria have been under the norms and regulation of SGRR University

THEORY & PRACTICAL EXAMINATION: All the theory and practical examination papers of every semester carrying 100 marks out of which 40 marks will be internal assessment and 60 marks for external assessment.

ATTENDANCE: 75% of attendance in each subject is compulsory for appearing in the internal as well as external examination.

INTERNAL ASSESSMENT

- (a) It shall be based on day-to-day assessment (see note), evaluation of student assignment, preparation for seminar. Clinical case presentation etc.
- (b) Two Sessional examinations should be conducted in each semester and compulsory to appear in the examination.
- (c) Day to day records should be given importance during internal assessment.
- (d) Student must secure at least 40% marks for internal Assessment in Particular subject in order to eligible to appear in final university examination.
- (e) 75% attendance is must for Internal Examination.

Note: Internal Assessment shall be different ways in which students' participation in learning process is evaluated. Some examples are as follows-

- (i) Preparation of subject for student's seminar.
- (ii) Preparation of a clinical case for discussion.
- (iii) Clinical case study problem solving exercise.
- (iv) Proficiency in carrying out a practical or a skill in small research project.
- (v) Multiple choice questions (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 homework'/Vacation work.

EXTERNAL ASSESSMENT

Theory Papers will be prepared by examiners as prescribed. Nature of question will be short answer type / objective type/Long answer 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 preferably include for assessment. Emphasis should be on candidate's capability in eliciting physical signs and their interpretation. Viva/ Oral evaluation is compulsory in theory/ practical/case study.

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.

DURATION OF EXAMINATION

- (i) Internal examination should be based on written paper and are of One-hour duration.
- (ii) External End Semester theory examination should be based on written paper and are of Three-hour duration.
- (iii) A clinical / practical examination in any subject for student shall not be for more than 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
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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 which will be for a period of 1 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 at 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 to 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 Technique
 - (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.

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-I
Course Code	: BMM-101
Semester /Year	: 1 st Semester

	L	T	P	C
	04		01	05

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

Course Contents

4hrs/Week

<p>Unit 1: Introduction to Anatomy and Physiology: Definition and scope of anatomy and physiology. Levels of structural organization. Anatomical terminology. Body planes, sections, and directional terms.</p> <p>Unit 2: The Cell: Overview of cell structure and function. Cellular organelles and their functions. Cell membrane structure and transport mechanisms. Cell cycle, mitosis, and meiosis.</p> <p>Unit 3: Tissues: Classification and characteristics of epithelial tissue. Connective tissue types and functions. Muscle tissue types and characteristics. Nervous tissue structure and function.</p> <p>Unit 4: Integumentary System: Structure and function of the skin. Skin layers & Accessory structures. Skin functions and disorders.</p> <p>Unit 5: Skeletal System and Muscular System: Bone structure, function, development and growth. Classification of bones. Joints: Types and functions. Overview of muscle tissue types. Anatomy of skeletal muscles. Mechanism of muscle contraction. Major muscles of the body and their functions.</p>
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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	Comprehend Basic Anatomical and Physiological Concepts.
CO2	Understand Cellular Structure and Function.
CO3	Classify and Describe Different Tissue Types.
CO4	Analyse the Structure and Function of the Integumentary System.
CO5	Explain the Skeletal System and Its Components.
CO6	Develop Understanding about the Muscular System and Muscle Physiology.

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 -I
Course Code	BMM-102
Semester /Year	1 st Semester

	L	T	P	C
	04		01	05

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

Course Contents

4hrs/Week

Unit I: Introduction to hematology. Laboratory organization & Safety measures. Formation, Composition and functions of blood. Anticoagulants, mode of action of anticoagulants and their merits & demerits.

Unit 2: Collection, preservation, transport and handling and disposal of blood samples. Basic haematology and estimation of haematocrit values, physiological variations, normal and absolute values and quality assurance in haematology.

Unit 3: Romanowsky dyes, preparation and staining procedures of blood smears, Morphology of blood cells and their identifications.

Unit 4: Haemo-globinometry: Various methods, errors involved and standardization of instruments.

Unit 5: Haemo-cytometry: Procedure of cell count, visual as well as electronic, red blood cells, leucocyte and platelet count. Errors involved and mean to minimize such errors.

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	Describe the basic concepts of hematology,
CO2	Explain the modes of action, merits, and demerits of various anticoagulants used in hematology.
CO3	Demonstrate the proper techniques in haematology.
CO4	Analyze and interpret blood smears using Romanowsky dyes, identifying the morphology of different blood cells and understanding the staining procedures.
CO5	Evaluate and standardize instruments and methods used in hemoglobinometry, identifying potential errors and ensuring accurate measurements.
CO6	Design and implement procedures for hemocytometry.

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-I
Course Code	BMM-103
Year/ Semester	1 st Semester

	L	T	P	C
	04		01	05

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

Course Contents

4hrs/Week

Unit I: 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.

Unit 2: Basic awareness of laboratory in respect to equipments & glassware's. (Unit of measurements and calibration of volumetric apparatus. Colorimetry, spectrophotometer, flame-photometry, (Principles Instrumentations & applications)

Unit 3: Preparation and storage of reagents, standard solutions, buffer solutions and pH determination. Biophysics, techniques – osmosis, dialysis, surface tension, sedimentation and viscosity – principles & applications.

Unit 4: 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.

Unit 5: Collection of blood specimens avoiding Haemolysis, de- proteinization & separation of serum /Plasma. Biochemical composition of body fluids and their physiological variations.

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	Define the fundamental concepts of clinical biochemistry.
CO2	Explain the principles and applications of instrumentation in biochemistry.
CO3	Apply Biophysical techniques in biochemistry laboratory.
CO4	Analyze and apply the Henderson-Hasselbalch equation to clinical scenarios.
CO5	Evaluate the clinical sensitivity and specificity of biochemical tests and assess the factors affecting clinical results.
CO6	Design and implement procedures for the collection of blood specimens.

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

B.Sc Medical Microbiology Ist Semester

Course Name	Preventive Medicine & Health care-I
Course Code	BMM-104
Year/ Semester	I st Semester

	L	T	P	C
	4		1	5

Course Contents

4 hrs/Week

<p>Unit 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.</p> <p>Unit 2: Hygiene and Sanitation: Sanitation barriers, excreta disposal and disposal of hospital waste, Incineration and disinfection.</p> <p>Unit 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.</p> <p>Unit 4: 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).</p> <p>Unit 5: 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.</p>

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	Describe the fundamental concepts of water, air, and noise pollution.
CO2	Explain the principles of hygiene and sanitation.
CO3	Demonstrate the application of knowledge about microbial pathogenicity.
CO4	Analyze epidemiological data related to community infections, including the role of surveillance, the emergence of drug resistance, and the impact of various preventive measures.
CO5	Evaluate the effectiveness of prophylactic immunization, national immunization programs and vaccine schedules.
CO6	Implement strategies for the prevention and control of infections in community and hospital settings.

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

B.Sc Medical Microbiology Ist Semester

Course Name	Fundamentals of Medical Microbiology-I
Course Code	BMM-105
Year/ Semester	1 st Semester

	L	T	P	C
	4		1	5

Course Contents

4hrs/Week

Unit 1: Microbiology & Medicine: Introduction to Medical Microbiology. Discovery of micro-organisms. Contribution of Robert Koch, Antony Van Leeuwenhoek, Louis Pasteur, Border, Paul Ehrlich, Alexander Fleming. Metchnikoff, Needham, Tyndall Jensen, Joseph Lister, Karl Landsteiner etc. Scope & relevance and safety measures of Medical Microbiology. Role of medical microbiology in identification and management of various infectious diseases.

Unit 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.

Unit 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.

Unit 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 5: Introduction to Virology, Mycology & Parasitology: Characteristics, morphology, and pathogenesis.

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	Introduce the key figures in the history of medical microbiology and their contributions.
CO2	Explain the anatomy of bacterial cells, including intracellular components.
CO3	Apply knowledge of bacterial morphology and classification to identify bacteria
CO4	Analyze various sterilization and disinfection methods and Evaluate their effectiveness and limitations in different scenarios.
CO5	Measure the role of medical microbiology in the identification and management of infectious diseases
CO6	Formulate strategies for identifying and managing infectious diseases, integrating knowledge from microbiology, virology, mycology, and parasitology.

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

B.Sc Medical Microbiology Ist Semester

Course Name	Instrumentation Techniques In Medical Microbiology-I
Course Code	BMM-106
Year/ Semester	1 st Semester

	L	T	P	C
	4		1	5

Course Contents

4hrs/Week

Unit I: 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.

Unit 2: Study of pH in Microbiology: Methods for measurements pH meter, Preparation dilution and chemistry of suspension fluids. Oxidation – reduction (redox) potential.

Unit 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, intra cytoplasmic lipids, polysaccharides nuclear material, Fields Stain for amoebae, fungi and rickettsiae.

Unit 4: Study of instruments used in Medical Microbiology: General instruments: Distillation plant, Centrifuge Machine, Analytical Balance, Hotplate, Magnetic Stirrer, water Bath, Automatic Dispensers and diluters. Deidonizer etc.

Unit 5: Microbiological Instruments: Autoclave, Incubator, Hot air oven, Laminar Air Flow, Colony Counter. Muffle furnace. Refrigerator, inoculators, Macintosh field- jar etc.

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	Identify the fundamentals types of microscopes such as phase contrast, interference, fluorescent, and electron microscopes.
CO2	Understand the care and maintenance of microscopes and common challenges associated with their use.
CO3	Apply knowledge of instrumentation techniques devised for measurements in microbiology.
CO4	Analyse the effectiveness of different stains in visualizing microbial structures.
CO5	Evaluate the function and usage of general and microbiological instruments in medical microbiology
CO6	Develop effective procedures for using and maintaining microbiological instruments

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

B.Sc Medical Microbiology Ist Semester

Course Name	English communication Skills
Course Code	BMM-107
Year/ Semester	1 st Semester

	L	T	P	C
	2			2

Course Contents

2 hrs/Week

Unit 1: Introduction to Communication: Definition and importance of communication. Types of communication (verbal and non-verbal). Barriers to effective communication. Overcoming communication barriers.

Unit 2: Listening & Speaking Skills: Importance of listening. Types of listening (active and passive). Barriers to effective listening. Techniques to improve listening skills. Components of effective speaking. Pronunciation and phonetics. Stress, intonation, and rhythm. Public speaking and presentation skills. Group discussions and debates.

Unit 3: Reading & Writing skills: Importance of reading. Intensive and extensive reading. Reading comprehension strategies. Critical reading and analysis. Sentence structure and grammar. Paragraph, Essay, Report writing. Email and business correspondence. Technical writing basics.

Unit 4: Interpersonal Communication: Building and maintaining relationships. Conflict resolution. Negotiation skills. Teamwork and collaboration.

Unit 5: Professional Communication: Resume and cover letter writing. Interview skills. Professional etiquette and workplace communication. Presentation and meeting skills.

