JAMIA HAMDARD

CENTRE FOR VIROLOGY

.....

CBCS ENABLED SYLLABUS
M. Sc. (Medical Virology)

SYLLABUS FOR M.Sc.
Medical Virology

Choice Based Credit System (CBCS)
Approval Date: 9TH JULY 2021
(29TH BOARD OF STUDIES)

CENTRE FOR VIROLOGY
JAMIA HAMDARD (Deemed to be University)
Accredited in 'A' Grade by NAAC
Declared to be designated as Institute of Eminence (IoE) by MHRD, GOI
New Delhi 110 062
www.jamiahamdard.edu

PROGRAMME NAME : M.Sc. Medical Virology
PROGRAMME CODE: 581
ACADEMIC SESSION OF INTRODUCTION OF THE PROGRAMME: (2021-2022)
SCHOOL NAME : SIST
DEPARTMENT NAME: CENTRE FOR VIROLOGY

APPROVAL DATE OF THE BOARD OF STUDIES(B.O.S) MEETING FOR THE PRESENT SYLLABUS

Seventh B. O. S. meeting held on 23rd February 2022

APPROVAL DATE AND NUMBER OF ACADEMIC COUNCIL OF MEETING FOR THE PRESENT SYLLABUS

6th April 2022, 159th meeting

COURSE BYE LAWS

Master of Science (M.Sc.) Medical Virology

(Four Semester Courses)
Two Year Full Time Program & Examination

Bye Laws
For the Semester Course Credit System

(CHOICE BASED CREDIT SYSTEM)

Centre for Virology
School of Interdisciplinary Sciences and Technology

I. INDEX

S.No.	Parameters
1	Affiliation
2	Programme Structure
3	Duration
4	Eligibility of admission
5	Course content
6	Course structure
7	Weightage
8	Attendance
9	Internal Assessment
10	Semester Examination
11	Scheme of Examinations
12	Pass Percentage

13 Classification of Result

14 Evaluation of Performance

15 Calculation of SGPA and CGPA of A Student in a Semester

16 Promotion

17 Classification of Successful Candidates

18 Span Period

19 Make-up Examinations

20 Improvement

21 Course content for each paper

22 Suggested Reading list

1. AFFILIATION

The programs are governed by Department of Molecular Medicine (DMM), School of Interdisciplinary Sciences and Technology, Jamia Hamdard, Delhi-110 062.

2. PROGRAMME STRUCTURE

Each M.Sc. Program is of two years duration. Each year will consist of two Semester as described below.

	Semester – Odd	**Semester-Even**
First Year	Semester – I	Semester – II
Second Year	Semester – III	Semester – IV

Each semester would consist of five papers including one practical through Semester I, II and semester III. For M.Sc. Medical Virology in semester-I there will be six papers including one practical rest will remain same. Semester IV would comprise of Optional Research area, from which each student has to select one Dissertation work. Selection of labs in Semester IV would be completed by the end of semester II, based on lottery. It is mandatory for the award of the degree that each student should complete a Mentored Dissertation, assigned at the end of II Semester and complete at the end of IV Semester. It would comprise of bench work, writing of thesis and presentation of work to an audience/expert committee. Dissertation can also be carried out optionally outside the institute in an industry, hospital or an institute as per student's interest with approval from theinstitute. The completed dissertation thesis must be submitted to the institute before end of the semester.

3. **Duration:** Two Years of Four semesters (two each year) designated as under:

1st Semester - July to December of 1st year
2nd Semester - January to May of 1st year
3rd Semester - July to December of 2nd year
4th Semester - January to May of 2nd year

Teaching days in each semester shall normally be **90 days**.

Medium of instruction and examinations: **English**

4. **Eligibility and mode of Admission: T**he candidates (national, foreign national or NRI) should fulfill the following qualifications for admission: Must have passed B. Sc. from a recognized university under 10+2+3 system with one of thesubjects in the area of life sciences (including Botany as major if there are specific areas covered in their course, viz., Genetics/ Molecular Biology/ Genetic Engineering/ Meditional Chemistry/Microbiology or related areas to increase opportunity to those students) and secured at least 55% marks in the aggregate. **Admissions will be done as per Jamia Hamdard guidelines.** All candidates seeking admission to the M.Sc. program must appear in the Entrance Test/Interview conducted by Jamia Hamdard.

COURSE CONTENT to M.Sc. Medical Virology

II. (Subject to improve/revise as per need in future)

Course Code	Course Name	Credits	Marks
MFC 001a	Foundation Course 1 (Units 1 & 2)	4	100
MFC 001b	Foundation Course 1 (Units 3 & 4)	4	100
MMV 101	Cell Biology and Virus cell interaction	4	100
MMV 102	Human Health and Pathology	4	100
MMV 103	General Virology	4	100
MMV 104	Skill building: Laboratory Practicals-1	6	200
		26	**700**
Semester -II			
MMV 201	Fundamentals in Microbiology and Vector biology	4	100
MMV 202	Methods in Virology	4	100
MMV 203	Biomedical Research and Development	4	100
MMV 204	Student Seminars/ MOOCs https://www.mooc.org	4	100
MMV 205	Skill building: Laboratory Practicals-2	6	200
		22	**600**
Semester -III			
MMV 301	Viral Diseases in Humans	4	100
MMV 302	Diagnostics and Therapeutic concepts	4	100
MMV 303	Viral Immunology	4	100
MMV 304	Communication, analytical skills& Manuscriptwriting/ MOOCS https://www.mooc.org	4	100
MMV 305	Skill development: Essentials for Independent Researchers	6	200
		22	**600**

Semester – IV			
MMV 401A-D	Dissertation & Introduction to Research Project (One Choice from MMV 401A-F)	**24**	600
		24	600
	Total	**94**	**2500**

5. Course Structure:

a) Foundation course shall be of 8 credits (200 marks). The internal assessment (Sessional Tests) shall be of 50 marks, while the final examination shall be of 150 marks. There shall be three Sessional tests, 10 marks each. 10 marks will be allocated to attendance and 50 marks to assignment.

b) A project may be prescribed in the course structure in the 4^{th} semester as per the requirement of specific program. The project work may involve experimental work and literature survey on a specified topic.

c) For project work the topics shall be given in advance, however, the credits assigned for the project work shall be awarded at the end of 4^{th} semester. For project work, the Head of the Department shall call a meeting of all the teachers of the Department and assign appropriate number of students to each teacher to act as the supervisor for project work. The student in consultation with the supervisor shall select a topic for the project work and inform the Head of the Department.

d) The contents of each theory course shall be divided into four units. Each unit shall preferably have equal teaching hours.

e) At the end of 2^{nd} and /or 4^{th} semester(s), a department may arrange, if possible, summer training of students for 6-12 weeks in an industry/research organization/university. The Head of the Department in consultation with Industry/research organization/university shall appoint respective supervisorsand co-supervisors for each student.

f) If the student wants to improve any of the subject by reappearing, the student can only attempt in the final semester. However the improved marks will not be included in the school ranking. If the student wants to re-evaluate the marks, a fee based / institute procedure will have to be followed.

6. Weightage:

Each course comprising M.Sc. program will be allotted credits as per the following criteria:

a) **Lectures/tutorials (L/T)**: A course that is allotted one lecture/tutorial hour

per week per semester shall be assigned one credit, and so on.

b) **Practicals/Project (P)**: Two lab hours per week per semester for lab course shall be assigned one credit.

7. Attendance

a) All Students must attend every lecture and practical class. However, to account for unforeseen contingencies, the attendance requirement for appearing in the semester examinations shall be a minimum of 75% of the classes prescribed for each course.

b) In order to maintain the attendance record of a particular course, a roll call will be taken by the teacher in every scheduled lecture and practical class. For the purpose of attendance, each practical class will count as one attendance unit, irrespective of the number of contact hours. Attendance on account of participation in the prescribed and notified activities such as NCC, NSS, Inter University sports, educational tours/field work, shall be granted provided the participation of the student is duly verified by the officer-in- charge and is sent to the Head of the Department within two weeks of the function/activity, etc.

c) The teacher shall consolidate the attendance record for the lectures and practical at the end of each month and submit to the Head of the Department. At the end of the semester, the teacher shall consolidate the attendance record for the whole semester and submit it to the Head of the Department. The statement of attendance of students shall be displayed by the Head of the Department on the Notice Board. A copy of the same shall be preserved as record. Attendance record displayed on the Notice Board shall deem to be a proper Notification for the students and no individual notice shall be sent to any student.

d) If a student is found to be continuously absent from the classes without any information for a period of 30 days, the concerned teacher shall report the matter to the Head of the Department who will report the matter to the Registrar for appropriate action that will include striking off the name of such student(s) from the rolls. Such a student may, however, apply for re-admission within 7 days from the date of issue of the notice of striking off the name of such student(s) from the rolls. The request for re-admission may be considered by the Dean of the Faculty. Such a student shall not be eligible for re- admission after the prescribed period of 7 days. The re-admission shall be effected only after the payment of prescribed

re-admission fee.

e) A student with less than 75% attendance in a course in a semester shall be detained from appearing in the semester examination of that course. The Dean of the Faculty may consider application for condoning up to 5% of attendanceon account of sickness, provided the medical certificate submitted by the students should be either from the HAHC Centenary/Majeedia Hospital or Medical Practitioner registered with MCI/other similar statutory bodies of Government of India. The Medical Certificate along with Fitness Certificate should be submitted to the Head of the Department within one week after rejoining the Department and Head of the Department should then send the Certificates immediately to the Office of the Dean after scrutinizing their genuineness along with all related documents. In extra-ordinary conditions, however, only Vice- Chancellor shall condone the attendance beyond 5% condoned by the Dean.

f) A student detained on account of shortage of attendance in any semester shall be re- admitted to the same class in the subsequent academic year on payment of prescribed fees applicable in that year to complete the attendance requirement ofthat course.

g) No student shall be considered to have pursued a regular course of study unless he/she is certified by the Head of the Department, to have attended 75% of the total number of lectures and seminars conducted in each semester, during his/her course of study. Provided that he/she fulfils other conditions, the Dean/Head of JH-IMM for Biomedical Research may permit a student to the next Semester who falls short of the required percentage of attendance by not more than 10% of the lectures and seminars conducted during the Semester.

8. Internal Assessment:

The Internal Assessment marks will constitute 25% of the total marks allotted to a course. For awarding Internal Assessment marks, there shall be two Sessional tests of 10 marks each for each course in a semester. First sessional test will be held after two months of the session, and the second sessional test 15 days before the commencement of the final semester examination. 5 marks will be allotted for assignment, while 5 marks will be allotted to the attendance in the respectivecourses in the following manner:

100% attendance	05 Marks
75 - 99.9% attendance	04 Marks

60 – 74.9% attendance	03 Marks
below 60% attendance but not less than 50%	02 Marks

For the evaluation of lab work, laboratory notebook, practical test/viva voce shall be taken into account. The marks shall be awarded by the respective teachers conducting the practical course.

For Foundation course, this course is of 200 marks with two papers of 100 marks each. This course will follow the same structure as the core course.