Text Books:

1. "Business Communication: Process and Product" by Mary Ellen Guffey and Dana Loewy. 2018. Edition 9th. Publisher Cengage Learning.
2. Technical Communication: A Practical Approach" by William S. Pfeiffer and Kaye E. Adkins. 2012. Edition 8th. Pearson.

Reference Books:

1. English Grammar in Use" by Raymond Murphy. 5th Edition 2019. Cambridge University Press.

Course outcomes (COs):

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

CO1	Describe the fundamental concepts of communication.
CO2	Explain the importance of listening and speaking skills.
CO3	Apply reading and writing skills in various contexts, including intensive and extensive reading, reading comprehension strategies, and critical analysis
CO4	Analyse interpersonal communication skills.
CO5	Evaluate professional communication techniques.
CO6	Design and implement effective communication strategies.

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

B.Sc Medical Microbiology Ist Semester

Course Name	Remedial Biology
Course Code	FC-101
Year/ Semester	1 st Semester

	L	T	P	C
	2			2

UNIT-I

Introduction to Biology

Definition and Scope of Biology

- What is Biology?
- Branches of Biology (e.g., Botany, Zoology, Microbiology, Ecology)
- Importance of Biology in Science and Society

UNIT-II

Cell Biology

Cell Structure and Function

- Cell Theory
- Prokaryotic vs. Eukaryotic Cells
- Organelles and their Functions (e.g., Nucleus, Mitochondria, Ribosomes, Endoplasmic Reticulum, Golgi Apparatus)

Cell Membrane and Transport

- Structure of the Plasma Membrane
- Passive Transport (Diffusion, Osmosis)
- Active Transport (Pump Mechanisms, Endocytosis, Exocytosis)

Cell Cycle and Division

- Mitosis and its Phases
- Meiosis and its Phases
- Regulation of the Cell Cycle

UNIT-III

Genetics

Mendelian Genetics

- Principles of Inheritance (Dominant and Recessive Traits)
- Punnett Squares
- Genetic Crosses (Monohybrid, Dihybrid)

Molecular Genetics

- DNA Structure and Function
- RNA and Protein Synthesis (Transcription, Translation)

Genetic Variation and Heredity

- Mutations and Their Effects
- Genetic Linkage and Recombination

UNIT-IV

Evolutionary Biology

Theory of Evolution

- Charles Darwin and Natural Selection
- Evidence for Evolution (Fossil Record, Comparative Anatomy, Embryology, Molecular Biology)

UNIT-V

Anatomy and Physiology

Human Anatomy and Physiology

- Basic Human Body Systems (Integumentary, Skeletal, Muscular, Nervous, Endocrine, Cardiovascular, Respiratory, Digestive, Urinary, Reproductive)

Functional Relationships

- How Systems Interact (Homeostasis, Feedback Mechanisms)

Course outcomes (COs):

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

CO1	Understand the Scope and Importance of Biology.
CO2	Describe Cell Structure and Function.
CO3	Understand Cell Membrane Dynamics and Transport Mechanisms.
CO4	Explain Cell Cycle and Division Processes.
CO5	Apply Principles of Genetics and Genetic Variation.
CO6	Discuss Evolutionary Theory and Evidence.

B.Sc Medical Microbiology Ist Semester

Course code	: BMM-P-108
Course Name	: Lab course based on Paper CC 1 & CC 2
Semester /Year	: 1 st Semester

	L	T	P	C
	-	-	02	01

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

S. No	Practical
1.	Identify and label body planes, sections, and directional terms on diagrams and models.
2.	Use models to identify and describe the levels from cellular to organismal.
3.	Prepare slides of animal cells, identify cellular organelles, and sketch observations.
4.	Perform osmosis and diffusion experiments using dialysis tubing and different solutions.
5.	Examine prepared slides of mitotic and meiotic cells, identify different stages, and draw labelled diagrams.
6.	Use skin models and slides to identify epidermis, dermis, and accessory structures like hair follicles and sweat glands.
7.	Examine bone models and real bones to identify and classify them into long, short, flat, and irregular bones.
8.	Use joint models to identify and describe different joint types, such as synovial, fibrous, and cartilaginous joints.
9.	Use muscle models and diagrams to locate and name major muscles, and learn about their roles in movement.
10.	Tour of the hematology lab, identification of safety equipment, and demonstration of safety protocols (e.g., handling of sharps, use of PPE).
11.	Microscopic examination of blood smears to identify different blood cells, discussion on blood components and their functions.
12.	Experiment with different anticoagulants (e.g., EDTA, heparin) to observe their effects on blood samples, discussion on their applications in various tests.
13.	Demonstration and practice of venipuncture, proper labeling, and preservation techniques, discussion on disposal of blood samples following safety protocols.
14.	Prepare blood smears, stain them using Wright's or Giemsa stain, and examine under a microscope to observe the morphology of blood cells.

15.	Perform haemoglobin estimation using cyanmethemoglobin method and hemoglobinometer, discuss sources of errors and standardization of instruments.
16.	Examine stained blood smears to identify various blood cells (e.g., RBCs, WBCs, platelets), discuss their characteristics and functions.
17.	Conduct repeated cell counts to assess reproducibility, implement quality control measures, and discuss the importance of quality assurance in clinical hematology.

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

BMM 1st year

Course code	: BMM-P-109
Course Name	: Lab course based on paper CC 3
Semester /Year	: 1 st Semester

	L	T	P	C
	-	-	02	01

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

S. No	Practical
1.	Tour of the clinical biochemistry lab to identify safety equipment, demonstration of proper handling and disposal of hazardous materials, practice emergency procedures, and first aid training for laboratory accidents.
2.	Hands-on sessions to identify and use various laboratory equipment and glassware, including pipettes, burettes, and beakers.
3.	Prepare various reagents and solutions, determine and adjust pH, and store them properly.
4.	Use pH meters and indicators to determine and adjust the pH of different solutions.
5.	To make 1.0 M solution of NaCl.
6.	To identify abnormal constituents of the urine
7.	To identify normal constituents of the urine
8.	Demonstration of colorimeter.
9.	To identify the type of carbohydrate in the given sample
10.	To identify protein and amino acid in the given sample.

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

BMM 1st year

Course Name	Lab Course based on DSC 1 & DSC 2
Course Code	BMM-P-110
Year/ Semester	1 st Semester

	L	T	P	C
			02	01

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

Credit hours

2hrs/Week

S.No	Practical
1.	Introduction to laboratory safety measures.
2.	Demonstrate sterilization techniques using autoclaves, dry heat ovens, and UV radiation, test the effectiveness using biological indicators.
3.	Use staining techniques to observe flagella, fimbriae, and pili under a microscope, and discuss their roles in bacterial motility and adhesion.
4.	Inoculate bacteria on different culture media using different isolation techniques.
5.	Observe growth patterns and documentation in laboratory file.
6.	To perform biochemical tests (e.g., catalase, oxidase, fermentation tests), and interpret the results.
7.	To Perform Gram staining, acid-fast staining, and spore staining, observe the results under a microscope, and classify bacteria based on staining characteristics.
8.	Observe fungal specimens under a microscope, identify structures like hyphae, spores, and conidia and discuss fungal infections and their clinical significance.
9.	Examine slides of common parasites (e.g., protozoa, helminths), identify morphological features and discuss the life cycles and pathogenicity of selected parasites.

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

B.Sc Medical Microbiology 2nd Semester

Course Name	: Human Anatomy & Physiology-II
Course Code	: BMM-201
Semester /Year	: II nd Semester

	L	T	P	C
	04		01	05

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

Course Contents

4hrs/Week

<p>Unit 1: Nervous System & Endocrine system: Organization of the nervous system in detail. Structure and function of neurons and neuroglia. Nerve impulse transmission. Overview of the endocrine system (major glands). Hormones: Types and functions Hormonal regulation and feedback mechanisms.</p> <p>Unit 2: Cardiovascular System: Composition and functions of blood. Heart anatomy and physiology. Blood vessels: Arteries, veins, and capillaries. Circulatory pathways. Cardiac cycle and cardiac output. Blood pressure regulation.</p> <p>Unit 3: Respiratory System: Anatomy of the respiratory system, Mechanics of breathing. Gas exchange in the lungs and tissues. Regulation of respiration. Respiratory volumes and capacities.</p> <p>Unit 4: Digestive system & Urinary System: Anatomy of the digestive tract. Digestive processes and enzymes. Nutrient absorption and metabolism. Anatomy of the kidneys and urinary tract. Regulation of fluid and electrolyte balance. Acid-base balance.</p> <p>Unit 5: Reproductive System & Immune System: Male and Female reproductive system: Anatomy and functions. Hormonal regulation of reproduction. Overview of the immune system. Innate immunity: Physical and chemical barriers. Adaptive immunity: B and T cells. Immune response: Primary and secondary. Vaccination and immune disorders.</p>

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	Describe the organization and function of the nervous and endocrine systems.
CO2	Explain the composition and functions of blood, the anatomy and physiology of the heart, the structure of blood vessels, circulatory pathways, the cardiac cycle, cardiac output, and the regulation of blood pressure.
CO3	Illustrate the anatomy of the respiratory system, the mechanics of breathing, the processes of gas exchange in the lungs and tissues, the regulation of respiration, and the various respiratory volumes and capacities.
CO4	Analyse the anatomy of the digestive tract and urinary system.
CO5	Describe the anatomy and functions of the male and female reproductive systems, hormonal regulation of reproduction, and the overview of the immune system including innate and adaptive immunity, immune responses, vaccination, and immune disorders.
CO6	Integrate knowledge of the different body systems to understand their interrelations and how they contribute to maintaining homeostasis and overall health.

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 2nd Semester

Course Name	Basic Pathology -II
Course Code	BMM-202
Semester /Year	II nd Semester

	L	T	P	C
	04		01	05

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

Course Contents

4hrs/Week

<p>Unit 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.</p> <p>Unit 2: Pathology of specific chronic infective disorders: Tuberculosis, Leprosy, Syphilis, SABE (Subacute bacterial endocarditis) and Rheumatological disorders.</p> <p>Unit 3: Study of microbes responsible for the pathogenesis of tumours and their oncogenesis.</p> <p>Unit 4: Immuno-histopathology & Immuno-histochemistry (Basic Principles, Procedures and applications).</p> <p>Unit 5: Introduction to blood banking technology: Regulatory and Ethical Considerations: National and international guidelines. Ethical issues in blood banking. Quality Control and Assurance. Record Keeping and Documentation.</p>

TB5. Text Book of Pathology Harsh Mohan VIII Edition

TB6. Text Book of Pathology Dr. A K Mandal

Reference Books:

RB6. Clinical Pathology Hematology & Blood Banking IV Edition

Nanda Maheshwari

RB7. Exam Oriented Pathology

K Mukhopadhyay

Course outcomes (COs):

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

CO1	Explain the pathology of inflammation in response to microbial invasion.
CO2	Analyse the pathology of specific chronic infective disorders.
CO3	Identify the microbes responsible for the pathogenesis of tumors and understand the mechanisms of oncogenesis.
CO4	Describe the basic principles, procedures, and applications of immuno-histopathology and immuno-histochemistry.
CO5	Understand the fundamentals of blood banking technology, including regulatory and ethical considerations, national and international guidelines, and ethical issues in blood banking.
CO6	Implement quality control and assurance practices in blood banking, along with effective record keeping and documentation.

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-II
Course Code	BMM-203
Year/ Semester	II nd Semester

	L	T	P	C
	04		01	05

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

Course Contents

4hrs/Week

Unit 1: Physical and Biochemical Examination of Urine Samples: Qualitative tests of inorganic Urinary ingredients: Chlorides, phosphate, sulphur compounds, sodium, Potassium, calcium and magnesium and their clinical significance.

Unit 2: 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.

Unit 3: Carbohydrates: Structure, classification and their function in biological system. Lipids: General structure of Fatty Acids and classification of Lipids.

Unit 4: Proteins: Classification, structural organization and function of proteins. Enzymes: Definition, classification of Enzyme, concept of active sites and general mode of action of enzymes.

Unit 5: Nucleic acids: Structure function and types of DNA and RNA. Nucleotides, Nucleosides, Nitrogen bases and role of Nucleic Acid.

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	Perform qualitative tests to identify inorganic urinary ingredients.
CO2	Conduct qualitative tests for glycosuria, pentosuria, galactosuria, proteinuria, microalbuminuria, and Bence Jones proteinuria, and analyse their clinical significance.
CO3	Describe the structure, classification, and function of carbohydrates and lipids in the body, including the general structure of fatty acids and lipid classification.
CO4	Explain the classification, structural organization, and function of proteins, as well as enzyme sites, and general mode of action of enzymes.
CO5	Describe the structure, function, and types of nucleic acids (DNA and RNA), including their synthesis and understand the role of nucleic acids in biological systems.
CO6	Integrate knowledge of biochemical testing and molecular biology to understand the interrelationship between various biochemical compounds and their roles in diagnosing and monitoring clinical conditions.

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

B.Sc Medical Microbiology 2nd Semester

Course Name	Preventive Medicine & Health care-II
Course Code	BMM- 204
Year/ Semester	2 nd Semester

	L	T	P	C
	4		1	5

Course Contents

4 hrs/Week

Unit 1: Bacteriology of water, milk, food and air: Bacteriological examination of water-collection of specimens, presumptive coliform count, cloak 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.

Unit 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 outbreak of food poisoning, Bacteriological examination of air and environments dust.

Unit 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.

Unit 4: Health Planning & Management: Health planning, Planning Cycle, Malaria eradication & various other National Health policy & programs.

Unit 5: Reproductive, Family planning & Child Health Care Programs.

Text Books:

Text Book of Preventive & Social Medicine by K Park

Reference Books:

**RB8. 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	Conduct and interpret bacteriological examinations of water, including specimen collection, coliform count, cloak room test, colony count, and analysis of results.
CO2	Perform bacteriological tests on milk, including bacterial standards.
CO3	Analyse the components of a balanced diet, identify factors responsible for nutritional disorders, and understand the role of carcinogens in food.
CO4	Explain the principles of health planning and management.
CO5	Understand reproductive health, family planning methods, and child health care programs, and analyse their implementation and impact on public health.
CO6	Integrate knowledge of bacteriological examination techniques, nutritional science, and health planning to develop comprehensive strategies for improving public health and managing diseases.

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

B.Sc Medical Microbiology 2nd Semester

Course Name	Fundamentals of Medical Microbiology-II
Course Code	BMM- 205
Year/ Semester	II nd Semester

	L	T	P	C
	4		1	5

Course Contents

4hrs/Week

Unit 1: Cultivation of bacteria: Isolation of pure culture and its preservation. Cultural Media: Classification in detail.

Unit 2: Pure Culture: Maintenance & Preservation of pure cultures. Collection, transport processing & storage of clinical samples for Microbiological Analysis.

Unit 3: 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 4: 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.

Unit 5: 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

TB7. 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	Demonstrate the techniques for isolation, cultivation, and preservation of pure bacterial cultures, and classify various cultural media in detail.
CO2	Explain the methods for maintaining and preserving pure cultures, and outline the procedures for the collection, transport, processing, and storage of clinical samples for microbiological analysis.
CO3	Describe the growth and nutrition of bacteria.
CO4	Understand the basic principles of immunology.
CO5	Identify and evaluate the various antimicrobial agents and antibiotics
CO6	Integrate knowledge of mechanism of antibiotic action and associated factors.

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

B.Sc Medical Microbiology 2nd Semester

Course Name	Instrumentation Techniques In Medical Microbiology-II
Course Code	BMM-206
Year/ Semester	II nd Semester

	L	T	P	C
	4		1	5

Course Contents

4hrs/Week

Unit 1: 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.

Unit 2: Instruments used in immunology: Electrophoresis, immunodiffusion, starplate, chromatography, ELISA reader, Transilluminator, Western Blotting, Immunofluorescence, automatic washer and RIA equipment etc.

Unit 3: Growth measurement techniques: Optical density, Colony counting, Dry weight measurement.

Unit 4: Clinical Microbiology Diagnostics: Blood culture systems, automated urine analysis, Molecular diagnostics in clinical microbiology, Point-of-care testing (POCT) devices.

Unit 5: Automated microbial identification systems and Advanced Instrumentation: MALDI-TOF, VITEK systems. Advanced imaging techniques: Atomic force microscopy (AFM), Super-resolution microscopy, High-throughput screening techniques.

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

TB8. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB9. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB10. 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	Identify and describe the functions of various instruments used in immunology.
CO2	Explain safety measures and precautions necessary in microbiology laboratories.
CO3	Apply growth measurement techniques.
CO4	Utilize clinical microbiology diagnostics.
CO5	Demonstrate the use of automated microbial identification systems.
CO6	Integrate knowledge of immunological instruments.

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

B.Sc Medical Microbiology 2nd Semester

Course Name	Professional Ethics in Healthcare sector
Course Code	BMM-207
Year/ Semester	II nd Semester

	L	T	P	C
	2			2

Course Contents

2 hrs/Week

Unit 1: Introduction to Healthcare Ethics: Definition and importance of ethics in healthcare. Historical development of medical ethics. Key ethical theories and principles (e.g., autonomy, beneficence, non-maleficence, justice). Relationship between ethics, law, and professional standards.

Unit 2: Ethical Decision Making in Healthcare: Frameworks for ethical decision making. Informed consent and patient autonomy. Confidentiality and privacy. Case studies on ethical dilemmas and resolutions.

Unit 3: Professional Responsibility and Accountability: Roles and responsibilities of healthcare professionals. Codes of conduct and professional standards. Ethical issues in patient care. Reporting and managing medical errors.

Unit 4: Ethical Issues in Medical Research: Ethical principles in research involving human subjects. Informed consent in research. Institutional Review Boards (IRBs). Ethical issues in clinical trials.

Unit 5: Technology and Innovation in Healthcare Ethics: Ethical implications of medical technologies. Telemedicine and digital health ethics. Privacy and data protection in healthcare. Ethical considerations in genetic testing and biotechnology.

Text Books:

1. "Principles of Biomedical Ethics" by Tom L. Beauchamp and James F. Childress. 2019. 8th Edition
2. "Medical Ethics: Accounts of Ground-Breaking Cases" by Gregory Pence. 2020. 8th Edition

Reference Books:

- a. "Clinical Ethics: A Practical Approach to Ethical Decisions in Clinical Medicine" by Albert R. Jonsen, Mark Siegler, and William J. Winslade. 2020. 8th Edition.
- b. "Ethical Issues in Modern Medicine: Contemporary Readings in Bioethics" by Bonnie Steinbock, Alex John London, and John Arras. 2012. 8th Edition.

Course outcomes (COs):

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

CO1	Understand and explain the foundational concepts of healthcare ethics and their importance in clinical practice.
CO2	Apply ethical theories and principles to analyse and resolve ethical dilemmas in healthcare settings.
CO3	Demonstrate awareness of professional responsibilities, including adherence to codes of conduct and professional standards in healthcare.
CO4	Evaluate ethical issues related to end-of-life care and medical research, and propose ethical solutions.
CO5	Analyse the impact of cultural beliefs and global perspectives on healthcare ethics, and develop culturally competent strategies.
CO6	Assess ethical implications of emerging technologies and public health interventions, and formulate ethically sound practices.

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 IInd Semester

Course code	: BMM-P-208
Course Name	: Lab course based on CC 5 & CC 6
Semester /Year	: 2 nd Semester

	L	T	P	C
	-	-	02	01

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

S. No	Practical
1.	Create diagrams or models to represent the central and peripheral nervous systems.
2.	Use microscopes to observe prepared slides of neurons and neuroglia, label and describe their parts and functions, create diagrams illustrating synapse formation and signal transmission.
3.	Identify major endocrine glands using anatomical models, discuss the types and functions of hormones produced by each gland, create flowcharts illustrating hormonal feedback mechanisms.
4.	Prepare and examine blood smears under a microscope to identify different blood cells, perform hematocrit and hemoglobin tests, discuss the functions of blood components.
5.	Use anatomical models and diagrams to study arteries, veins, and capillaries,
6.	Use anatomical models and dissections to examine the structures of the respiratory tract (nose, pharynx, larynx, trachea, bronchi, lungs), create diagrams illustrating respiratory anatomy.
7.	Measure respiratory volumes and capacities using spirometry,
8.	Use models to study urine formation and regulation of fluid and electrolyte balance.
9.	To perform Hemoglobin by Sahli's method.
10.	To perform Hemoglobin by CMG method.
11.	To perform Total RBC count.
12.	To perform total leucocyte count.
13.	To perform differential leucocyte count.

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

BMM 1st year

Course code	: BMM-P-209
Course Name	: Lab course based on CC 7
Semester /Year	: 2 nd Semester

	L	T	P	C
	-	-	02	01

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

S. No	Practical
1.	Identify the presence of abnormal sugars in urine.
2.	Detect abnormal proteins in urine.
3.	Measure metabolic byproducts in urine
4.	Create models of DNA and RNA molecules, extract DNA from biological samples.
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.