9. Semester Examination:

a) Semester examination shall be held at the end of each semester as per schedule given in the Academic Calendar of the Faculty.

b) Up to maximum of seven days preparatory holidays may be given to the examinees before the start of the semester examinations.

c) Each theory/practical/project/summer training having 3 to 5 credits shall be of 100 marks out of which 75% marks shall be for semester examination and 25% marks for internal assessment. Any theory/practical/project/summer training having more than 3 to 5 credits shall be given weightage accordingly. Foundation course having 8 credits shall be of 200 marks; out of which 75% marks shall be for semester examination and 25% marks for internal assessment.

d) The question paper for semester examinations shall be set either by the external examiner or an internal examiner. The Board of Studies of a department shall draw a panel of name of examiners, both internal and external, for approval by the Vice chancellor. If the external examiner is unable to send the question paper by the deadline set by the examination branch of the University, the Head of the Department after consultation with the examination branch shall get the paper set internally by a faculty. The papers set by the examiners can be moderated in consultation with the teacher who taught that course. Teachers appointed on contractual basis with appointment of less than one academic session, and temporary as well as ad-hoc teachers may not ordinarily be appointed as

examiners. All such teachers, however, will be expected to assist in the practical examination.

e) The question paper shall have five - seven questions. There shall be one question from each of the 4 units of the course and one question shall contain objective type/short answer questions covering all the units of the course. The candidate shall have to answer all the questions. There shall, however, be internal choice within a unit/question. The choice shall be given by settingalternative questions from the same unit. The question paper should be such that it covers all the topics of that course. The question paper shall have questions of 75% marks from desirable sections of each unit, while questions of 25% markfrom optional sections.

f) The duration of the semester examination of a theory course shall be three hours. Practical exams of a lab course shall be of three to four hours duration. The practical examination shall be conducted by an external and an internal examiner and assisted by other teachers.

g) For projects, each student shall submit three typed bound copies of his/herproject work to the supervisor(s) by the end of the 4^{th} semester. A student shall not be entitled to submit the project report unless he/she has pursued projectwork during 4^{th} semester under the guidance of a duly appointed supervisor(s). The report shall embody the candidates own work and an up-to-date review of the subject area. The write-up shall detail a critical assessment of the subject area and indicate in what respect the work appears to advance the knowledge of the subject concerned and future course of investigation required.

h) The project report shall be examined by a Board of Examiners and the student shall have to appear for viva-voce. The Board of Examiners shall consist of the following:

- An external examiner
- Head of the Department
- A senior teacher of the Department
- Supervisor(s)

The Board shall examine the project report of all the students, conduct the viva- voce and award marks for the project and viva-voce. All other teachers of the department will also be invited by the Head of the Department to be present during the examination. In case a student fails to secure the minimum pass marks, he/she may be asked to appear in the viva-voce again, or he/she may be asked to revise the project report in the light of the suggestions of the examiners and resubmit. For this,he/she

will have to enroll as an ex-student in the next session. A resubmitted projectreport will be examined as above and viva voce shall be conducted along with other students.

10. SCHEME OF EXAMINATION

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each theory course will carry 100 marks and will have two components: Internal assessment (25marks) and end of semester examination (75 marks) and practical course will carry 200 marks with components internal assessment (50 marks) and end semester examination (75 marks)

Theory

i. Internal Assessment 25 marks

a. Attendance* = 5 marks
b. Test / Assignments 2x10 = 20 marks

ii. End of semester examination 75 marks

[*Note: During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Practical

i. Internal Assessment 50 marks

iii. End Semester Examination (Practical) 150 marks

Dissertation

i. Internal Assessment 125 marks

iv. End Semester Examination (thesis/viva) 475 marks

4. The system of evaluation shall be as follows:

4.1 Internal assessment will be broadly based on assignments and tests in the theory component (20 marks). These criteria are tentative and could be modified by the faculty members associated with teaching of a paper based on guidelines approved by the academic council.

4.2 The scheme of evaluation for dissertation shall be as follows:

4.2.1 Dissertation will formally begin from end of Semester II and will consist of bench work.

4.2.2 Dissertation work will consist of internal evaluation by the concerned Mentor/Supervisor based on general performance, participation in daily activities in the lab, instrument handling, concept development / ability to develop hypothesis/ method protocols through published literature, and student seminar. Research complexity of the dissertation/writing skills (100 marks), Project work (500 marks), presentation and viva-voce (100 marks) - the last two being evaluated by a board comprising of all teachers in the Department and /or external experts.

5. Examinations for courses shall be conducted only in the respective odd and even Semester as per the Scheme of Examinations.

12. PASS PERCENTAGE

Minimum marks for passing the examination in each semester shall be 40% in each paper and 45% in aggregate of a semester.

However, a candidate who has secured the minimum marks to pass in each paper but has not secured the minimum marks to pass in aggregate may reappear in any of the paper/s of his choice in the concerned semester in order to be able to secure the minimum marks prescribed to pass the semester in aggregate.

No student would be allowed to avail of more than two chances to pass a paper inclusive of the first attempt.

13. Classification of Result:

Following grading system with 10 point scale shall be followed to represent performance of students in the examination:

%age marks	Grade	Grade Point	Performance level
80	A+	10	Outstanding
75-<80	A	9	Excellent
70-<75	B+	8	Very good
60-<70	B	7	Good
50-<60	C	6	Average
45-<50	D	5	Below Average
40-<45	E	4	Marginal
<40	F	0	Fail
Absent	I	-	Incomplete

If a candidate does not write a paper, He/She will be awarded "I" grade. To pass the course, the student must obtain a minimum of 'E' grade The minimum CGPA required for the award of degree shall be 5

Earned Credits (EC):

The credits for the courses in which a student has obtained E (minimum passing grade for a course) or a higher grade in the semester exam shall be counted as credits earned by him/her. Any course in which a student has obtained 'F' or 'I' grade shall not be counted towards his/her earned credits.

14. Evaluation of Performance:

a) SGPA (Semester Grade Point Average) shall be awarded on successful completion of each semester.

b) CGPA (Cumulative Grade Point Average), which is the Grade Point Average for all the completed semesters at any point in time shall be awarded in each semester on successful completion of the current semester as well as all of the previous semester. In 1^{st} semester, CGPA is not applicable.

15. Calculation of SGPA and CGPA of A Student in a Semester:

$$\text{SGPA} = \frac{\Sigma \text{ (Earned Credits X Grade Point)}}{\Sigma \text{ (Total Course Credits in a Semester)}}$$

$$\text{CGPA} = \frac{\sum_{j=1}^{m} \Sigma \text{ (Earned Credits X gradepoint)}j}{\Sigma \text{ (Total Course Credit in a Semester)}}$$

Where m is the number of semesters passed.

16. Promotion:

a) Promotion from 1^{st} semester to 2^{nd} semester and from 3^{rd} semester to 4^{th} semester shall be as per institute guideline.

b) A student shall be promoted to the 3rd semester of the programme, if he/she has passed in each theory and practical courses separately of 1st and 2nd semesters. Provided that a student may carry over a maximum of 8-9 credits (equivalent to two-three theory papers, which may be of 3 or 4 credits each of courses uncleared) to the 3rd semester. A candidate will be given a total number of 3 attempts, inclusive of the first attempt, to clear the papers in which he/she fails. For such students, promotion to the next higher class will be considered subject to rules relating to passing the 1st and 2nd semester examinations within two academic years. Award of degree shall be subject to successfully completing all the requirements of the programme of study within four years from admission.In no case the award of degree shall be allowed to the students, who abstain from appearing in the semester examination.

c) Candidates who are unable to appear in the examination, because of serious illness at the time of examinations, may be given another chance. The request has to be processed through the Head of the Department and Dean to the Vice Chancellor. The Vice chancellor may look into the merit of the case and decide accordingly.

17. Classification of Successful Candidates:

The result of successful candidates, who fulfill the criteria for the award of M. Sc., shall be classified after the 4th semester, on the basis of his/her marks of all the four semesters.

Classification shall be done on the basis of following criteria:

a) He/she will be awarded "Distinction", if his/her final marks are greater than or equal to75% in all the semester examinations in the first attempt.

b) He/she will be awarded "1st Division", if his/her final marks are greater than or equalto 60% in all the semester examinations in the first attempt.

c) He/she will be awarded "2nd Division", if his/her final marks are greater than or equal to 50% but less than 60% in all the semester examinations in

the first attempt.

d) He/She will be awarded "Pass", if his/her final marks are greater than or equal to 40% but less than 50% in all the semester examinations in the first attempt.

e) He/she will be treated as "fail", if his/her final marks are less than 40% in allthe semester examinations in the first attempt.

18. Span Period:

a) 1st and 2nd Semester Exams: Within two years from the first admission to the programme.

b) All requirement of M. Sc. degree within a total period of four years from thedate of their first admission.

19. Make-up Examinations:

Make-up examinations shall be held at the end of 3rd and 4th semesters. The maximum papers for each make-up examinations should not exceed two papersincluding Foundation Course.

20. Improvement:

A candidate who wishes to improve the previous performance will be allowed to do so as per the following regulation:

a) A student shall be allowed only once to reappear in the semester examination of up to four theory courses along with regular students of that semester to improve upon the previous performance.

b) Such a student shall inform the Head of the Department in writing of his/her intention to improve the performance two months before the date of semester examination is tobe held.

c) If the student improves the performance, he/she shall be required to submit the earlier mark-sheet/degree. A new mark-sheet and degree shall be issued. The new mark-sheet/degree shall bear the year in which the student improved the grade.

d) In case the grade obtained in improvement is lower than the one obtainedearlier, the higher grade shall be retained.

PROGRAM LEARNING OUTCOME (PLOs)

PROGRAM SPECIFIC OUTCOME (PSOs)

COURSE LEARNING OUTCOME (CLOs)

Master of Science (M.Sc.) Medical Virology

(Four Semester Course)
Two Year Full Time Program & Examination

SYLLABUS
For the Semester Course Credit System

(CHOICE BASED CREDIT SYSTEM)

Centre for Virology
School of Interdisciplinary Sciences and Technology
JAMIA HAMDARD

Jamia Hamdard (University) Vision Statements

To provide international quality higher education and undertake cutting-edge research in the fields of social, natural science and technology and particularly promote study of modern and traditional medicine systems, especially Unani-tibb, encompassing a holistic and integrative approach to healthcare and to meet societal education needs of underprivileged Indian communities.

Jamia Hamdard (University) Mission Statements

- To promote and advance the cause of higher education through modern methods of teaching and advanced research in such branches of knowledge as the Jamia Hamdard may continue to develop core-competence for and as may be in consonance with the emerging needs of India in general and underprivileged communities in particular.
- To co-operate, collaborate and associate with national and international organizations and institutions in any part of the world having mission wholly or partly similar to those of Jamia Hamdard and as per the provision of the UGC regulations in place from time to time.
- To provide avenues for higher education leading to excellence and innovations in such Branches of knowledge as may be deemed fit primarily at under-graduate, post-graduate and doctoral levels, fully conforming to the concept and idea of the Jamia Hamdard.

Centre for Virology (CFV) Vision Statements

The centre for virology established at Jamia Hamdard to provide international quality education and cutting-edge research training in the fields of Basic virology, viral diagnostics, vaccine biology, drug discovery and clinical virology with active collaboration with national and international academic, scientific and health-care institutions as well as industries to meet societal education and training needs.

Centre for Virology (CFV) Mission Statements

- To provide advance post graduate, diploma and doctoral programs in the field of Virology.
- To create opportunities for multi-disciplinary education, training and research in the field of Virology.
- To create public awareness about viral diseases, cure and vaccination in society.
- To instill spirit of innovation and creativity in young minds for startup India, atmanirbhar bharat and swastha bharat schemes of the Govt.
- To nurture confident individuals who are effective contributors towards growth of the nation.

COURSE CONTENT

(Subject to improve/revise as per need in future)

Course Code	Course Name	Credits	Marks
MFC 001	Foundation Course 1	4	100
MFC 002	Foundation Course 2	4	100
MMV 101	Cell Biology and virus cell interaction	4	100
MMV 102	Human Health and Pathology	4	100
MMV 103	General Virology	4	100
MMV 104	Skill building: Laboratory Practicals-1	6	200
		26	**700**
Semester -II			
MMV 201	Fundamentals in Microbiology and Vector biology	4	100
MMV 202	Methods in Virology	4	100
MMV 203	Biomedical research and development	4	100
MMV 204	Student Seminars or MOOCs course at http://www.mooc.org	4	100
MMV 205	Skill building: Laboratory Practicals-2	6	200
		22	**600**

Semester -III			
MMV 301	Viral Diseases in Humans	4	100
MMV 302	Viral Diagnostics, Therapeutic and Vaccines	4	100
MMV 303	Viral Immunology	4	100
MMV 304	Communication, analytical skills& Manuscript writing	4	100
MMV 306	Skill development: Essentials for Independent Researchers	6	200
		22	**600**
Semester – IV			
MMV 401A-D	Dissertation & Introduction to Research Project (One Choice from MMV 401A-G)	**24**	600
		24	**600**
	Total	**94**	**2500**

Program and courses in detail

THE PROGRAM: M.Sc. Medical Virology

Overall Learning Outcome of the Program (Program Learning Outcome [PLOs]):
Centre for Virology (CFV) of the School of Interdisciplinary Sciences and Technology (SIST) of Jamia Hamdard in the year 2021 initiated a post-graduation program, M.Sc. Medical Virology. This 2-year course is expected to prepare students with multidisciplinary knowledge for specialty training in virology to set the standards to ensure that
PLO 1: They will have basic knowledge of Biosciences, microbiology and Immunology.
PLO 2: They will be well trained theoretically and experimentally in the field o Virology.
PLO 3: The trainees are fully prepared to lead a full virology service at consultant level in the National laboratories.
PLO 4: The hands-on training in basic, clinical and translational Biomedical sciences.
PLO 5: Students to have wider career options in competing for professional opportunities in diagnostics, Biotech, Pharmaceutical industry.
PLO 6: Students will have opportunity to get job in Viral Research and Diagnostics Laboratories (VRDL) and Education (academic) sectors in India and abroad.

The Program Specific Outcomes (PSOs) of the program are detailed below
PSO1: Introduction to Biochemistry, Molecular Biology and Biophysics and infection biology with relevance to viral and other human diseases

PSO 2: Ability to comprehend the cell organelle, cell membrane, signal transduction, DNA replication and its implications, stem cell biology, cell cycle and its relevance to virus cell interaction

PSO 3: Introduction to human microbiome, comprehensive understanding of human physiological processes, and human pathology

PSO 4: Comprehension of the fundamental concepts and methods used in immunology

PSO 5: Ability to understand the basics of techniques to study cells, basics of microscopy, Aseptic techniques and microbial culture methods

PSO 6: Ability to comprehend microbial diversity including Bacteria, viruses, parasites, emerging pathogens) and understanding the fundamentals in microbial pathogenesis

PSO 7: Detailed theory and hands on training of cell culture methods and techniques/tools involved in molecular virology, molecular biology, genomics, statistics and bioinformatics used for virology studies

PSO 8: Comprehension of the fundamental concepts and methods used in virology

PSO 9: Skill development for effective scientific communication and manuscript preparation

PSO 10: Hands on training to handle the laboratory equipments, demonstrate skills to use modern techniques, tools/ software/ equipment's and analyze and solve problems in biochemistry and molecular biology. Gaining sufficient knowledge about the assays and analyzing data

PSO 11: Understanding of the fundamental concepts of viral diseases in humans, Genetics in Human diseases

PSO 12: Ability to comprehend the viral diagnostics and therapeutic concepts in Clinical Biochemistry, Medicinal Chemistry, pharmacology and Vaccine Biology in relation to viruses

PSO 13: Hands-on training and independent research experience

PSO 14: Freedom to choose an elective subject as per CBCS

Mapping of Program Leaning Outcomes (PLOs) with Program Specific Outcomes (PSOs)

Program Learning Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
PLO1	+++	+	+		++		++				+		++	
PLO2	++	++	+++			++		++		+		++		++
PLO3	+++	+		++	++	++ +	+	+		++	+		+	+
PLO4	++	++		++	+	++		+		+		+	+	+
CLO5	++	++		++		++			+	+	+	++		++
CLO6	++			++		++		++		+	+	+	++	

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Mapping of Program Specific Outcomes (PSOs) with the semester courses

Program Specific Outcomes [PSOs]														
Course Name	**PSO 01**	**PSO 02**	**PSO 03**	**PSO 04**	**PSO 05**	**PSO 06**	**PSO 07**	**PSO 08**	**PSO 09**	**PSO 10**	**PSO 11**	**PSO 12**	**PSO 13**	**PSO 14**
MFC 001	+++	++	+	++	++	+				+	+			
MFC 002	+++	++	++	++	++	++	++	++		+++	+	++		
MMV 101	++	+++	+	++	+++		+	++		++	+++	+		
MMV 102	++	+	+++	+++	+					+	++	++		
MMV 103	++	+++	++	++	+++	++	++	+++			++	++		
MMV 104	++	++		++	+++		+++	+++		+++	++	+	++	
MMV 201	++	++	++	+	++	+++	++	+++		++	+++	++		
MMV 202	++	++	++	+++		+++	+++	+++		+	++	++		
MMV 203	++	++	++	++	++	+++		++	++		++	++		
MMV 204									+++				+++	++
MMV 205	+++			++	+++	++	+++	+++		+++	+	++	+++	
MMV 301	++	++	++	++	++		++	+++			+++	+++		
MMV 302	++	++		++	++		++	++			++	++		+
MMV 303	++	++	++	+++		+++	++	+++			++	++		+++
MMV 304									+++			+++	+++	+++
MMV 305	++	++		++	+++			+++					+++	
MMV 401	+++			++					++	+++		++	+++	+++

+++ ‘High-level’ mapping

++ ‘Medium-level’ mapping

+ ‘Low-level’ mapping

Semester wise course outcomes:

Semester-1- [Max marks 600; 24 credits)

Foundation Course: Course Code MFC 001
Credit-4; Maximum Marks 100 [Internal 25 marks; End exam 75 marks]
Total Teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Enable students to learn about the fundamentals of Biochemistry
CLO2: Enhance basic knowledge on various cellular metabolism process
CLO3: Enable to learn about fundamentals of Biotechnology and molecular biology
CLO4: Enhance basic knowledge on the molecular biology tools will get towards genetic engineering
CLO5: Inform about DNA, RNA and protein in vitro manipulations
CLO6: Teach about gene cloning and DNA manipulations
CLO7: Teach biosafety and ethics in DNA recombinant techniques
CLO8: Educate about enzyme reactions and kinetics

Mapping of Course Outcomes (Cos) with Program Specific Outcomes (POSs)

Course Outcomes	Program Specific Outcomes													
	PLO 01	PLO 02	PLO 03	PLO 04	PLO 05	PLO 06	PLO 07	PLO 08	PLO 09	PLO 010	PLO 011	PLO 012	PLO 013	PLO 014
CLO1	+++	+	+								+			
CLO2	++	++	+++							+				
CLO3	+++	+				++ +	+			++				
CLO4	+++	++		++	+	++		+		+		+	+	+
CLO5	+++	++		++		++			+	+	+			
CLO6	+++			++		++				+	+			
CLO7	+										+++			
CLO8	+++	+												

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Biochemistry: Macromolecules: Carbohydrates, amino acids, lipids and nucleic acids. Cell and its composition; Overview of Cell organelles and subcellular fractionation; Bioenergetics and Intermediary Metabolism: Glycolysis, TCA cycle, Oxidative phosphorylation, ATP as energy currency; Intermediary metabolism. Central dogma of life. DNA as genetic material. DNA and RNA structures. (15 Hrs.)

Protein structure and function: Secondary and tertiary structure of protein: a helix, ß sheets, examples of proteins. Types of bonding. Enzymes and Enzyme Kinetics: Substrate, active site, transition state, activation energy, equilibrium constant Km, Vmax, specificity, Michaelis-Menten equation. Reaction Mechanism: Acid-base catalysis and covalent catalysis. Regulation of enzyme activity: Reversible and irreversible inhibition (non-competitive, uncompetitive) and their effects on Km and Vmax, effect of pH, heat, PMSF and other inhibitors. (15 Hrs.)

Unit 2: Basic Biotechnology: Basic concepts in recombinant DNA technology. Concepts of Promoters and replication origin. Mutation and mutagenesis. Genetic Engineering - Essentials of gene manipulation, vectors & enzymes used in recombinant technology. Primer design. Cloning and sub-cloning methods. cDNA and reverse transcription. Detection and identification of cloned DNA sequences. Application and principles of Polymerase Chain Reaction. Mutagenesis – different methods used to generate mutants. (15 Hrs.)

Types of Restriction endonucleases; restriction maps. Enzymes used in genetic engineering such as T4 ligase, S1 nuclease, polynuceotide kinase, mung bean nuclease etc. Vectors - cloning and expression vectors, prokaryotic and eukaryotic cloning vectors, yeast vectors, shuttle vectors, YAC & BAC. Principles of selection of specific cloned DNA - blue white selection, insertional inactivation, antibiotic markers used in prokaryotic and eukaryotic cloning. Application of recombinant DNA technology: DNA fingerprinting, gene therapy, diagnostics. Bio-safety and ethics for recombinant DNA technology. (15 Hrs.)

References

1. Harper's biochemistry by Robert K. Murray and Daryl K. Granner and Peter A. Mayes and Victor W. Rodwell; Ed. 25th; McGraw-Hill; 2000.
2. Biochemistry by Donald Voet and Judith G. Voet; Ed. 3rd; Wiley; 2008.
3. Lehninger principles of biochemistry by David L. Nelson and Michael M. Cox; Ed. 5th; W.H. Freeman, 2004.
4. Gene VIII by Benjamin Lewin Ed.7th; Oxford; 2008.
5. Molecular cell biology by Harvey Lodish and Arnold Berk, Chris A. Kaiser, and Monty Krieger; Ed.6th ; W H Freeman and Company; New York; 2008
6. Cell: a molecular approach by Geoffrey M. Cooper; Ed.3rd; ASM Press; 2004.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Foundation Course: Course Code MFC 002
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorials/practical

The Course Learning Outcomes (CLOs)

CLO1: This will enable to learn about Infectious diseases
CLO2: To educate on epidemics, pandemics of mainly viruses
CLO3: Students will learn about Biophysical and Biochemical Techniques
CLO4: Learning on the preparation of related laboratory reagents
CLO5: The knowledge on the equipment used in the biochemical and molecular tools
CLO6: Educate on the equipment's operation and applications
CLO7: Methods used to study molecular interactions will be learned

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1	+++		+++	+			++	++			++			
CLO2	+++				+++		+	+++			++			
CLO3	+++					+++				++	+	++		
CLO4				++				++		++		+		
CLO5						+				+++		++		
CLO6						+++					+			
CLO7	+++	++ +					+			++	+	++		

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: An introduction: Infections, epidemics, pandemics and viruses

History and principles of virology, virus taxonomy, introduction to replication strategies. Virus structure and morphology. Viruses of veterinary importance and zoonotic viruses. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory. Plant and animal viruses propagation. Bacteriophages,

bacteriophage propagation and viroids. Viral epidemics and pandemics. Challenges and solutions to pandemics. (15 Hrs.)

Unit 2: Biophysical and Biochemical Techniques: Solution preparation and concentration calculations – molarity, moles and percentage. pH concepts, buffers, buffer index, and buffer capacity. Cell lysis and tissue homogenization processes – methods, Buffer composition and inhibitors. Extraction and isolation of macromolecules from cells and tissues. Principles of UV/VIS Spectroscopic techniques and applications. Quality check and quantification of biological macromolecules – DNA, RNA and Protein. (15 Hrs.)

Principle of Chromatography, Classification of chromatographic techniques – Ion-exchange, gel filtration (molecular sieve), affinity chromatography, hydrophobic chromatography. HPLC and FPLC methods. Application of chromatography for Protein, and nucleic acid purification. Electrophoresis technique and applications. SDS-PAGE, PAGE, 2D electrophoresis and their applications. Isoelectric point determination.