B.Sc Medical Microbiology 2nd Semester

Course Name	Lab Course Based on DSC 3&4
Course Code	BMM-P-210
Year/ Semester	2 nd Semester

	L	T	P	C
			02	01

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

Credit hours

2hrs/Week

S.No	Practical
1.	Isolate and obtain pure cultures of bacteria.
2.	To preserve bacterial cultures using different techniques.
3.	Prepare and classify different types of cultural media: selective and differential media.
4.	Observe Growth pattern of bacterial cultures and recording of result.
5.	To perform Simple staining, Gram staining, Spore staining, Capsule staining to identify and differentiate bacterial species.
6.	To perform Antimicrobial susceptibility test.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	BACTERIAL PATHOGENS & ASSOCIATED DISEASES-I
Course Code	BMM-301
Year/ Semester	3 rd Semester

	L	T	P	C
	4		1	5

Course Contents

4 hrs/Week

<p>Unit 1: Introduction to Bacterial Pathogens: Definition and classification of pathogens. Pathogenesis and virulence factors. Mechanisms of bacterial infection and disease.</p> <p>Unit 2: Gram-Positive Bacterial Pathogens: <i>Staphylococcus aureus</i>, <i>Streptococcus pyogenes</i>, <i>Clostridium</i>: Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.</p> <p>Unit 3: <i>Gram-Negative Bacterial Pathogens: E.coli, Salmonella spp., Pseudomonas aeruginosa</i>: Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.</p> <p>Unit 4: Acid-Fast Bacterial Pathogens: <i>Mycobacterium tuberculosis</i>, <i>M. leprae</i>: Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.</p> <p>Unit 5: Treatment and Prevention of Bacterial Infections: Antibacterial agents: Mechanisms of action and resistance. Antibiotic stewardship. Vaccines and immunization. Public health strategies for prevention.</p>
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Text Books:

TB9. Text Book of Microbiology

Dr. C P Baveja Edition

TB10. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB11. Prescott's Microbiology

Joanne Willey, Kathleen Sandman XI Edition

RB12. 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	Demonstrate a thorough understanding of the classification, pathogenesis, and virulence factors of bacterial pathogens, including mechanisms of infection and disease.
CO2	Analyse and differentiate between Gram-positive, Gram-negative, and acid-fast bacterial pathogens in terms of their diseases, virulence factors, pathogenesis, diagnosis, and treatment.
CO3	Critically evaluate the diagnostic techniques and methodologies used for the identification and characterization of various bacterial infections.
CO4	Assess the mechanisms of action and resistance of antibacterial agents and develop strategies for effective antibiotic stewardship to combat antibiotic resistance.
CO5	Discuss and appraise the role of vaccines, immunization, and public health strategies in the prevention and control of bacterial infections.
CO6	Apply theoretical knowledge to practical scenarios in clinical microbiology and public health, proposing innovative solutions for the management and prevention of bacterial diseases.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	Systematic Bacteriology-I
Course Code	BMM-302
Year/ Semester	3 rd Semester

	L	T	P	C
	4		1	5

Course Contents

4 hrs/Week

Unit 1: The role of laboratory in the diagnosis and control of infections: Management and quality control of medical microbiology laboratory. Specimen Collection from patients, clinics, and hospitals. Specimen collection for epidemiological investigations. Training of medical microbiologist to handle epidemics.

Unit 2: Morphology, Cultural Characteristics, Biochemical Characterization, Diagnosis and Treatment of *Bacillus cereus*, *S. aureus*, *Clostridium tetani*, *Pasteurella*.

Unit 3: Morphology, Cultural Characteristics, Biochemical Characterization, Diagnosis and Treatment of *Neisseria*, *Bordetella* and *Haemophilus*, *Yersinia*.

Unit 4: Treatment and Prevention of Bacterial Infections: Antibiotics and Mechanisms of Action: Classes of antibiotics, Mechanisms of bacterial resistance. Immunization and Vaccines: Types of vaccines, Immunization schedules.

Unit 5: Infection Control Measures: Hospital infection control practices, Public health strategies.

TB11. Text Book of Microbiology

Dr. C P Baveja Edition

TB12. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB13. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB14. 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	Explain the role of the medical microbiology laboratory in diagnosing and controlling infections.
CO2	Demonstrate proficiency in the morphological, cultural, and biochemical characterization of key bacterial pathogens.

CO3	Analyse the morphological, cultural, and biochemical properties of bacterial pathogens.
CO4	Evaluate the mechanisms of action of different classes of antibiotics, understand the development of bacterial resistance, and assess the principles of antibiotic stewardship.
CO5	Discuss the types of vaccines, immunization schedules, and their roles in preventing bacterial infections, as well as the principles and practices of immunization.
CO6	Develop and apply effective infection control measures, including hospital infection control practices and public health strategies.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	Miscellaneous Microbes, Fungal Pathogens and Associated-I Diseases-I
Course Code	BMM-303
Year/ Semester	3 rd Semester

	L	T	P	C
	2		1	3

Contents

4 hrs/Week

Course Content:

Unit 1: Introduction to Miscellaneous Microbes: Overview of miscellaneous microbes: Archaea, Eukarya, and Bacteria. Environmental and clinical significance. Basic morphology and physiology.

Unit 2: Morphology, Virulence, clinical manifestation, diagnostic procedures: *Bacteroides*, *Streptobacilli*, *Donovania*, *Lactobacillus*, *Actinomyces*.

Unit 3: Clinical presentation and pathogenesis of miscellaneous microbial infections: *Chlamydia*, *Rickettsiae*, *Yeast*, *Yeast like organism* and *Candidiasis*.

Unit 4: Pathogenic & Nonpathogenic fungi: Clinical features and pathogenicity: *Cryptococci*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*.

Unit 5: Antifungal Agents: Classes of antifungal drugs, Mechanisms of action. Resistance mechanisms.

Text Books:

TB13. Text Book of Microbiology

Dr. C P Baveja Edition

TB14. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB15. Prescott's Microbiology

Joanne Willey, Kathleen Sandman XI Edition

RB16. 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	Explain the diversity and classification of miscellaneous microbes, including Archaea, Eukarya, and Bacteria.
CO2	Analyse the virulence factors associated with these microorganisms.

CO3	Describe the clinical features and pathogenesis of microbes.
CO4	Evaluate the prevention strategies for identifying fungal infections.
CO5	Discuss the different classes of antifungal drugs and their mechanisms of action.
CO6	Develop protocols for effective antifungal therapy and resistance management.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	Lab Diagnosis of Microbial Diseases-I
Course Code	BMM-304
Year/ Semester	3 rd Semester

	L	T	P	C
	4		1	5

Contents

4 hrs/Week

Course Outcomes

Unit 1: Introduction to Laboratory Diagnosis: Overview of laboratory diagnosis. Importance of laboratory tests in clinical decision-making. Principles of diagnostic accuracy: sensitivity, specificity, positive predictive value, negative predictive value.

Unit 2: Etiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Osteomyelitis, sore throat, scarlet fever, rheumatic fever, acute glomerulonephritis, Pneumonia, whooping cough, respiratory infections.

Unit 3: Etiopathogenesis, Pathology, Clinical features and Lab diagnosis of: plague, genital infections, typhus, oral thrush, ringworms and mycetoma.

Unit 4: Etiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Typhoid and paratyphoid fever, bacterial food poisoning, bacillary dysentery, gastroenteritis.

Unit 5: Molecular Diagnostic Techniques: Principles and applications of PCR, RT-PCR, and other nucleic acid amplification techniques. Genotyping, sequencing, and microbial identification using molecular methods. Diagnostic algorithms combining molecular and traditional techniques

Text Books:

TB15. Text Book of Microbiology

Dr. C P Baveja Edition

TB16. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB17. Prescott's Microbiology

Joanne Willey, Kathleen Sandman XI Edition

RB18. 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

B.Sc Medical Microbiology 3rd Semester

Course Name	Human Parasitology-I
Course Code	BMM-305
Year/ Semester	3 rd Semester

	L	T	P	C
	4		1	5

Course Contents

4hrs/Week

Unit 1: Introduction to Parasitology: Definition and scope of parasitology. Historical perspective. Host-parasite relationships

Unit 2: Introduction, Classification and General Characteristics of parasites.

Unit 3: Introduction, Clinical manifestation, Lab Diagnosis and Treatment of Protozoa: *Rhizopoda-Amoeba. Mastigophora-Intestinal, oral and vaginal flagellates trypanosome and leishmania. Sporozoa – black water. Ciliata.*

Unit 4: Introduction, Clinical manifestation, Lab Diagnosis and Treatment of Protozoa: Helminthic Parasites. Nematodes: *Ascaris lumbricoides, Enterobius vermicularis.*

Unit 5: Treatment and Prevention of Parasitic Infections: Antiparasitic drugs. Preventive measures and control strategies.

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

TB17. Text Book of Microbiology by Apurba S Sastry & Sandhya Bhat

Reference Books:

- RB19. Prescott’s Microbiology**
Joanne Willey, Kathleen Sandman XI Edition
- RB20. 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	Explain the definition, scope, and historical perspectives of parasitology, and analyse the dynamics of host-parasite relationships.
CO2	Identify and classify various human parasites and describe their general characteristics, including their life cycles and ecological roles.
CO3	Recognize the clinical manifestations of protozoan infections and demonstrate proficiency in laboratory diagnosis and treatment options.
CO4	Identify the clinical manifestations of helminthic infections, demonstrate the ability to diagnose and treat these infections.

CO5	Evaluate the mechanisms, efficacy, and application of various antiparasitic drugs used in the treatment of parasitic infections.
CO6	Develop and implement preventive measures and control strategies to manage and reduce the incidence of parasitic infections, considering both individual and public health perspectives.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	Environmental Science
Course Code	BMM-S-307
Year/ Semester	3 rd Semester

	L	T	P	C
	2			2

Course Contents**2 hrs/Week**

Unit 1: Ecology and Ecosystems: Definition, structure, and function of ecosystems. Energy flow in ecosystems. Food chains, food webs, and ecological pyramids. Biogeochemical cycles: Carbon, nitrogen, phosphorus, and water cycles. Types of ecosystems: Terrestrial and aquatic

Unit 2: Biodiversity and Conservation: Importance of biodiversity, Conservation strategies: In-situ and ex-situ conservation, Biodiversity hotspots. Natural Resources: Types of natural resources, their uses, overexploitation and management.

Unit 3: Environmental Pollution: Air pollution, water Pollution, Soil pollution, Noise pollution, thermal Pollution: Sources, effects, and control measures

Unit 4: Environmental Biotechnology: Bioremediation: Techniques and applications. Phytoremediation. Bio-indicators and biosensors. Genetic engineering and its applications in environmental science.

Unit 5: Climate Change and Global Environmental Issues: Greenhouse effect and global warming, Ozone layer depletion, Acid rain, Climate change: Causes, effects, and mitigation strategies, International efforts and agreements on climate change.

Text Books:

3. Agarwal, K.C. 2001 Environmental Biology, Nidhi Publisher Ltd. Bikaner.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental

Reference Books:

- RB21.** Principles of Environmental Science: Inquiry and Applications" by William P. Cunningham and Mary Ann Cunningham
- a. Textbook of Environmental Studies for Undergraduate Courses" by Erach Bharucha.