Methods used to study protein-protein interactions (e.g. co-Immunoprecipitation) and protein-DNA interactions (EMSA and DNA foot-printing). Blotting techniques. (15 Hrs.)

References

1. Medical Microbiology by Geo. Brooks and Karen C. Carroll and Janet Butel and Stephen Morse; Ed. 24th; McGraw-Hill Medical, 2007.

2. Topley and Wilson's Microbiology and Microbial Infections by Leslie Collier and Albert Balows and Max Sussman; Ed. 9th; 6-Volume Set; A Hodder Arnold Publication, 2000.
3. Introduction to Spectroscopy, Pavia DL. Lampson GM 2009.
4. Microscopic techniques in Biotechnology Hoppers M 2003.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Cell Biology and virus cell interaction: Course Code MMV 101
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: This will enable students to learn about cell and its organelle structures
CLO2: Students will learn about cellular processes
CLO3: Learning process of structure and functions of RNA and DNA
CLO4: Learning of gene structures, elements and functional aspects
CLO5: Education of cell division and cycle process
CLO6: This will enable postgraduate students to learn about signal transduction
CLO7: Comprehension of virus cell interaction

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

+++ 'High-level' mapping

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1	+	+++		++	+				+		+			
CLO2	++	+++		++	+		+			+	+			
CLO3	+++	+				+				+	+		+	
CLO4	+++	+			++				++					+
CLO5	++	+++										++		
CLO6		+++						++		+				
CLO7		+++					+	++		+				

++ 'Medium-level' mapping

+ 'Low-level' mapping

Detailed Syllabus

Paper -1 (Course Code: MMV 101) : Cell Biology and virus cell interaction [Max Marks 100; Credit 4]

Unit 1: Cell structure and function: Introduction to the cell: chemical composition, molecular organization, origin and evolution; Prokaryotic and eukaryotic cells; Cell theory and modern cell biology; Mammalian Cell organelles: Membrane biology- chemical composition and its structural plan; Membrane models; Structure of major sub-cellular organelles : endoplasmic reticulum, Golgi body, cytoskeleton, ribosome, mitochondria, and nucleus; Movement of ions and macromolecules across membrane; Protein Trafficking; Methods to study the cell: Visualization of cells, Principles of microscopy, and flow cytometry. (15 Hrs.)

Unit 2: Cellular processes: DNA Replication - replication in prokaryotes and eukaryotes: origin of replication, replication fork, replisome. Enzymes in DNA synthesis, structure, function and mechanisms of action. Transcription and RNA processing – splicing, capping and ploy A tail addition; Protein synthesis – ribosome assembly, t-RNA function, initiation, elongation and termination; Enzymes in post-translational modification; Chromosomes, Chromatin and the nucleosome - Packaging of eukaryotic DNA into chromosome; Nucleosome and Chromatin organization; epigenetic modifications; Gene-structure and Gene-expression; regulation concepts - promoters, enhancers, transcription factors; coding and non-coding genome; Mutation and polymorphism; Cell cycle and Cell division –Regulations and synchronization (15 Hrs.)

Unit 3: Signal Transduction: Signal hypothesis; Cell responses to stimuli, Ligands; Receptor Biology – GPCRs, transporters, ion channels, Growth factors and receptor tyrosine kinases; Proteins and molecules involved in transduction of signal into the cell and from cytoplasm to nucleus; second messengers; soluble receptors; nuclear receptors; feedback loops, signaling cross-talks and converging pathways. Paracrine, autocrine and endocrine actions; Hormone mediated cellular responses. (15 Hrs.)

Unit 4: Virus-cell Interaction: Definition, structure and methods of discovery of viral receptors (polio, herpes, VSV, HIV). Kinetics of receptor binding. Cellular interactions—clathrin coated pits, lipid rafts, caveolae, endocytosis and virus uncoating mechanisms. Nuclear localization signals and nuclear pore transit, virus–cytoskeletal interactions, chaperons. 2. Replication sites and their characterization, IRES, replicons, transport of viral proteins. [3 hrs.] 3. Host cell 'shut off', apoptosis, necrosis, stress response, alteration of signaling pathways, cellular basis of transformation, types of cenotaphic effects, ultrastructural cytopathology. [3 hrs.] 4. Cellular injury associated markers, mechanism of viral persistence and latency—in vivo and in vitro models (JE, measles, LCM and HIV). (15 Hrs.)

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1 . English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25

marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Human Health and Pathology: Course Code MMV 102
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Basic concepts and learning of Immunology
CLO2: This will enable students to have fundamental knowledge of Human Physiological processes
CLO3: Learning of detail of nervous, hepatic and gastro-intestinal systems
CLO4: Learning and detail of muscular, blood and cardio-vascular systems
CLO5: This will enable students to have detailed knowledge of Human Physiological processes
CLO6: Learning of Human Pathology
CLO7: Learning of Cellular Adaptations, Cell Injury and Cell Death

Mapping of Course Outcomes (COs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1			+++		+						++			
CLO2			+++	++	+			+	+	+	++	+		
CLO3			+++	++		+					++		+	
CLO4			+++		++		+				++			+
CLO5	++		+++							+	+			
CLO6	++	++		+							+++			
CLO7			+++	++	++						++			

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit -1 Introduction to Immunology: Introduction and history; Cells and organs of the immune system. Innate immune response & inflammation complement system.. Hapten/antigen; antibody, structure & function, Immunoglobulin classes. Antigen & antibody interaction, Antibody diversity. Ontogeny of immune cells. B and T cell receptors and signaling. Major histocompatibility complex, Polymorphisms, Human leukocyte antigen association with disease. Antigen processing and presentation, Cytokines & Chemokines. (15 Hrs.)
Unit 2: Human Physiological process (I): Basic anatomic concepts and structures overview of integrative physiology. **Nervous system**: Overall anatomical features – central and peripheral; Cellular features of neurons; concept of synapse; neurotransmission; role of non-

neuronal cells –astrocytes, oligodendrocytes, glia, microglia, Schwann cells. **Nerve Physiology:** Origin of resting membrane potential and action potential, electrophysiology of ion channels. Structure and function of neuron, conduction of nerve impulse in a neuron, Synapse, its types and synaptic transmission, Neurotransmitters, types and functions **Gastro-intestinal (GI) system**: General concept of digestive system. Structure and function of GI system. Mechanisms controlling GI system. Enteric Nervous System. (15 Hrs.)

Unit 3: Human Physiological Process (II): Pulmonary system: Breathing and lung mechanics. Homeostasis and gas exchange. Regulation of blood pH. **Cardiovascular system**: Structure and function of heart, cardiac cycle, Basic concepts of electrocardiogram (ECG), circulatory system and hemodynamics, Lymph and lymphatic circulation, blood pressure (causes and factors effecting it). **Blood/lymphatic systems:** Blood components and their functions; Blood groups, ABO system, rhesus system; Overall design of circulatory system - pulmonary and systemic circulation. Clotting factors, extrinsic and intrinsic pathways; Composition and functions of lymph and lymphatic system; **Muscular system**: Types of muscles, Functional anatomy of muscular system, concepts of degeneration and regeneration of muscle, neuromuscular transmission, muscle excitation and contraction, types of contraction and its properties. (15 Hrs.)

Unit 4: Human Pathology: Cellular Adaptations, Cell Injury and Cell Death: Causes and mechanisms of cell injury, reversible and irreversible injury, Necrosis, Apoptosis, subcellular and intracellular response, cellular ageing, cellular adaptations: Hyperplasia, Hypertrophy, Atrophy, Metaplasia. **Acute and Chronic Inflammation**: General features of inflammation: Acute Inflammation Vascular Changes, cellular events, chemical mediators of inflammation. termination of acute inflammation. Outcome and morphological effects of acute inflammation. Chronic Inflammation with examples, Systemic effects of Inflammation. **Tissue Renewal and Repair:** Regeneration and its mechanism. Role of Extracellular Matrix, repair and its types andmechanisms wound healing, healing-scar formation and fibrosis. **Applications of Pathology in understanding diseases:** Diabetes, Asthma,Jaundice. Schizophrenia, Parkinsons – Pathogenesis and Clinical symptoms. (15 Hrs.)

References

1. Textbook of medical physiology by Arthur C. Guyton and John E. Hall; Ed.11th; Saunders; 2005.
2. Review of medical physiology by William F. Ganong; Ed. 22nd; McGraw Hill; 2005.
3. Essential medical physiology by Leonard R. Johnson and Ed. 3rd; ELSEVIER; 2003.
4. Principles of anatomy and physiology by Gerard J. Tortora and Bryan Derrickson; Ed.1th; John Wiley; 2006. With (Brief atlas of the skeleton surface anatomy, and selected medical images)
5. Best and Taylor's physiological basis of medical practice by John B. West; 12th; B I Waverly Pvt Ltd.; New Delhi; 1990.
6. Medical Physiology: A cellular and molecular approach by Walter F. Boron and Emile L. Boulpaep; Saunders; 2003.
7. Physiology by Robert M. Berne and Matthew N. Levy; Mosby; 1998.
8. Kuby Immunology by Thomas Kindt and Richard A. Goldsby and Barbara A. Osborne; Ed. 6th; W.H. Freeman and Company, New York; 2007.
9 . Cellular and molecular immunology by Abul K. Abbas and Andrew H. Lichtman and Shiv Pillai; Ed. 6th; Saunders, 2007.
10. Immunology; Ed.7th by David Male and Jonathan Brastoff and David B. Both and Ivan Roitt; Mosby Elsevier; 2006.
11. Immuno biology: the immune system in health and disease by Charles A. Janeway and Paul Travers and Mark Walport and Mark J. Shlomchik; 7th Ed;

Garland Science; 2008.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

General Virology: Course Code MMV 103
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Basic concepts about classification of viruses
CLO2: This will enable students to have fundamental knowledge of virus replication and propagation
CLO3: Learning of detail of viral diagnosis, pathogenesis and antiviral drugs
CLO4: Comprehension of Enveloped and non-enveloped DNA viruses and disease caused by them
CLO5: Comprehension of Enveloped and non-enveloped RNA viruses and disease caused by them
CLO6: Learning of Human viral disease pathology
CLO7: Learning of viral infection control

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1	++	+	+++		+	++	++	+++			++			
CLO2			+++	++	+	+	+++	+++			++	++		
CLO3			+++	++		+++	++	++			++	+++		
CLO4			+++		++	++	++	+++			++	++		
CLO5	++		+++			++		+++			+	++		
CLO6	++	++		+		++		+++			+++	+		
CLO7			+++	++	++		++	++			++	++		

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Classification of viruses, A typical virus like particles, Viral replication, how do viruses cause diseases, Viral pathogenesis, Antiviral drugs, Laboratory diagnosis, Disinfection and inactivation of viruses. (15 Hrs.)
Unit 2: DNA Viurses - Enveloped DNA Viruses: Herpesviridae, Herpes Simplex Viruses 1, Herpes Simplex Viruses 2, Varicella-Zoster Virus (Human Herpesvirus-3), Epstein Barr Virus (Human Herpesvirus-4), Cytomegalovirus (Human Herpesvirus-5), Human Herpesvirus-6,

Kaposi Sarcoma (Human Herpesvirus-8), Poxviridae, Poxvirus, Molluscum Contagiosum Virus, Monkeypox virus.

Non-enveloped DNA Viruses: Adenoviruses, Papovaviridae, Human Papillomavirus, Polyomaviridae, Polyomaviruses, Parvoviridae, Parvoviruses, Hepatitis Viruses, Enterical transmitted hepatitis viruses, I (HAV, HEV), Hepatitis A Viruses (Picornaviridae), Hepatitis E Virus (Caliciviridae), Parentral transmitted hepatitis viruses, II (HBV, HDV, HCV and HGV), Hepatitis B Virus (Hepednaviridae), Hepatitis D Virus (Deltaviridae), Hepatitis C Virus (Flaviviridae). (15 Hrs.)

Unit 3: RNA Viruses - **Non-enveloped RNA viruses**: Picornaviridae, Polioviruses, Coxsackie A Virus, Coxsackie B Virus, Echo Viruses, Reoviridae, Rotaviruses. **Enveloped RNA viruses:** Orthomyxoviridae, Influenza Virus A, B and C, Coronaviridae, Coronavirus, Paramyxoviridae, Mumps Virus, Measles Virus, ParainfluenzaVvirus, Respiratory Syncitial Virus, Togaviridae, Rubella Virus, Caliciviridae, Norwalk Virus, Rhabdoviridae, Rabies, Slow Virus Infections (Prion Disease), Retroviridae, Human T-Lymphotrophic Virus 1, Human Immunodeficiency Virus, Arbo Viruses, Flaviviridae, Yellow Fever Virus, Western Equine Encephalitis Virus, Bunyaviridae, California Encephalitis Virus, Hantavirus, Filoviridae, Marburg Virus, Ebola Virus, Arenaviridae, Lassa Virus, Lymphocytic choriomeningitis Virus. (15 Hrs.)

Unit 4: Control of Viral Infections: Skin and Soft Tissue Infections, Respiratory Tract Infections, Gastro Intestinal Tract Infections, Urinary Tract Infections, Eye Infections, Central Nervous System Infections, Sexually Transmitted Diseases, Congenital Infections, Perinatal Infections. (15 Hrs.)

References:

Acheson NH. 2006. Fundamentals of Virology. Wiley.

• Carter J & Saunders V. 2007. Virology: Principles and Applications. 1stEd. Wiley.

• Knipe DM, Howley PM, Griffin DE. 2006. Fields Virology. 5th Ed. Vols. I,II. Lippincott, Williams & Wilkins.

• Mahy, BWJ & Kangaroo HO. 1996. Virology Methods Manual. Academic Press.

• Murphy FA, Gibbs, EPJ, Holzmek MK & Studdert MJ. 1999. Veterinary Virology. 3rd Ed. Academic Press.

• Laboratory Biosafety Manual, WHO, http://www.who.int/csr/resources/publications/biosafety/WHO_cds_csr_lyo_20034/en/

• Epidemiology: An Introduction. Kenneth J.J.Rothman. Latest Edition/Pub Date: May 2002. Publisher: Oxford University Press.

• Epidemiology: Leon Gordis, Latest Edition/ Pub Date: November 2004. Publisher: Elsevier Health Sciences.

• Hackett NR, Crystal RG. 2000.Adenovirus vectors for gene therapy. In Gene Therapy, ed. NS Templeton, DD Lasic, pp.17-39. New York: Marcel Dekker.

• Friedman T. 1999. The Development of Human Gene Therapy. Cold Spring Harbor,NY: Cold Spring Harbor Lab.Press.

• CRISPR Gene Editing Methods and Protocols. Editors: Luo, Yonglun (Ed.). ISBN978-1-4939-9170-9.

• In Situ Hybridization Protocols. Editors: Darby, Ian A., Hewitson, Tim D. (Eds.). ISBN 978-1-59745-007-2.

• Ran FA, Hsu, Wright Jgoo, Agarwala V, Scott DA, Zhang. Nat Protoc. Genome engineering using the CRISPR-Cas9 system. 2013 Nov;8(11):2281-2308.
• Sequence Analysis in a Nutshell – A Guide to Common Tools & Databases (2003), Scott Markel. O′Reilly, 1st edition. ISBN-13: 978-0596004941.
• Viral Infections of Respiratory Tract by Raphael Dolin and Peter Wright. Mercel Dekker.
• Clinical Virology Manual Ed: Specter, RL Hodinka, SA Young. ASM Press.
• Influenza. Edited by C.W. Potter. Elsevier Perspectives In Medical Virology.
Series Editor:Arie J. Zuckerman , Uk Isa K. Mushahwar. 2002.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Laboratory Practicals-1: Course Code MMV 104
Credit-6, Max Marks 200 [Internal 50 marks; End exam 150 marks]
Total teaching hours: 90 **Class Type: L/T/P: P=6 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Hands-on practice of sterilization procedures vis., Media preparation, bacteria and viruses and growth curve.
CLO2: Learning of protein estimation by Lowry and Bradford methods
CLO3: Hands on training of Cell culture techniques
CLO4: Counting of cells from culture by haemocytometer and cell counter
CLO5: Hands-on training of cell viability assays like trypan blue and -MTT
CLO6: Training of affinity chromatography and protein purification
CLO7: Learning of ELISA
CLO8: Learning of Western blot and dot blot

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1	++			++	+++			++		+++		+	+++	
CLO2				+++						+++		+	+++	
CLO3	++	++		++					++	+++		+	+++	
CLO4					++	+++			+	+++		+	+++	++
CLO5				++	++				++	+++		+	+++	
CLO6	++				++				+++	+++		++	+++	
CLO7							+++	++	+	+++	++		+++	
CLO8										+++	++	++	+++	

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

-Sterilization procedures, Buffer preparation, DNA estimation, protein estimation by Lowry and Bradford method
-Media preparation, bacteria growth curve, colony forming unit,

-Cell culture methods, thawing of cells, freeze down of cell lines, cell viability assay- trypan blue and -MTT assay
-Biochemical assays, affinity chromatography, protein purification
-IgM capture ELISA, IgG ELISA, Western blot, dot blot

References

1. Cell: molecular approach by Geoffrey M. Cooper and Robert E. Hausman; Ed. 4th; ASM Press; 2007.
2. Medical microbiology: a guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control by David Greenwood and Richard C. B. Slack and John F. Peuthere, ed. 17th Ed. Churchill Livingstone; 2007.
3. Essentials of diagnostic microbiology by Lisa Anne Shimeld and Anne T. Rodgers; Delmar Publishers, 1999.
4. Microscopic techniques in Biotechnology Hoppers M 2003.
5. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. For the practical the End Semester Examination (Practical) 200 marks
2. The system of evaluation shall be as follows: Internal assessment will be broadly based on assignments and tests in the theory component (20 marks/100 marks). These criteria are tentative and could be modified by the faculty members associated with teaching of a paper based on guidelines approved by the academic council.

Semester-II [Max Marks 600; Credit- 24]

Paper 1

Fundamentals in Microbial and vector biology: Course Code MMV 201
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Enable students to have detailed knowledge of prokaryotic system
CLO2: Enable to learn virulency of pathogens
CLO3: Enable to learn bacterial pathogens
CLO4: Enable to learn virus replication
CLO5: Students will learn about methods used in virology and vector biology studies
CLO6: To facilitate students understand about emerging infectious diseases
CLO7: Enable to learn on COVID-19 as a unique example of a pandemic

Course Outcomes	**Program Specific Outcomes**													
	PSO 01	**PSO 02**	**PSO 03**	**PSO 04**	**PSO 05**	**PSO 06**	**PSO 07**	**PSO 08**	**PSO 09**	**PSO 010**	**PSO 011**	**PSO 012**	**PSO 013**	**PSO 014**
CLO1	+++		+++	++	++	+++	++					+++		
CLO2					+++	++	++	++		++	++	+++		
CLO3			+++	++	+++	++				++		+++		
CLO4					+++			+++			+++	+++		
CLO5	+++				+++	+		+++			+++	+++		
CLO6	++		++		+++	++		++			++	+++		
CLO7	+		+++		+++	+		++		++	++	+++		

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Bacteriology: Structure-function relationships of macromolecular complexes and cellular ultrastructure involved in fundamental microbial processes.
Bacterial signaling and sensing: quorum sensing and two component regulatory systems, Bacterial pathogenicity: Mechanisms of bacterial pathogenesis including adherence, invasion, intracellular survival, toxins, host defenses and microbial evasion strategies, Virulence factors

in specific infectious diseases. Key examples of infectious diseases relevant to the global population including emerging diseases, and disease epidemiology. Antimicrobial mode of action and antimicrobial drug resistance, Biofilm initiation and development. (15 Hrs.)

Unit 2: Virus Replication and Virological Methods: 1. Replication of positive sense RNA virus (polio virus, any flavivirus), negative sense RNA viruses (VSV and influenza), [5 hrs.] 2. Replication of double stranded RNA virus (Rotavirus), ambisense RNA (LCM) and retroviruses (HIV and HTLV). 3. Replication of double stranded DNA viruses (SV40, pox), ssDNA virus (AAV). Prion proteins, replication of plant virus. Virological Methods: In vivo, in vitro and in ovo systems for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation methods. Immuno-diagnosis, haemagglutination and haemagglutination-inhibition tests. (15 Hrs.)

Unit 3: Vector Biology: Introduction to general entomology, insect morphology and classification. Insects and other arthropods of medical importance and their structures and functions. Methods for collecting these insects and arthropods, their preservation/ maintenance and transportation. Biology and life history of Aedes, Culex and Anopheles mosquitoes, their behavior and ecology with special reference to dengue, chikungunya, Japanese encephalitis and West Nile virus. Biology, morphology and disease relationship of sandflies (sandfly fever and chandipura). Biology and morphology of fleas, lice, culicoides. Biology, ecology, life history of ticks with special reference to Kyasanur Forest Disease (KFD, CCHF). Biology and morphology of mites. Vector virus relationship interactions: Virus dissemination & mechanism of virus transmission in vectors, natural cycle, maintenance of viruses in nature, basis of vector competence, mechanical transmission, virus dissemination, susceptibility intrinsic and extrinsic factors.

Xenodiagnosis- methods and application. Vector Control: Various control strategies and environmental management. Control in urban settings, control at aquatic stages, adult population, personal protection, insecticide resistance mechanism and control dynamics. (15 Hrs.)

Unit 4: Emerging Infectious diseases: Overview on the origins and pathogens causing emerging and re-emerging infectious diseases; Inter-species transmission; Vector borne infectious disease: dengue fever, Chikungunya, and Japanese Encephalitis. Pandemics - Drifts and shifts in Covid -19, Influenza and Avian flu; Animal to human transmissions (Covid-19, anthrax, brucellosis, bubonic plague, typhus etc) Impact of climate change. Neglected tropical diseases. Impact of corona infection in the population as an example – long term impact in the central nervous system and peripheral tissues. Anticipation and preparedness of a novel pathogen. (15 Hrs.)

References

1. Microbiology by Lansing M. Prescott and John P. Harley and Donald Klein; Ed. 6th; McGraw-Hill Science, 2004.
2. Color ATLAS and textbook of diagnostic microbiology by Elmer W Koneman and Stephen D Allen and William M Janda and Paul C Schreckenberger and Washington C Winn; Ed. 6th; Lippincott Williams & Wilkins, 2005.
3. Medical microbiology: a guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control by David Greenwood and Richard C. B. Slack and John F. Peuthere, ed. 17th Ed. Churchill Livingstone; 2007.
4. Medical Microbiology by Geo. Brooks and Karen C. Carroll and Janet Butel and Stephen Morse; Ed. 24th; McGraw-Hill Medical, 2007.
5. Topley and Wilson's Microbiology and Microbial Infections by Leslie Collier and Albert Balows and Max Sussman; Ed. 9th; 6-Volume Set; A Hodder Arnold Publication, 2000.