Course outcomes (COs):**Upon successful completion of the course a student will be able to**

CO1	Understand and Explain Environmental Concepts.
CO2	Analyze Human Impact on the Environment.
CO3	Apply Techniques for Environmental Monitoring and Assessment.
CO4	Evaluate and Propose Solutions to Environmental Issues.
CO5	Understand and Implement Conservation Strategies.
CO6	Engage in Environmental Advocacy and Policy Making.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	Lab course based on DSC 5& 6
Course Code	BMM-P-308
Year/ Semester	3 rd Semester

	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.	Characterization of bacteria using IMViC test.
8.	To perform urine/ Pus culture.
9.	To perform motility Test by hanging drop method.
10.	To perform Drug Susceptibility testing.
11.	Classify bacteria based on morphology, Gram staining, and pathogenicity
12.	Perform assays to detect common virulence factors (e.g., hemolysin production, capsule formation).
13.	Perform biochemical test for identification of unknown bacterial species.
14.	Perform toxin detection assays.
15.	Perform serotyping to identify specific strains.
16.	Perform Ziehl-Neelsen staining to identify acid-fast bacilli.

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

B.Sc Medical Microbiology 3rd Semester

Course Name	Lab course based on DSC 7& 8
Course Code	BMM-P-309
Year/ Semester	3 rd Semester

	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.

B.Sc Medical Microbiology 3rd Semester

Course Name	Lab course based on DSC 9 & 10
Course Code	BMM-P-310
Year/ Semester	3 rd semester

	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 identification of bacterial species using biochemical test; Urease, Amylase, Carbohydrate fermentation, IMVic test, etc.,
3.	To perform Drug susceptibility against fungal sample.

4.	To perform serological testing for identification of unknown bacterial species using commercial available kit (VDRL, RPR, HIV Tri DOT)
5.	To perform antibiotic susceptibility tests using Agar Well Diffusion Method.
6.	To perform antibiotic susceptibility tests using MIC and MBC assay.
7.	To perform different types of ELISA test using commercial available Kit.

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

B.Sc Medical Microbiology 4th Semester

Course Name	BACTERIAL PATHOGENS & ASSOCIATED DISEASES-II
Course Code	BMM-401
Year/ Semester	4 th Semester

	L	T	P	C
	4		1	5

Course Contents

4 hrs/Week

Unit 1: Spirochetes and Other Bacterial Pathogens: *Treponema pallidum*, *Borrelia*, *Leptospira*: Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.

Unit 2: Emerging Bacterial Pathogens: Overview of Antibiotic-resistant bacteria: Methicillin-resistant *Staphylococcus aureus* (MRSA), Multi-drug resistant tuberculosis (MDR-TB), Carbapenem-resistant *Enterobacteriaceae* (CRE), ESBL. Prevention and control

Unit 3: Zoonotic Bacterial pathogens: *Yersinia pestis*, *Bacillus Anthracis*, *Brucella*. Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.

Unit 4: Respiratory Infections: *Bordetella*, *Burkholderia*, *Corynebacterium*. Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.

Unit 5: Urinary tract Infections: *Klebsiella*, *Proteus*, *Enterococci*. Diseases, Virulence factors, Pathogenesis, diagnosis and Treatment.

Text Books:

TB18. Text Book of Microbiology

Dr. C P Baveja Edition

TB19. 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	Describe the diseases caused by <i>Treponema pallidum</i> , <i>Borrelia</i> , and <i>Leptospira</i> , including their virulence factors, pathogenesis, diagnosis, and treatment options
CO2	Identify and explain the challenges posed by antibiotic-resistant bacteria such as MRSA, MDR-TB, CRE, and ESBL-producing bacteria, and develop strategies for their prevention and control.
CO3	Discuss the diseases caused by zoonotic bacterial pathogens such as <i>Yersinia pestis</i> , <i>Bacillus anthracis</i> , and <i>Brucella</i> , including their virulence factors, pathogenesis, diagnosis, and treatment.

CO4	Explain the diseases caused by respiratory pathogens such as Bordetella, Burkholderia, and Corynebacterium, including their virulence factors, pathogenesis, diagnosis, and treatment.
CO5	Identify the diseases caused by urinary tract pathogens such as Klebsiella, Proteus, and Enterococci, and discuss their virulence factors, pathogenesis, diagnosis, and treatment.
CO6	Synthesize information on bacterial pathogens, including spirochetes, antibiotic-resistant bacteria, zoonotic, respiratory, and urinary tract pathogens, to develop comprehensive diagnostic, therapeutic, and preventive strategies.

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

B.Sc Medical Microbiology 4th Semester

Course Name	Systematic Bacteriology-II
Course Code	BMM-402
Year/ Semester	4 th Semester

	L	T	P	C
	4		1	5

Course Contents

4 hrs/Week

Unit 1: Host-Microbe Interactions: Pathogenesis of Bacterial Infections: Mechanisms of bacterial pathogenicity, Host defense mechanisms, Factors influencing bacterial virulence.

Unit 2: Epidemiology of Bacterial Infections: Transmission and spread of bacterial infections. Outbreak investigation and control measures.

Unit 3: Morphology, Cultural Characteristics, Biochemical Characterization, Diagnosis and Treatment of *Salmonella*, *Shigella*, *Proteus*.

Unit 4: Morphology, Cultural Characteristics, Biochemical Characterization, Diagnosis and Treatment of *Vibrio*, *Enterobacter*, *Lactobacillus*.

Unit 5: Antimicrobial Susceptibility Testing: Principles of antimicrobial testing, Methods (disk diffusion, MIC determination). Interpretation of results.

TB20. Text Book of Microbiology

Dr. C P Baveja Edition

TB21. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB24. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB25. 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	Explain the mechanisms of bacterial pathogenicity, host defense mechanisms, and the factors influencing bacterial virulence.
CO2	Describe the transmission and spread of bacterial infections, and develop strategies for outbreak investigation and control measures.
CO3	Identify the morphology, cultural characteristics, biochemical properties, diagnostic methods, and treatment options for infections caused by <i>Salmonella</i> , <i>Shigella</i> , and <i>Proteus</i> .

CO4	Identify the morphology, cultural characteristics, biochemical properties, diagnostic methods, and treatment options for infections caused by Vibrio, Enterobacter, and Lactobacillus.
CO5	Apply the principles of antimicrobial susceptibility testing, including methods such as disk diffusion and MIC determination, and interpret the results to guide treatment decisions.
CO6	Synthesize knowledge of host-microbe interactions, epidemiology, bacterial characterization, and antimicrobial testing to develop comprehensive management strategies for bacterial infections.

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

B.Sc Medical Microbiology 4th Semester

Course Name	Miscellaneous Microbes, Fungal Pathogens and Associated Diseases-II
Course Code	BMM-403
Year/ Semester	4 th Semester

	L	T	P	C
	4		1	5

Contents

4 hrs/Week

Course Content:

Unit 1: Morphology, Virulence, Clinical manifestation, diagnostic procedures of *Nocardia*, *Leptospira*, *Treponema*, *Borrelia*, *Mycoplasma*.

Unit 2: Morphology, Virulence, clinical manifestation, diagnostic procedures: Dermatophyte and Superficial fungal infections. Systematic fungi-*Aspergillosis*, *Mucormycosis*.

Unit 3: Clinical presentation and pathogenesis of miscellaneous microbial infections: Pediatric mycoses, Geriatric mycoses, Fungal infections in immunocompromised patients.

Unit 4: Emerging and Re-emerging Fungal Pathogens: *Candida auris*, Mycetoma, MDR and Other emerging pathogens.

Unit 5: Laboratory Diagnosis of Fungal Infections: Microscopic and cultural techniques. Serological and molecular methods. Antifungal susceptibility testing.

Text Books:

TB22. Text Book of Microbiology

Dr. C P Baveja Edition

TB23. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB26. Prescott's Microbiology

Joanne Willey, Kathleen Sandman XI Edition

RB27. 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	Describe the morphology, virulence factors, clinical manifestations, and diagnostic procedures of <i>Nocardia</i> , <i>Leptospira</i> , <i>Treponema</i> , <i>Borrelia</i> , and <i>Mycoplasma</i> .
CO2	Explain the morphology, virulence factors, clinical manifestations, and diagnostic procedures of dermatophytes, superficial fungal infections, and systemic fungi such as <i>Aspergillosis</i> and <i>Mucormycosis</i> .
CO3	Analyze the clinical presentation and pathogenesis of pediatric mycoses, geriatric mycoses, and fungal infections in immunocompromised patients.

CO4	Identify and describe the clinical significance of emerging and re-emerging fungal pathogens, including <i>Candida auris</i> , <i>Mycetoma</i> , and multi-drug resistant (MDR) fungal pathogens.
CO5	Perform and interpret laboratory diagnostic techniques for fungal infections, including microscopic, cultural, serological, and molecular methods, as well as antifungal susceptibility testing.
CO6	Synthesize information on bacterial and fungal pathogens, clinical presentations, diagnostic methods, and emerging threats to develop comprehensive management and treatment strategies for microbial infections.

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

B.Sc Medical Microbiology 4th Semester

Course Name	Lab Diagnosis of Microbial Diseases-II
Course Code	BMM-S-404
Year/ Semester	4 th Year

	L	T	P	C
	4		1	5

Contents

4 hrs/Week

Course contents

Unit 1: General strategy of Diagnosing microbial specimen: Gram staining, culture techniques, biochemical tests, molecular methods, serological tests. Antibiotic susceptibility testing and resistance mechanisms.

Unit 2: Etiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Meningitis, Gonorrhoea, rat bite fever actinomycosis dental caries and leptospirosis.

Unit 3: Etiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Diphtheria, Tuberculosis, skin, ulcers and leprosy, malignant pustules and isortiers diseases, brucellosis.

Unit 4: Etiopathogenesis, Pathology, Clinical features and Lab diagnosis of: choleraangrene, tetanua, botulism, wound infections, Aspergillosis, Blastomycosis.

Unit 5: Quality Control and Laboratory Management: Principles of quality control and assurance in the clinical microbiology laboratory. Standard operating procedures (SOPs) and laboratory accreditation. Biosafety and infection control in the laboratory.

Text Books:

TB24. Text Book of Microbiology

Dr. C P Baveja Edition

TB25. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB28. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB29. 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	Apply a range of diagnostic techniques including Gram staining, culture methods, biochemical tests, molecular methods, and serological tests to
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CO4	Recognize the clinical manifestations, diagnostic procedures, and treatment options for waterborne and foodborne parasitic infections including Cryptosporidium, Cyclospora, and Taenia solium.
CO5	Discuss the impact of parasitic infections in immunocompromised hosts, such as those with HIV/AIDS and transplant recipients, and the unique challenges in diagnosis and treatment.
CO6	Synthesize information on immunology, epidemiology, clinical presentation, diagnosis, and treatment to develop comprehensive management strategies for parasitic diseases.