6. Immuno Biology: the immune system in health and disease by Charles A. Janeway and Paul Travers and Mark Walport and Mark J. Shlomchik; 7th Ed; Garland Science;2008.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Paper 2

Methods in virology: Course Code MMV 202
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Students will learn about Eukaryotic cell culture methods
CLO2: Learning of host cell counting, imaging of cells
CLO3: Learning of Fluorescence and confocal cell imaging of cells
CLO4: Learning of DNA recombinant technology including cre-lox, CRISPR-Cas9, DiCre methods
CLO5: Learning of gene expression editing steps, viz, siRNA, RNAi, microRNA.
CLO6: Enable students to learn modern Genomic analysis tools including meta genomics
CLO7: Learning sequencings of Proteins, RNA and DNA

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

+++ 'High-level' mapping

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CO1	+++	++	++	++	++	+++	++	++		+	++	++		
CO2	+++	++	+	++	++ +	+++	++	+		+	+	++		+
CO3	+++	+	+	++	++ +	+++		++	+	+	++	+	+	
CO4	+++	++	++	++		+++	++	++			+++	+		
CO5	+++	+	+	++		+++		++		+	+++			
CO6	+++	+	+	++		+++	+	+		+	+++	++		
CO7	+++			++		+++					+++	++		

++ 'Medium-level' mapping

+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Cell culture Methods: Prokaryotic and Eukaryotic cell culture methods; Types of Media, Composition and Nutrients; in vitro and ex vivo cell cultures; Tissue and primary cell cultures, preservation of cells, cell counting and viability, staining, mycoplasma: detection and control; Developing Cell-based assays and detection techniques; Microscopy and Image analyses; Inverted, Fluorescence and confocal microscopy and imaging; cell cycle synchronization. (15 Hrs.)

Unit 2: DNA recombinant technology and medical biotechnology: Cloning methods; Protein over-expression vectors - prokaryotic versus eukaryotic systems; Fusion protein

expression strategies; Protein over-expression procedures and purification; Cloning strategies for promoter DNA; Concepts of reporter genes and vectors; Homologous, non-homologous, site specific and replicative recombination; Cre-Lox; CRISPR Cas9; DiCRE recombination; Types of gene transfections. Bacterial artificial chromosome engineering, selection genomic mutagenesis by gene-trapping. Tools for protein knock-down by gene-silencing – shRNA design tools, vectors, shRNA cloning and transfection techniques; evaluation of protein knock-down – advantages and disadvantages. (15 Hrs.)

Unit 3: Genomic techniques: DNA, RNA and protein sequencings; shot-gun sequencing; High-throughput genomics techniques (NGS, metagenomics, whole genomics); PCR types: Real-time PCR; quantitative PCR; Multiplex PCR; Nested PCR; RNA inhibition: siRNA; RNAi and microRNA; siRNA versus shRNA; RFLP; RAPD; APPCR; SSR; EST, microarray; SNP genotyping, Chromatin Immunoprecipitation (CHIP) analysis. (15 Hrs.)

Unit 4: Bioinformatics: Data-base search tools, Sequence analysis: pairwise and clustal W sequence alignment; dendrogram analysis; pathway analysis; Secondary structure prediction; homology modelling; protein-protein interaction simulation; plasmid design tools; Primer design tools. Genomics - informatics analysis of NGS and metagenomics data. (15 Hrs.)

References

1. Color ATLAS and textbook of diagnostic microbiology by Elmer W Koneman and Stephen D Allen and William M Janda and Paul C Schreckenberger and Washington C Winn; Ed. 6th; Lippincott Williams & Wilkins, 2005.
2. Essentials of diagnostic microbiology by Lisa Anne Shimeld and Anne T. Rodgers; Delmar Publishers, 1999.
3. Topley and Wilson's Microbiology and Microbial Infections by Leslie Collier and Albert Balows and Max Sussman; Ed. 9th; 6-Volume Set; A Hodder Arnold Publication, 2000.
4. Introduction to Spectroscopy Pavia DL. Lampson GM 2009.
5. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Biomedical Research and Development: Course Code MMV 203
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Learning to exploit microbial metabolism for medical Biotechnology
CLO2: Learning about Pre-clinical Research, Toxicity and safety evaluation
CLO3: Knowing cellular responses to toxicants
CLO4: Learning about experimental models in biomedicine research
CLO5: To learn fundamentals in statistics
CLO6: To apply statistical methods in Biomedical Research
CLO7: To learn about cGLP and cGMP products

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1	++	+	+	+	+++	++		++				+++		
CLO2	+++			++				++			++	+++		
CLO3	+++	++		++				++			++	+++		
CLO4		++		++	++	+		++			++	+++		
CLO5	+++	++		+				++	++		++	+++		
CLO6				++				++	++		++	+++		
CLO7		+						++			++			

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Medical Microbiology and Biotechnology: Diversity and complexity of applications; Biodiversity of fermentations; Microbial metabolism and the assimilation of carbon, nitrogen, and sulphur; Inter-connections between catabolic and biosynthetic pathways; Selection, isolation and construction of useful organisms. Contemporary examples of industrial processes using microbes; Exploitation of microbial metabolism for medical biotechnology purposes. (15 Hrs.)

Unit 2: Pre-clinical Research, Toxicity and safety evaluation: Research models in Biomedicine – Primates, rodents, zebra fish, drosophila and c. elegans; advantages and disadvantages; Pre-clinical models in Biomedical research - mammalian versus primates; Laboratory Animal usage ethics; Regulatory bodies for research using animal models; Alternative to animal models; Toxicity and Safety - Overview**;** Types of toxicants; Environmental toxicants – elemental and pathogenic source; Cellular responses to toxicants; Drug/NCE toxicity: Drug interactions, Drug/NCE Toxicity evaluation and safety assessment. (15 Hrs.)

Unit 3: Statistical methods in Biomedical Research: Fundamental of Statistics - Arithmetic mean, median, mode: theory and simple numerical problem; Measures of variation: standard deviation, variance, coefficient of variation; Correlation, types and methods: simple, multiple, linear and nonlinear correlation, spearman's correlation, rank correlation; Regression: linear and curvilinear regression (for two variable X and Y only), Regression lines by least square method; regression equations of X on Y and Y on X only; Sample size; Power of study.

Tests of significance - Null hypothesis; Standard error; Level of significance; Degrees of freedom; Significance of mean for large samples; Significance in means for small samples (students t-test); Significance in ratio of two samples; F test (for difference between variance of two samples); Chi square test; Analysis of variance test (ANOVA) for one and two way classification; Signed rank test; Dunnet's test; Applications of various online tools: SPSS, Minitab, XLSTAT etc. (15 Hrs.)

Unit 4: cGLP and cGMP products; Biosafety procedures; BSL laboratory types; Clinical trials, Intellectual property rights, Regulatory bodies and regulatory procedures; Major professional scientific organizations and research funding mechanisms; Ethics in research; Record keeping; SOPs; Major scientific journals and journal impact factors; Literature survey (15 Hrs.)

References

1. Basic statistics by A. L. Nagar and R. K. Das; 2nd Ed.; Oxford; 2002.
2. Biostatistics: a manual of statistical methods for use in health, nutrition and anthropology by K. Visweswara Rao; Jaypee Borthers, 1996.
3. Introductory statistics by Prem S. Mann; 5th Ed.; John Wiley; 2003.
4. Biostatistics: a foundation for analysis in the health sciences by Wayne W. Daniel; 8th Ed.; John Wiley; 2005.
5. Cellular and molecular immunology by Abul K. Abbas and Andrew H. Lichtman and Shiv Pillai; Ed. 6th; Saunders, 2007.
6. Medical microbiology: a guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control by David Greenwood and Richard C. B. Slack and John F. Peuthere, ed. 17th Ed. Churchill Livingstone; 2007.
7. Medical Microbiology by Geo. Brooks and Karen C. Carroll and Janet Butel and Stephen Morse; Ed. 24th; McGraw-Hill Medical, 2007.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Seminar presentation by students: Course Code MMV 204
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 (CBCS) Class Type: L/T/P: T=4 credits

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Enable students to develop skills for effective communication
CLO2: Enable students to develop skills for data presentation
CLO3: Enable students to develop skills for presenting journal articles
CLO4: Enable students to get rid off-stage fear
CLO5: Enable students to know effective preparation of powerpoint slides

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1									+++				+++	++
CLO2									+++				+++	++
CLO3									+++				+++	++
CLO4									+++				+++	++
CLO5									+++				+++	++

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.

2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

OR

A MOOC - Max Marks 100; Credits - 4

Any one online course at https://www.mooc.org/

Lab Practical -2: Course Code MMV 205
Credit-6, Max Marks 200 [Internal 50 marks; End exam 150 marks]
Total teaching hours: 90 **Class Type: L/T/P: P=6 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Hands on trainings on DNA Cloning methods
CLO2: Hands-on on transformation and Transfection techniques in prokaryotic/eukaryotic cells
CLO3: Hands on trainings on genomic isolation, Northern blots, Southern blots
CLO4: Hands-on on PCR, multiplex PCR, q-PCR and RT-PCR
CLO5: Hands on training of Immunofluorescence, ELISA, Flowcytometry
CLO6: Cell transfection; virus like particle generation, recombinant virus introduction
CLO7: PBMCs isolation, isolation of adeherent and non-adherent cells from PBMCs and spleen
CLO8: Lymphocyte proliferation assay and Hybridoma preparation

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1	+++			++	++	+	+++	+++		+++	++	++	++	
CLO2	+++			++	++	+	+++	+++		+++	+	++	++	
CLO3	+++			++	++	+	+++	+++		+++	+	+++	++	
CLO4	+++			++	++	+	+++	+++		+++	+	+++	+++	
CLO5	+++			++	++	+	+++	+++		+++	++	+++	+++	
CLO6	+++			++	++	+	+++	+++		+++	+	++	++	
CLO7	+++			++	++	+	+++	+++		+++	++	+++	+++	
CLO8	+++			++	++	+	+++	+++		+++	+	+++	+++	

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

-Molecular biology techniques- Cloning strategies- transformation, restriction digestion, ligation and screening PCR, real time PCR RFLP; RAPD, northern blot, genomic isolation, nested PCR, multiplex PCR
-Immunology- PBMC isolation, immunofluorescence, flow cytometry, ELIPSOT, cytokine ELISA, virus antigen ELISA

- Cell transfection with viral proteins, viral like particle generation, Pseudoparticle generation, recombinant virus
- Isolation of PBMCs by various methods, assay for the separation of B and T cells, Separation of adherent and non-adherent cells (both from splenocytes & PBMCs), Assay for antigen presentation by phagocytosis, Lymphocyte proliferation assay, Hybridoma (fusion and limiting dilution)

References

1. Molecular biology of the cell by Bruce, Alberts and Alexander Johnson and Julian Lewis, and Martin Raff; Ed. 5th Garland Science; 2008.
2. Molecular cell biology by Harvey Lodish and Arnold Berk, Chris A. Kaiser, and Monty Krieger; Ed. 6th ; W H Freeman and Company; New York; 2008.
3. Cell: molecular approach by Geoffrey M. Cooper and Robert E. Hausman; Ed. 4th; ASM Press; 2007.
4. Microscopic techniques in Biotechnology Hoppers M 2003.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. For the practical the End Semester Examination (Practical) 200 marks
2. The system of evaluation shall be as follows: Internal assessment will be broadly based on assignments and tests in the theory component (20 marks/100 marks). These criteria are tentative and could be modified by the faculty members associated with teaching of a paper based on guidelines approved by the academic council.