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

B.Sc Medical Microbiology 4th Semester

Course Name	Applied Medical Microbiology-II
Course Code	BMM-S-406
Year/ Semester	4 th Semester

	L	T	P	C
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	4		1	5
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Text Books:

<p>Unit 1: Preparation of container and swabs for collections of specimens for microbial examinations. Portal regulation and transport of specimen. Flowchart of Lab diagnostic procedures.</p> <p>Unit 2: Documentation of specimen in Laboratory. Preservation of Micro-Organisms: Periodic subculture methods, cold Storage, freezing, deep freezing, lyophilize on methods. Total and viable counts of bacteria.</p> <p>Unit 3: Infection syndromes and diagnostic procedures. Strategy of anti-microbial therapy. Epidemiology markers of microorganisms: Serotyping and Bacteriophage.</p> <p>Unit 4: Prophylactic mass immunization. Nosocomial infection and sterility testing of I.V. fluids and processing of various samples for various hospital infections. Diagnosis, treatment and control of common infections and infestations.</p> <p>Unit 5: Cell, tissue and organ culture. Specific serological methods of diagnosis. Test of sensitivity to antimicrobial agents and their preparation. Specific culture and drug sensitivity methods.</p>
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TB27. Text Book of Microbiology

Dr. C P Baveja Edition

TB28. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB32. Prescott’s Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB33. 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	Apply principles of quality control and assurance in the clinical microbiology laboratory.
CO2	Analyse factors contributing to the emergence and re-emergence of infectious diseases.
CO3	Implement principles of infection control and conduct epidemiological surveillance and outbreak investigations.

CO4	Explain the principles of immunization including types of vaccines and their mechanisms of action, and develop immunization schedules and strategies, addressing challenges and advancements in vaccine development.
CO5	Classify and understand the mechanisms of action of various antimicrobial agents, and evaluate the mechanisms and clinical implications of antimicrobial resistance.
CO6	Synthesize knowledge of microbiology, epidemiology, immunization, and antimicrobial resistance to develop comprehensive public health strategies for the prevention and management of infectious diseases.

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

B.Sc Medical Microbiology 4th Semester

Course Name	Lab course based on DSC 12 &13
Course Code	BMM-P-407
Year/ Semester	4 th Semester

	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.	Characterization of bacteria using IMViC test.
8.	To perform urine/ Pus culture.
9.	To perform motility Test by hanging drop method.
10.	To perform Drug Susceptibility testing.
11.	Classify bacteria based on morphology, Gram staining, and pathogenicity
12.	Perform assays to detect common virulence factors (e.g., hemolysin production, capsule formation).
13.	Perform biochemical test for identification of unknown bacterial species.
14.	Perform toxin detection assays.
15.	Perform serotyping to identify specific strains.
16.	Perform Ziehl-Neelsen staining to identify acid-fast bacilli.

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

B.Sc Medical Microbiology 4th Semester

Course Name	Lab course based on DSC 14 &15
Course Code	BMM-P-408
Year/ Semester	4 th Semester

	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.

B.Sc Medical Microbiology 4th Semester

Course Name	Lab course based on DSC 16& 17
Course Code	BMM-P-409
Year/ Semester	4 th semester

	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 identification of bacterial species using biochemical test; Urease, Amylase, Carbohydrate fermentation, IMVic test, etc.,
3.	To perform Drug susceptibility against fungal sample.
4.	To perform serological testing for identification of unknown bacterial species using commercial available kit (VDRL, RPR, HIV Tri DOT)
5.	To perform antibiotic susceptibility tests using Agar Well Diffusion Method.
6.	To perform antibiotic susceptibility tests using MIC and MBC assay.
7.	To perform different types of ELISA test using commercial available Kit.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Pathogenic Viruses and Associated Diseases-I
Course Code	BMM-501
Year/ Semester	5 th Semester

	L	T	P	C
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Course Contents

Unit 1: Introduction to Virology: Basics of virology: structure and classification of viruses. Viral replication cycles: lytic and lysogenic cycles. Methods of studying viruses: culture techniques, microscopy, molecular methods.

Unit 2: Respiratory Viruses: Pathogenesis, clinical features, and treatment: Influenza viruses: types, Coronaviruses: SARS, MERS, COVID-19. Respiratory syncytial virus (RSV) and other common respiratory pathogens.

Unit 3: Pox-Viruses: Pathogenesis, clinical features, and treatment Smallpox, Vaccinia, Molluscum contagiosum.

Unit 4: Herpes Virus: Pathogenesis, clinical features, and treatment. H Simplex, Chickenpox-Zoster, CMV, IMN and burkitt's Lymphomas.

Unit 5: Picorna Viruses: Pathogenesis, clinical features, and treatment Entero viruses, Poliomyelitis Aseptic and Epidemic Myalagia.

Text Books:

TB29. Text Book of Microbiology

Dr. C P Baveja Edition

TB30. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB34. Prescott's Microbiology

Joanne Willey, Kathleen Sandman XI Edition

RB35. 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	Describe the structure and classification of viruses, and differentiate between lytic and lysogenic replication cycles.
CO2	Demonstrate knowledge of various methods for studying viruses, including culture techniques, microscopy, and molecular methods.

CO3	Explain the pathogenesis, clinical features, and treatment options for major respiratory viruses, including Influenza viruses, Coronaviruses (SARS, MERS, COVID-19), and Respiratory Syncytial Virus (RSV).
CO4	Identify and describe the pathogenesis, clinical features, and treatment of pox-viruses such as Smallpox, Vaccinia, and Molluscum contagiosum.
CO5	Analyse the pathogenesis, clinical features, and treatment of Herpes viruses, including Herpes Simplex, Chickenpox-Zoster, Cytomegalovirus (CMV), Infectious Mononucleosis (IMN), and Burkitt's Lymphomas.
CO6	Understand the pathogenesis, clinical features, and treatment of Picorna viruses, with a focus on Enteroviruses, Poliomyelitis, and Aseptic and Epidemic Myalgia.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Applied Immunology & Serodiagnosis-I
Course Code	BMM-502
Year/ Semester	5 th Semester

	L	T	P	C
	4		1	5

Course Contents

Unit 1: Basic Concept: Antigen, antibody complements and immune complexes. Immune reactions and laboratory tests for detection of antigen and antibodies. Antibody production by microbial agents and its clinical significance.

Unit 2: Advanced Immunodiagnostics: Emerging Techniques. Molecular Diagnostics in Immunology. Next-Generation Sequencing and Genomics. Quality Control and Assurance in Serodiagnosis. Ensuring Accuracy and Reliability.

Unit 3: Clinical Immunology and Diagnostics: Detailed Study of Clinical Applications of Immunology. Diagnostic Challenges in Clinical Settings.

Unit 4: Autoimmune Diseases and Allergies: Autoantibodies and Their Diagnostic Significance. Common Autoimmune Disorders (e.g., Rheumatoid Arthritis, Systemic Lupus Erythematosus). Allergy Testing Techniques

Unit 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.

Text Books:**TB31. Text Book of Microbiology**

Dr. C P Baveja Edition

TB32. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB36. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB37. 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	Explain the basic concepts of antigens, antibodies, complements, and immune complexes, and their roles in immune reactions and laboratory tests for detecting antigens and antibodies.
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CO2	Evaluate emerging immunodiagnostic techniques, including molecular diagnostics, next-generation sequencing, and genomics, ensuring accuracy and reliability through quality control and assurance measures.
CO3	Analyse the clinical applications of immunology in diagnostic settings, addressing the challenges and implications in clinical immunology and diagnostics.
CO4	Identify autoantibodies and their diagnostic significance, and explain common autoimmune disorders such as Rheumatoid Arthritis and Systemic Lupus Erythematosus, as well as allergy testing techniques.
CO5	Demonstrate proficiency in techniques for detecting and interpreting hepatitis markers, including HBsAg, anti-HBc IgM, HBeAg/anti-HBe Ag, HDV, anti-HBs, HBV DNA, and HCV RNA, and understand their clinical significance.
CO6	Assess antibody production by microbial agents and its clinical significance, understanding the implications for disease diagnosis and patient management.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Advanced Diagnostic Technology-I
Course Code	BMM-503
Year/ Semester	5 th Semester

	L	T	P	C
	4		1	5

Course Content

Unit 1 Advanced Technologies in Diagnostics: Emerging Technologies. Biosensors and Lab-on-a-Chip Devices. Microfluidics and Nanotechnology.

Unit 2: Biochemical and ImmunoTesting: Biochemical Diagnostic Tests. Enzyme Assays, Metabolite Analysis. Electrophoresis Techniques: Agarose Gel Electrophoresis, SDS PAGE.

Unit 3: Molecular Diagnostics: Principles of Molecular Diagnostics, PCR (Polymerase Chain Reaction). RT-PCR (Reverse Transcription PCR). Next-Generation Sequencing (NGS).

Unit 4: Quality Control and Regulatory Issues: Quality Assurance in Diagnostic Testing. Regulatory Standards and Compliance. FDA, CLIA, ISO Standards.

Unit 5: Diagnostics in Emerging and Re-emerging Diseases: Diagnostic Approaches for Emerging Infectious Diseases. Case Studies on Diagnostics for Re-emerging Diseases.

Text Books:

TB33. Text Book of Microbiology

Dr. C P Baveja Edition

TB34. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB38. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB39. 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	Explain the principles and applications of emerging technologies in diagnostics, including biosensors, lab-on-a-chip devices, microfluidics, and nanotechnology.
CO2	Perform biochemical diagnostic tests and enzyme assays, analyze metabolites, and utilize electrophoresis techniques such as agarose gel electrophoresis and SDS PAGE for diagnostic purposes.

CO3	Demonstrate proficiency in molecular diagnostics, including the principles and applications of PCR, RT-PCR, and next-generation sequencing (NGS) for detecting and analysing genetic material.
CO4	Implement quality assurance measures in diagnostic testing, and understand regulatory standards and compliance requirements, including FDA, CLIA, and ISO standards.
CO5	Develop diagnostic approaches for emerging infectious diseases, and analyze case studies on diagnostics for re-emerging diseases to understand their impact and management.
CO6	Integrate advanced diagnostic techniques from various disciplines to enhance the accuracy and efficiency of diagnostic testing, improving overall patient care and outcomes.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Recombinant DNA Technology-I
Course Code	BMM-504
Year/ Semester	5 th semester

	L	T	P	C
	4		1	5

Course Content:

Unit 1: Introduction to Recombinant DNA Technology: Overview of Recombinant DNA Technology. Historical Development and Milestones. Applications in Biotechnology and Medicine.

Unit 2: 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 3: 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 4: 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 5: 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, phagmids, artificial chromosome vectors (BAC,PAC and YAC), vectors for animal cells and shuttle vectors.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Clinical Biochemistry
Course Code	BMM-505
Year/ Semester	5 th Semester

	L	T	P	C
	2		1	3

Course Content

Unit 1: Determination of Blood Glucose by various methods. Glucose tolerance test, Glycosylated haemoglobin: Interpretation of results & Clinical Co-relation. Profile test: Serum Cholesterol, HDL, LDL, Triglycerides. Lipoproteins & lipids.

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

Unit 4: 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. Static Mechanism: Theories of Blood Coagulation & Diagnostic procedures for coagulation disorders.

Unit 5: Antiglobulin (COOBM'S) test: Principle procedure and application. Direct indirect coomb's test. Anemia & Leukemia: Definition, Classification, Pathogenesis and Diagnostic Procedures.

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 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

B.Sc Medical Microbiology 5th Semester

Course Name	Clinical Lab Technology-I			
Course Code	BMM-506			
Year/ Semester	5 th Semester			
	L	T	P	C
	4		1	5

Course Content

Unit 1: Introduction to Clinical Lab Technology: Overview of Clinical Laboratory Science. Role and responsibilities of a Clinical Laboratory Technician. Introduction to laboratory safety and ethics. **Medical Terminology:** Introduction to medical terminology. Understanding prefixes, suffixes, and root words. Common medical abbreviations and symbols.

Unit 2: Haematology & Histotechnology: Introduction to hematology. Structure and function of blood cells. Basic hematology tests (CBC, ESR). **Histotechnology:** Tissue processing and staining. Microscopic examination of tissues. Special stains and techniques.

Unit 3: Microbiology & Immunology: Introduction to microbiology. Classification and characteristics of microorganisms. Basic techniques for microbial culture and identification. Basics of the immune system. Antigens and antibodies. Introduction to serological tests.

Unit 4: Clinical Chemistry & clinical Biochemistry: Introduction to clinical chemistry. Basic principles of biochemical analysis. Analytical techniques (spectrophotometry, electrophoresis). **Clinical Biochemistry:** Metabolic disorders and their biochemical diagnosis. Endocrinology and hormone assays. Clinical enzymology.

Unit 5: Research Methodology: Basics of clinical research. Designing and conducting research studies. Data analysis and interpretation.

Text Book

1. "Introduction to Diagnostic Microbiology for the Laboratory Sciences" by Rita D. Mittal and William J. Costerton. 2nd Edition. 2020.
2. "Clinical Laboratory Technology: Principles and Practice" by Lawrence E. Johnson and Richard L. Day. 2nd Edition. 2020

Course outcomes (COs):

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

CO1	Describe the overview of clinical laboratory science, including the roles and responsibilities of a clinical laboratory technician, and understand laboratory safety and ethics.
CO2	Demonstrate proficiency in medical terminology by understanding prefixes, suffixes, root words, and common medical abbreviations and symbols.
CO3	Explain the structure and function of blood cells, perform basic hematology tests (CBC, ESR), and demonstrate tissue processing, staining, and microscopic examination techniques in histotechnology.

CO4	Classify and characterize microorganisms, apply basic techniques for microbial culture and identification, and understand the basics of the immune system, including antigens, antibodies, and serological tests.
CO5	Apply the basic principles of biochemical analysis using techniques such as spectrophotometry and electrophoresis, and understand the biochemical diagnosis of metabolic disorders, endocrinology, hormone assays, and clinical enzymology.
CO6	Design and conduct clinical research studies, perform data analysis, and interpret research results to contribute to the field of clinical laboratory technology.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Microbial Genetics-I
Course Code	BMM-507
Year/ Semester	5 th Semester

	L	T	P	C
	2		1	3

Course Content

Unit 1: Introduction to Microbial Genetics: Overview of microbial genetics. Genetic organization in bacteria, archaea, and fungi. Plasmids, transposons, and integrons. Horizontal gene transfer (HGT) mechanisms.

Unit 2: DNA Replication, Mutation, and Repair: DNA replication. Types of mutations and mutagenic agents. DNA repair mechanisms (mismatch repair, excision repair, SOS response). Mutation detection and analysis techniques.

Unit 3: Genetic Recombination and Transfer: Mechanisms of genetic recombination (homologous and site-specific recombination). Transformation, transduction, and conjugation. Mapping bacterial genes by conjugation and transduction. CRISPR-Cas systems in bacteria and archaea.

Unit 4: Molecular Techniques in Microbial Genetics: Polymerase Chain Reaction (PCR) and its variants. DNA sequencing methods. Gene cloning and recombinant DNA technology. Use of reporter genes and gene knockouts in functional studies.

Unit 5: Mobile Genetic Elements and Genomics: Types and roles of mobile genetic elements. Mechanisms of transposition. Impact of mobile genetic elements on genome evolution. Comparative genomics and functional genomics.

Text Books:

1. Molecular Genetics of Bacteria by Larry Snyder and Wendy Champness. 2013 4th Edition.
2. Microbial Genetics by Stanley R. Maloy, John E. Cronan, and David Freifelder. 1994 2nd edition.
3. Brock Biology of Microorganisms by Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, and David A. Stahl. 2017 15th edition.
4. Genetics: Analysis and Principles by Robert J. Brooker. 2017 6th Edition.
5. Fundamental Bacterial Genetics by Nancy Trun and Janine Trempey. 2003 1st edition.

Course outcomes (COs):

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

CO1	To understand the genetic organization of prokaryotes.
CO2	To explore the replication mechanisms in microorganisms.
CO3	To apply genetic tools and techniques for the study of microorganisms.

CO4	To analyse the role of genetic elements in microbial adaptation and evolution.
CO5	To understand the principles of comparative and functional genomics.
CO6	To study the role of mobile elements in microbial genetics.

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

B.Sc Medical Microbiology 5th Semester

Course Name	Lab course based on DSC 18 & 19
Course Code	BMM-P-508
Year/ Semester	5 th Semester

	L	T	P	C
			02	01

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

Credit hours

2hrs/Week

S.No	Practical
1.	Perform serological tests to diagnose viral infections using ELISA kits, immunofluorescence assays, serum samples.
2.	Perform immunoassays to detect specific antibodies in serum samples.
3.	Measure the concentration of specific antibodies in serum samples
4.	Perform immunoprecipitation to study antigen-antibody complex formation.
5.	Perform serological tests to diagnose autoimmune diseases using Autoantibody detection kits (e.g., anti-dsDNA, anti-Smith antibodies), serum samples.
6.	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.

B.Sc Medical Microbiology 5th Semester

Course Name	Lab course based on DSC 20 &21
Course Code	BMM-P-509
Year/ Semester	5 th Semester

	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.

B.Sc Medical Microbiology 5th Semester

Course Name	Lab course based on DSC 22, 23 & DSEC 1
Course Code	BMM-P-510
Year/ Semester	5 th Semester

	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.
12.	Prepare blood smears, stain them using Wright's or Giemsa stain, and examine under a microscope to observe the morphology of blood cells.
13.	Perform haemoglobin estimation using cyanmethemoglobin method and hemoglobinometer, discuss sources of errors and standardization of instruments.
14.	Examine stained blood smears to identify various blood cells (e.g., RBCs, WBCs, platelets), discuss their characteristics and functions.
15.	Conduct repeated cell counts to assess reproducibility, implement quality control measures, and discuss the importance of quality assurance in clinical hematology.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Pathogenic Viruses and Associated Diseases-II
Course Code	BMM-601
Year/ Semester	6 th Semester

	L	T	P	C
	4		1	5

Course Contents

Unit 1: RNA Viruses: Influenza Viruses: Structure, Replication, and Pathogenesis. Human Immunodeficiency Virus (HIV): Biology and Disease Progression. Hepatitis C Virus (HCV): Epidemiology and Clinical Features.

Unit 2: DNA Viruses: Herpesviruses (HSV, VZV, CMV, EBV): Life Cycle and Diseases. Hepatitis B Virus (HBV): Transmission and Pathogenesis. Human Papillomavirus (HPV): Oncogenesis and Disease Burden.

Unit 3: Arthropod-Borne Viral Infections: Dengue, Chikungunya, and Zika Viruses: Transmission Dynamics and Vector Control. Clinical Features and Management.

Unit 4: Viral Infections in Immunocompromised Hosts: Cytomegalovirus (CMV) and Epstein-Barr Virus (EBV) in Immunocompromised Individuals. Human Herpesvirus 8 (HHV-8) and Kaposi's Sarcoma. Clinical Management and Treatment Strategies.

Unit 5: Viral Vaccines and Antiviral Therapies: Principles of Vaccination and Vaccine Development. Antiviral Drugs: Mechanisms of Action and Resistance. Current Vaccines and Therapeutic Approaches

Text Books:

TB35. Text Book of Microbiology

Dr. C P Baveja Edition

TB36. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB40. Prescott's Microbiology

Joanne Willey, Kathleen Sandman XI Edition

RB41. 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	Explain the structure, replication, and life cycle of various pathogenic viruses.
CO2	Analyse the mechanisms of viral pathogenesis and host-virus interactions.
CO3	Identify the clinical manifestations and epidemiology of major viral diseases.
CO4	Evaluate diagnostic methods for detecting viral infections.
CO5	Discuss current antiviral treatments and vaccination strategies.
CO6	Formulate prevention and control measures for viral infections based on public health principles.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Applied Immunology & Serodiagnosis-II
Course Code	BMM-602
Year/ Semester	6 th Semester

	L	T	P	C
	4		1	5

Course Contents

Unit 1: Immune Response Mechanisms: Humoral and Cell-Mediated Immunity. Primary and Secondary Immune Responses. Cytokines and Chemokines.

Unit 2: Advanced Immunotechniques: Western Blotting and Flow Cytometry. Principles and Applications. Agglutination and Precipitation Reactions. Immunofluorescence and Immunohistochemistry.

Unit 3: Autoimmunity and Serodiagnosis: Overview of Autoimmune Diseases. Autoantibodies and Their Diagnostic Significance. Serodiagnostic Techniques in Autoimmunity.

Unit 4: Serodiagnosis in Transplantation and Blood Banking: HLA Typing and Crossmatching. Serodiagnosis in Blood Transfusion.

Unit 5: Public Health and Epidemiology: Role of Serodiagnosis in Public Health. Surveillance and Outbreak Investigation. Case Studies: Epidemiological Application

Text Books:

TB37. Text Book of Microbiology

Dr. C P Baveja Edition

TB38. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB42. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB43. 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	Explain the fundamental principles of humoral and cell-mediated immunity
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CO2	Differentiate between primary and secondary immune responses and their significance.
CO3	Describe the roles of cytokines and chemokines in immune regulation and response.
CO4	Demonstrate proficiency in performing and interpreting Western blotting and flow cytometry.
CO5	Evaluate the role and methods of serodiagnosis in blood transfusion services.
CO6	Assess epidemiological case studies to formulate serodiagnostic strategies for disease control.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Advanced Diagnostic Technology-II
Course Code	BMM-603
Year/ Semester	6 th Semester

	L	T	P	C
	4		1	5

Course Outcomes

Unit 1: DNA, Replication, translation and transduction: Principles, technology and applications in diagnosis.

Unit 2: TORCH-Profile: Technique and interpretation of results. Anti A-60Mycobacterium IgG and mycodot, Technique and interpretation of results.

Unit 3: IgM to HB core antigen (HBCAg), IgG to Hepatitis C virus (HCV), Anti ds DNA test: Technique and interpretation of results.

Unit 4: IgG to Hepatitis A Virus (HAV), Dengue IgM, HIV P-24 Antigen test: Technique and interpretation of results.

Unit 5: Ethical and Social Considerations: Ethical Issues in Diagnostic Technologies. Impact of Diagnostics on Society and Public Health.