Semester-III [Max marks 600; 24 credits]

Paper 1

Viral Diseases in Humans: Course Code MMV 301	
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]	
Total teaching hours: 60	**Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Enable students to understand disease burden, pathology, treatment and prevention of enteric diseases and oncogenic viruses

CLO2: Learning on Viral hepatitis diagnosis, immunopathogenesis and experimental approach for research

CLO3: Enable students to understand hepatitis vaccines and future prospective

CLO4: This will enable students to learn antiviral drug development, antiviral drug resistant and other issues

CLO5: This will enable students to learn clinical trial design

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	**Program Specific Outcomes**													
	PSO 01	**PSO 02**	**PSO 03**	**PSO 04**	**PSO 05**	**PSO 06**	**PSO 07**	**PSO 08**	**PSO 09**	**PSO 010**	**PSO 011**	**PSO 012**	**PSO 013**	**PSO 014**
CO1	+++	+	++	++	++	++	++	+++			+++	+++		
CO2	++	+	++	++	++		++	+++		+	+++	+++	+	
CO3	+	++	+	++	++		++	+++	+		+++	+++		+
CO4	++	++	++	++	++		++	+++			+++	+++		
CO5			++	++				+++			+++	+++		

+++ 'High-level' mapping

++ 'Medium-level' mapping

+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Viral Enteric Diseases and Oncogenic viruses: Classification of enteric viruses, epidemiological scenario with respect to Viral Enteric Diseases at National and International level. Clinical course, disease burden, risk factors, prevention, and treatment. Rotavirus diversity, emerging strains, immune responses and immunopathogenesis of major viral agents associated with acute gastroenteritis. Other Enteric viruses associated with acute gastroenteritis: Adenoviruses, astroviruses, Noro and Sapporo viruses. Diagnostic methods and vaccines. Enterovirus diseases of public health concern (non-polio EVs). Polioviruses, Viral oncogenesis, oncogenic viruses HPV, HTLV, Epstein Barr virus**.** (15 Hrs.)

Unit 2: Viral Hepatitis: Physiology of Jaundice, clinical features and differential diagnosis, presentations of hepatitis caused by different hepatitis viruses, epidemiology of hepatitis

viruses. Structure & genomic organization, replication, genotypes, serotypes of HAV, HBV, HCV & HEV. Mutations in hepatitis viruses. Serological and molecular diagnosis of different hepatitis viruses. Immunopathogenesis of different hepatitis viruses. Animal models and their uses. Historical aspects, types of hepatitis vaccines, vaccines presently used & vaccines of the future, antivirals against HBV and HCV. (15 Hrs.)

Unit 3: Viral Respiratory Diseases: Epidemiological scenario with respect to respiratory diseases at National and International level. History, clinical features, epidemiology of influenza, RSV and other respiratory viruses (Human Metapneumovirus, Human parainfluenza, Human Rhinovirus). Biology and of Novel respiratory viruses (SARS, MERS CoV, SARS-CoV-2, H7N9, COVID-19). Differential diagnosis of different respiratory diseases. Vaccines against different viral respiratory diseases. (15 Hrs.)

Unit 4: Antivirals: Antiviral Drug Classification. Designing / Screening of antivirals. Target identification & molecular modeling. Systems Biology approach & drug repurposing. Preclinical evaluation of antiviral agents. Clinical trial design. Mechanism of Antiviral drug resistance. Traditional & synthetic antivirals. Drug delivery approaches. Pharmacogenomics. Pharmacokinetics & pharmacodynamics. Interferons. Anti-sense RNA, siRNA, miRNA, ribozymes. Antibody based therapeutics. Drug discovery to clinics. (15 Hrs.)

References

- Hackett NR, Crystal RG. 2000.Adenovirus vectors for gene therapy. In Gene Therapy, ed. NS Templeton, DD Lasic, pp.17-39. New York: Marcel Dekker.
- Friedman T. 1999. The Development of Human Gene Therapy. Cold Spring Harbor,NY: Cold Spring Harbor Lab.Press.
- CRISPR Gene Editing Methods and Protocols. Editors: Luo, Yonglun (Ed.). ISBN978-1-4939-9170-9.
- In Situ Hybridization Protocols. Editors: Darby, Ian A., Hewitson, Tim D. (Eds.). ISBN 978-1-59745-007-2.
- Ran FA, Hsu, Wright Jgoo, Agarwala V, Scott DA, Zhang. Nat Protoc. Genome engineering using the CRISPR-Cas9 system. 2013 Nov;8(11):2281-2308.
- Sequence Analysis in a Nutshell – A Guide to Common Tools & Databases (2003), Scott Markel. O′Reilly, 1st edition. ISBN-13: 978-0596004941.
    - Viral Infections of Respiratory Tract by Raphael Dolin and Peter Wright. Mercel Dekker.
    - Clinical Virology Manual Ed: Specter, RL Hodinka, SA Young. ASM Press.
    - Influenza. Edited by C.W. Potter. Elsevier Perspectives In Medical Virology. Series Editor:Arie J. Zuckerman , Uk Isa K. Mushahwar. 2002.
- Virology Methods Manual. Brian W.J. Mahy (Editor), Hillar O. Kangro (Editor). Latest edition / Pub. Date: January 1996. Publisher: Elsevier Science & Technology Books.
- Methods and Techniques in Virology. Pierre Payment, Trudel (Editor). Latest edition / Pub. Date: July 1993. Publisher: Marcel Dekker.
- Diagnostic Virology Protocols: Methods in Molecular Medicine. John R. Stephenson (Editor), Alan Warnes Latest edition / Pub. Date: August 1998. Publisher: Humana P ress.
- Diagnostic Procedures for Viral, Rickettsial, and Chlamydial Infections. Edwin H. Lennette (Editor), David A. Lennette, Evelyne T. (Eds.) Lennette, Evelyne T. Lennette (Editor). Latest edition / Pub. Date: January 1995. Publisher: American Public Health Association Publications.
- Antiviral Agents, Vaccines, and Immunotherapies. Stephen K. Tyring. Latest edition / Pub. Date: October 2004. Publisher: Marcel Dekker.
- Antiviral Drug Discovery for Emerging Diseases and Bioterrorism Threats. Paul F. Torrence (Editor). Latest edition / Pub. Date: July 2005. Publisher: Wiley, John & Sons, Incorporated.
- Vaccines. Stanley A. Plotkin, Walter A. Orenstein. Latest edition / Pub. Date: September 2003. Publisher: Elsevier Health Sciences.

- Drew Farmer (Editor), Advanced Virology Hardcover, Callisto Reference; 2 Edition, 2015, ISBN: 1632390213.
- Harvey O'Brien (Editor), Advanced Principles of Virology Hardcover, 2019, Callisto, ISBN: 1641161272.
- D.J.McCance (Editor), Human Papilloma Viruses. Elsevier Perspectives in Medical Virology. Series editor: Arie J. Zuckerman, UK, Isa K. Mushahwar.2002.
- E.Tabor (Editor),Viruses and Liver cancer. Elsevier Perspectives in Medical Virology. Series Editor:Arie J. Zuckerman, UK Isa, K.Mushahwar.2002.
- J.A.Grand (Editor),Viruses, Cell Transformation, and Cancer.. Elsevier Perspectives in Medical Virology. Series Editor: Arie J. Zuckerman, UK Isa K. Mushahwar. 2001.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Paper 2

Diagnostics Therapeutic and Vaccine: Course Code MMV 302
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 **Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: This will enable students to understand Clinical Biochemistry and Diagnostics
CLO2: This will enable students to have knowledge in Medicinal Chemistry
CLO3: Learning on novel drug delivery systems
CLO4: Learning on factors influencing diagnostic methods
CLO5: This will enable students to learn Systemic Pharmacology
CLO6: This will enable students to learn Vaccine Biology

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	**Program Specific Outcomes**													
	PSO 01	**PSO 02**	**PSO 03**	**PSO 04**	**PSO 05**	**PSO 06**	**PSO 07**	**PSO 08**	**PSO 09**	**PSO 010**	**PSO 011**	**PSO 012**	**PSO 013**	**PSO 014**
CLO1	++	++		++	++		++	++			+++	++		
CLO2	++	++		+	+		++	++			++	++		
CLO3	++	++		+	++		++	++			++	++		
CLO4	+++	++		++	++		++	++			++	++		
CLO5	++	++			+		++	+			+++	++		
CLO6	++	+		+++			+++				+++	+++		

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Clinical Biochemistry and Diagnostics: Clinical chemistry/biochemistry - concept, definition and scope; Biological samples - types, collection, processing, stability and storage; Serum and serum separator devices; Chemical composition of biological fluids: blood, urine and cerebrospinal fluid; Reference range; Quality assurance; Accuracy and precision; Factors influencing the accuracy of results; Levy-Jennings's chart; Reliability of laboratory methods; Interferents; Biochemical tests in clinical practice: uses of a chemical/biochemical analysis; Criteria for selecting a method for biochemical analysis; Enzymes as diagnostic tool; Advantages and disadvantages of enzyme assays; Isoenzymes and their diagnostic importance; Methods for the detection of isoenzymes; Organ function tests: clinical presentation and diagnosis of the diseases of the liver and kidney; Bilirubin metabolism and hyperbilirubinaemia; Acid base disorders. (15 Hrs.)

Unit 2: Medicinal Chemistry: Drug design and targeting - Discovery of lead compound, lead modification, conventional drug screening, structural modification, bioisosteres, structure

activity relationship, Quantitative structure activity relationships, introduction to molecular modelling and molecular graphics, pharmacophore descriptors

Receptors - Chemical nature of receptors, Neurotransmitters and their receptors, Receptor modulation and mimics, Receptor sites, Drug receptor interactions, active transport, affinity and efficacy, antagonism, partial antagonism, inverse agonism, allosteric binding sites Chirality and receptor binding.

Drug Metabolism - Biotransformations and their mechanisms, Phase I and Phase II metabolism, Oxidation, Reduction, Hydrolysis, Deamination and Conjugation (GSH, Sulfate, Glucuronide and Amino acids), Role of non-specific enzymes: Oxidases, Mono-oxygenases, Di-oxygenases and Peroxidases: Biotransformations illustrated by suitable examples of commonly used drugs, Chirality and drug metabolism. Enzyme Inhibition concepts.

Reversible and irreversible, Adverse drug reactions, Drugs acting on cell wall, Fungal membrane and Nuclear membrane, Drugs inhibiting protein synthesis. Structure-based drug design; rules and strategies, NCEs versus repurpose; analytical tools; Concept & Models for Novel Drug-delivery systems (NDDS): Classification of rate controlled drug delivery systems (DDS), rate programmed release, activation modulated &feedback regulated DDS, effect of system parameters in controlled drug delivery, computation of desired release rate and dose for controlled release DDS, pharmacokinetic design for DDS – intermittent, zero order & first order release. (15 Hrs.)

Unit 3: Systemic Pharmacology: Study of consolidation parameters; Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters; Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption.

Drug interactions: introduction, the effect of protein binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters.

Application of Pharmacokinetics: Modified-Release Drug Products; Targeted Drug Delivery Systems and Biotechnological Products. Nano Particles & Liposomes: Types, preparation and evaluation The various approaches for development of novel drug delivery systems. (15 Hrs.)

Unit 4: Vaccine Biology: history; Vaccine development; Types of vaccines (conventional and modern) - DNA/RNA, subunit and whole organism vaccines; Killed and live attenuated vaccines; Therapeutic and prolylactic types; Vaccines in current use; Passive and active immunity; childhood vaccines; immunization schedules; vaccines against bioterrorism; Viral vaccines; personalised vaccines; cold- chain management; vaccine administration, immunomodulators (cytokines). Vaccine delivery and vaccination strategies, vaccine components- adjuvants, preservatives, large scale manufacturing-QA/QC issues. Animal models and vaccine potency testing. Clinical trial of vaccines.Vaccines against emerging viral diseases. Challenges and solutions. (15 Hrs.)

References

1. Biochemistry by Christopher K. Mathews and Kensal E. van Holde and Kevin G. Ahern; Ed. 3rd; Prentice Hall, 1999.
2. Textbook of biochemistry with clinical correlations by Thomas M. Devlin; Ed.6th; Wiley-Liss; 2005.
3. Biochemistry by Jeremy M. Berg and John L. Tymoczko and Lubert-Stryer; Ed. 6th ; W.H. Freeman,

4. Medicinal chemistry: principles and practice by Frank D. King; Ed. 2nd; The Royal Society of Chemistry; 2002.
5. Introduction to medicinal chemistry by Graham L. Patrick; Ed. 3rd; Oxford; 2006.
6. Essentials of diagnostic microbiology by Lisa Anne Shimeld and Anne T. Rodgers; Delmar Publishers, 1999.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Paper 3

Viral Immunology: Course Code MMV 303	
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]	
Total teaching hours: 60	**Class Type: L/T/P: L=4 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: To learn on Introduction to immune system and immune response against viruses
CLO2: Learning about Host pathogen interaction focused on immune evasion by viruses
CLO3: Learning about interferons mediated antiviral responses and evasion by viruses
CLO4: Comprehension of Immune defense mechanisms against viruses
CLO5: To learn about Products and factors produced by immune system
CLO6: Learning of various methods and techniques in Immunology

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 10	PSO11	PSO12	PSO 013	PSO 014
CLO1	+	++	+	++		+++	++	++			++	++		
CLO2	++	++	+	+		++	+	++			++	++		
CLO3	+	+	+	++		++	++	++			++	++		
CLO4	+	++	+	+		++	+	++			++	++		
CLO5	+	++	+	++		++	++	+++			++	++		
CLO6	++	+	+	++ +		++	++	+++			++	++		

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit 1: Immune Response to viral Infections; Immune responses to virus; immunotherapy; allergy, Immunodeficiency; Tolerance, autoimmunity and inflammation. Immune booster response Transplantation immunology; tumor immunology; tumor surveillance; immunomodulators and as drugs. Mucosal effector mechanisms. Cell mediated effector mechanisms: Phagocytosis, Cytotoxic and T helper response, Natural killer cells. Immunoregulation, Vaccine induced immune response and immune correlates of protection, Hypersensitivity. (15 Hrs.)

Unit 2: Viral evasion of Immune system: Viral mechanisms of immune evasion. Inhibitions of humoral response. Interference with Interferons. Inhibition and modulation of chemokines and cytokines. Inhibitors of apoptosis. Evading CTLks and NKs. Modulating MHC function. (15 Hrs.)

Unit 3: Products and factors produced by immune system during viral infection; cytokines and chemokines; antibody engineering. Plantibodies; bispecific antibodies; immunity generated against antigens/vaccines; recall response; Th1 and Th2 polarity; Th1 and Th2 balance; central memory and effector memory; T cell memory response; B cell memory response. (15 Hrs.)

Unit 4: Methods in Immunology: Agglutination; Immunofluoresecence; Immunoelectrophoresis; RIA; ELISA: Indirect and Sandwish; ELISPOT assay; Cytotoxicity assay; MTT assay; MLR; Hemolytic plaque assay; Flow Cytometry; Cell sorting; MHC inbred, nude, congenic, syngenic, knockout mice and utility; Hybridoma Technology. Complement fixation, neutralization, Immunoprecipitation, Radioimmunoprecipitation assay and immunohistochemistry. Fluorescence, confocal - principles and applications. (15 Hrs.)

References

1. Kuby Immunology by Thomas Kindt and Richard A. Goldsby and Barbara A. Osborne; Ed. 6th; W.H. Freeman and Company, New York; 2007.
2. Cellular and molecular immunology by Abul K. Abbas and Andrew H. Lichtman and Shiv Pillai; Ed. 6th; Saunders, 2007.
3. Immunology; Ed.7th by David Male and Jonathan Brastoff and David B. Both and Ivan Roitt; Mosby Elsevier; 2006.
4. Immuno biology: the immune system in health and disease by Charles A. Janeway and Paul Travers and Mark Walport and Mark J. Shlomchik; 7th Ed; Garland Science; 2008.
5. Immunology of infection diseases by Stefan H. E. Kaufmann and Alan Sher and Rafi Ahmed; ASM Press, Washington; 2002.
6 Essentials of immunology & serology by Jacqueline H. Stanley; DELMAR; Australia; 2002.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

Paper 4

Communication and Manuscript Preparation: Course Code MMV 304
Credit-4, Max Marks 100 [Internal 25 marks; End exam 75 marks]
Total teaching hours: 60 (CBCS) Class Type: L/T/P: T=4 credits

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Students will learn through SEMINARS (by Students/ Internal faculties/visiting faculties)
CLO2: Students will learn through their Journal Article presentation
CLO3: Stimulation of critical data evaluation skills
CLO4: Students will learn about Manuscript Preparation
CLO5: Aspiring young minds towards choice based credit system

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	Program Specific Outcomes													
	PSO 01	PSO 02	PSO 03	PSO 04	PSO 05	PSO 06	PSO 07	PSO 08	PSO 09	PSO 010	PSO 011	PSO 012	PSO 013	PSO 014
CLO1									+++			++	+++	
CLO2									+++			++	+++	
CLO3									+++			++	+++	
CLO4									+++			++	+++	
CLO5														+++

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

Unit -1: SEMINARS (Students/Internal faculties/visiting faculties);

Unit 2: Journal Article presentation – critical data evaluation skills.

Unit 3: Manuscript Writing

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of

Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. English shall be the medium of instruction and examination.
2. Examinations shall be conducted at the end of each semester as per the Academic Calendar notified by the University.
3. Each course will carry 100 marks and will have two components: Internal assessment (25 marks) and end of semester examination (75 marks)
4. Internal Assessment 25 marks: a. Attendance = 5 marks; b. Test / Assignments 2x10 = 20 marks; c.
5. End of semester examination 75 marks.
6. During the pandemic year 2020, attendance of 5 marks has been included with the assignments.]

OR

A MOOC - Max Marks 100; Credits - 4

Any one online course at https://www.mooc.org/

References

Paper 5

Practicals - Essentials for Independent Researchers: Course Code MMV 305
Credit-6, Max Marks 200 [Internal 50 marks; End exam 150 marks]
Total teaching hours: 90 **Class Type: L/T/P: P :6 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Students will learn virology techniques for being able to independent research, i.e. virus propagation and purification methods
CLO2: To learn Hemagglutination, plaque and focus forming assay and PCR
CLO3: Analytical techniques like TLC and HPTLC will be performed by students
CLO4: Students will learn virus entry assay for host interaction studies

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	**Program Specific Outcomes**													
	PSO 01	**PSO 02**	**PSO 03**	**PSO 04**	**PSO 05**	**PSO 06**	**PSO 07**	**PSO 08**	**PSO 09**	**PSO 010**	**PSO 011**	**PSO 012**	**PSO 013**	**PSO 014**
CLO1	++	++		+	++			+++	++				++	
CLO2	++	++		++	++			+++	++				++	
CLO3	++	++		++	++			+++	+++				+	
CLO4	++	++		+	++			+++					+++	

+++ 'High-level' mapping
++ 'Medium-level' mapping
+ 'Low-level' mapping

Detailed Syllabus

-Virus propagation and purification methods (sucrose gradient, PEG method), infection in different cell lines (Vero, BHK and HepG2), primary culture maintenance,
-Hemagglutination, plaque assay, MOI calculation, TCID50, focus forming assay, titre calculation, interpretation of CPE, multiplex PCR for serotyping,
-biochemical analysis of blood, Measurement of metabolites by TLC, HPLC
- Virus entry assay- using dye labelled virus, virus cell fusion de-quenching, cell- cell fusion, time of drug addition assays
-Preparing frequency distributions/cross tables, computing descriptive statistics and interpretation, graphical presentation of data: bar diagram, Line diagram, pie chart, histogram, epi-curve, interpretations
Motif data bases, Epitope prediction, molecular modeling & visualization, molecular dynamic simulation

References

Notes and SOPs distributed by the teachers.

Teaching-Learning Strategies in brief

The teaching learning strategies, followed are board and chalk teaching, Learning through discussion among the peer group, classroom interaction, discussion of research papers of Journal related to topics, power point presentation, Q & A session and reflective learning, remedial classes, group discussions, assignments students seminars etc

Assessment methods and weightages in brief

1. For the practical the End Semester Examination (Practical) 200 marks
2. The system of evaluation shall be as follows: Internal assessment will be broadly based on assignments and tests in the theory component (20 marks/100 marks). These criteria are tentative and could be modified by the faculty members associated with teaching of a paper based on guidelines approved by the academic council.

Semester – 4 [Max Marks 600; credits 24]

Elective: Dissertation in any one from the options below –Course code BMS 401
Credits – 24 Max Marks 600 [Internal 150 marks; End exam 450 marks]
Total teaching hours- 360 (CBCS) **Class Type: L/T/P: P=24 credits**

L/T/P: Lectures/tutorial/practical

The Course Learning Outcomes (CLOs)

CLO1: Virus host cell interaction will be taken as independent work by student mentored by faculty member

CLO2: Student will perform independent work under a mentor on Virus epidemiology

CLO3: Student will learn about pseudo virus and recombinant virus

CLO4: Independent research under mentor by student on Immunity against virus

CLO5: Mentored dissertation on Oncoviruses will be taken by student

CO6: Antiviral drug screening and virus entry will taken as dissertation work by student under mentorship

Mapping of Course Learning Outcomes (CLOs) with Program Specific Outcomes (PSOs)

Course Outcomes	**Program Specific Outcomes**													
	PSO 01	**PSO 02**	**PSO 03**	**PSO 04**	**PSO 05**	**PSO 06**	**PSO 07**	**PSO 08**	**PSO 09**	**PSO 010**	**PSO 011**	**PSO 012**	**PSO 013**	**PSO 014**
CLO1	+++			++				++	++	+++		+++	+++	
CLO2	+	+	+	++	+			++	+	+++		+++	+++	+++
CLO3	+			++		+		++	++	+++	+	+++	+++	+++
CLO4	+++			++			+	++	+++	+++		+++	+++	+++
CLO5	++			++				++	+	+++		+++	+++	+++
CLO6	++		+	+				++	++	+++		+++	+++	+++

+++ ‘High-level’ mapping
++ ‘Medium-level’ mapping
+ ‘Low-level’ mapping

Detailed Syllabus

Research projects (Dissertation):

- ➢ **401A:** Virus-host cell interaction- Binding partners of virus protein by co-immunoprecipitation and other methods
- ➢ **401B:** Virus epidemiology- patient sample virus detection and other parameters- ELISA, viral load, cytokine estimation
- ➢ **401C**: Surrogate system to study pathogenic viruses- pseudovirus, viral like particle, recombinant virus.
- ➢ **401D:** Host immune response to viral infection- Cytokine profiling and transcription profiling of host genes
- ➢ **401E**: Virus mediated Cancer biology- Differentiation and Basis of metastasis, Concepts of Drug Targets
- ➢ **401F**: Anti-viral assays of drug-Cytotoxicity, effective dose and determination point of action of stage of virus life cycle
- ➢ **401G**: Virus entry – Host proteins involved, fusion mechanism by fluorescence de-quenching and content mixing

References

1. Project related research and review peer reviewed journal articles
2. Laboratory publications and protocols/SOPs
3. References on methods studied in earlier semesters

Teaching-Learning Strategies in brief

For project work the topics shall be given in advance, however, the credits assigned for the project work shall be awarded at the end of fourth semester. For project work, the Head of the Department shall call a meeting of all the teachers of the Department and assign appropriate number of students to each teacher to act as the supervisor for project work. The student in consultation with the supervisor shall select a topic for the project work and inform the Head of the Department.

Assessment methods and weightages in brief

Dissertation will formally begin from end of Semester II and will consist of bench work. Dissertation work will consist of internal evaluation by the concerned Mentor/Supervisor based on general performance, participation in daily activities in the lab, instrument handling, concept development / ability to develop hypothesis/ method protocols through published literature, and student seminar. Research complexity of the dissertation/writing skills (100 marks), Project work (400 marks), presentation and viva-voce (100 marks) - the last two being evaluated by a board comprising of all teachers in the Department and /or external experts.

…ooo000O000ooo…