Text Books:

TB39. Text Book of Microbiology

Dr. C P Baveja Edition

TB40. Text Book of Microbiology

Apurba S Sastry & Sandhya Bhat

Reference Books:

RB44. Prescott's Microbiology

Joanne Willey ,Kathleen Sandman XI Edition

RB45. 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	Explain the principles of DNA replication, translation, and transduction and their relevance in molecular diagnostics.
CO2	Describe the techniques used for TORCH profile testing and interpret the results for clinical diagnosis.

CO3	Demonstrate proficiency in performing and interpreting serological tests for HBCAg, HCV, and anti-dsDNA, understanding their diagnostic importance.
CO4	Analyze the techniques and clinical relevance of serological tests for HAV, Dengue, and HIV P-24 Antigen, and accurately interpret the results.
CO5	Discuss the ethical issues surrounding diagnostic technologies and their impact on society and public health.
CO6	Formulate strategies to address ethical dilemmas and societal impacts related to the use of advanced diagnostic technologies.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Recombinant DNA Technology-II
Course Code	BMM-604

Year/ Semester	6 th semester			
	L	T	P	C
	4		1	5

Course Content:

Unit 1: Advanced Cloning Techniques: Site-Directed Mutagenesis. Gateway Cloning and Gibson Assembly. CRISPR-Cas9 and Genome Editing.

Unit 2: Expression of Recombinant Proteins: Expression Systems: Bacterial, Yeast, Insect, and Mammalian Cells. Protein Purification Techniques. Characterization and Analysis of Recombinant Proteins.

Unit 3: Functional Genomics and Proteomics: Techniques in Functional Genomics (e.g., RNAi, CRISPR Screens). Proteomics: Protein-Protein Interactions, Mass Spectrometry. Applications in Disease Research and Drug Development.

Unit 4: 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).

Unit 5: Recombinant DNA in Medicine: Production of Therapeutic Proteins (e.g., Insulin, Growth Hormones). Gene Therapy and Genetic Vaccines. Case Studies: Applications in Medicine.

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	Demonstrate an understanding of site-directed mutagenesis and its application in gene manipulation.
CO2	Explain the expression of recombinant proteins.

CO3	Analyse the mechanisms functional and comparative genomics.
CO4	Compare and contrast different strategies of gene cloning.
CO5	Apply techniques for production of therapeutic vaccine.
CO6	Characterize Gene therapy and Genetic vaccines.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Immunology
Course Code	BMM-605

Year/ Semester	6 th Semester			
	L	T	P	C
	4		1	5

Course Content

Unit 1: Introduction to Immunology: Overview of the Immune System. Components and Functions. Primary and Secondary Immune Organs. Cells of the Immune System. Types of Immune Cells (e.g., B cells, T cells, Macrophages). Functions and Differentiation.

Unit 2: Innate Immunity: Mechanisms of Innate Immunity. Physical and Chemical Barriers. Phagocytosis and Inflammation. Innate Immune Cells. Neutrophils, Monocytes, Dendritic Cells. Pattern Recognition Receptors (PRRs) and Pathogen-Associated Molecular Patterns (PAMPs).

Unit 3: Adaptive Immunity: Overview of Adaptive Immunity. Humoral and Cellular Immunity. Antigen Presentation. Major Histocompatibility Complex (MHC) Molecules. Antigen Processing and Presentation. B Cell and T Cell Responses. Activation, Proliferation, and Differentiation. Memory Cells and Immunological Memory

Unit 4: Immune System Disorders: Autoimmune Diseases. Mechanisms and Examples (e.g., Rheumatoid Arthritis, Systemic Lupus Erythematosus). Allergic Reactions. Types of Allergic Reactions. Mechanisms and Treatments. Immunodeficiencies. Primary and Secondary Immunodeficiencies.

Unit 5: Current Advances in Immunology: Recent Research and Developments. Immunotherapy and Cancer Immunology. Advances in Vaccine Development. Ethical and Societal Implications. Ethical Issues in Immunology Research. Impact of Immunological Discoveries on Public Health.

Text Book:

1. Janeway's Immunobiology by Kenneth Murphy and Casey Weaver. Edition: 10th Edition. 2022.

2. Basic Immunology: Functions and Disorders of the Immune System by Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai. Edition: 6th Edition. 2023.

3. Fundamentals of Immunology: Basic and Clinical Principles by Joseph A. Madigan. Edition: 1st Edition.2020

Course outcomes (COs):

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

CO1	Describe the fundamental components and functions of the immune system, including immune cells and organs.
CO2	Explain the mechanisms of innate and adaptive immune responses, including antigen presentation and immune cell activation.
CO3	Analyze the causes and consequences of immune system disorders, such as autoimmune diseases, allergies, and immunodeficiencies.
CO4	Apply various immunological techniques for diagnostic and research purposes, including ELISA, Western blotting, and flow cytometry.
CO5	Evaluate the principles and practices of vaccine development and immunization, and their applications in disease prevention.
CO6	Discuss recent advancements in immunology, including immunotherapy and new vaccine technologies, and their implications for human health.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Clinical Lab Technology-II
Course Code	BMM-606
Year/ Semester	6 th Semester

	L	T	P	C
	4		1	5

Course Content

Unit 1: Laboratory Management: Principles of laboratory management. Quality control and assurance. Regulatory standards (CLIA, CAP, ISO). Clinical Correlations: Correlation of laboratory results with clinical conditions. Case studies and clinical scenarios. Interpretation and reporting of laboratory results.

Unit 2: Urinalysis, Body Fluids & Cytogenetics: Physical, chemical, and microscopic examination of urine. Analysis of other body fluids (CSF, synovial fluid). Basics of cytogenetics. Chromosome analysis and karyotyping. Fluorescence in situ hybridization (FISH).

Unit 3: Advanced Hematology: Hematologic malignancies and their diagnosis. Flow cytometry and cell counting techniques. Hematopoietic stem cell transplantation. Advanced Clinical Chemistry: Toxicology and therapeutic drug monitoring. Nutritional assessment and metabolic syndrome. Clinical applications of mass spectrometry.

Unit 4: Immunology: Advanced immunological techniques. Autoimmune diseases and allergies. Immunoassays (ELISA, RIA). Molecular Diagnostics: Introduction to molecular biology. Principles of PCR and RT-PCR. Applications of molecular diagnostics.

Unit 5: Blood Banking and Transfusion Medicine: Blood group systems. Blood donation and component preparation. Cross-matching and compatibility testing. Microbial Testing: Automated Methods, Molecular Characterisation.

Text Book

1. "Clinical Laboratory Science: The Basics and Routine Techniques" by Mary Louise Turgeon. 6th Edition. 2019.
2. "Clinical Microbiology Procedures Handbook" by American Society for Microbiology (ASM). **Edition:** 4th Edition. 2019.

Course outcomes (COs):

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

CO1	Describe the overview of laboratory management.
CO2	Demonstrate proficiency of cytogenetics.
CO3	Explain the applications of advanced haematology.
CO4	Classify and characterize applications of mass spectrometry.
CO5	Apply the advanced immunological tools for molecular diagnostics.
CO6	Design and conduct blood banking and transfusion protocols.

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

B.Sc Medical Microbiology 6th Semester

Course Name	Microbial Genetics-II
Course Code	BMM-607
Year/ Semester	6 th Semester

	L	T	P	C
	4		1	5

Course Content

Unit 1: Microbial Genomics and Systems Biology: Structure and function of microbial genomes. Meta-genomics and its applications. Systems biology approaches in microbiology. Microbial gene networks and synthetic biology

Unit 2: Bacteriophage Genetics: Genetic Mapping of Phage Genomes. Recombination in Bacteriophages. Mutations and Phage Evolution.

Unit 3: Molecular Mechanisms of Bacteriophage Infection: Host Recognition and Attachment. DNA Injection Mechanisms. Host Manipulation and Phage Gene Expression.

Unit 4: Microbial genetics in antibiotic resistance. Genetic basis of pathogenicity and virulence factors.

Unit 5: Applications of Microbial Genetics: Genetic manipulation of microbes for industrial and medical applications. Microbial genetics in biotechnology: production of biofuels, bioremediation, and pharmaceuticals.

Text Books:

1. Molecular Genetics of Bacteria by Larry Snyder and Wendy Champness. 2013 4th Edition.
2. Microbial Genetics by Stanley R. Maloy, John E. Cronan, and David Freifelder. 1994 2nd edition.
3. Brock Biology of Microorganisms by Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, and David A. Stahl. 2017 15th edition.
4. Genetics: Analysis and Principles by Robert J. Brooker. 2017 6th Edition.
5. Fundamental Bacterial Genetics by Nancy Trun and Janine Trempy. 2003 1st edition.

Course outcomes (COs):

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

CO1	To understand the microbial genomics and system.
CO2	To explore the genetic mapping of bacteriophage.
CO3	To apply genetic tools and techniques for the study of bacteriophage.
CO4	To analyse the role of microbial genetics in antibiotic resistance.
CO5	To understand the application of microbial genetics.

CO6	To study the production of biofuels as product.
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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

B.Sc Medical Microbiology 6th Semester

Course Name	Lab course based on DSC 24 & 25
Course Code	BMM-P-608
Year/ Semester	6 th Semester

	L	T	P	C
			02	01

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

Credit hours

2hrs/Week

S.No	Practical
1.	Perform serological tests to diagnose viral infections using ELISA kits, immunofluorescence assays, serum samples.
2.	Perform immunoassays to detect specific antibodies in serum samples.
3.	Measure the concentration of specific antibodies in serum samples
4.	Perform immunoprecipitation to study antigen-antibody complex formation.
5.	Perform serological tests to diagnose autoimmune diseases using Autoantibody detection kits (e.g., anti-dsDNA, anti-Smith antibodies), serum samples.
6.	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.

B.Sc Medical Microbiology 6th Semester

Course Name	Lab course based on DSC 26 &27
Course Code	BMM-609- P
Year/ Semester	6 th Semester

	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.

B.Sc Medical Microbiology 6th Semester

Course Name	Lab course based on DSC 28 & 29
Course Code	BMM-P-610
Year/ Semester	6th Semester

	L	T	P	C
			02	01

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

Credit hours

2hrs/Week

S.No	Practical
1.	Perform serological tests to diagnose viral infections using ELISA kits, immunofluorescence assays, serum samples.
2.	Perform immunoassays to detect specific antibodies in serum samples.
3.	Measure the concentration of specific antibodies in serum samples
4.	Perform immunoprecipitation to study antigen-antibody complex formation.
5.	Perform serological tests to diagnose autoimmune diseases using Autoantibody detection kits (e.g., anti-dsDNA, anti-Smith antibodies), serum samples.
6.	Prepare blood smears, stain them using Wright's or Giemsa stain, and examine under a microscope to observe the morphology of blood cells.
7.	Perform haemoglobin estimation using cyanmethemoglobin method and hemoglobinometer, discuss sources of errors and standardization of instruments.
8.	Examine stained blood smears to identify various blood cells (e.g., RBCs, WBCs, platelets), discuss their characteristics and functions.
9.	Conduct repeated cell counts to assess reproducibility, implement quality control measures, and discuss the importance of quality assurance in clinical hematology.

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