

**DISCIPLINE SPECIFIC CORE COURSE – 12:
VIROLOGY**

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
MICROB-DSC403: VIROLOGY	4	3	0	1	Class XII pass with Biology/ Biotechnology/ Biochemistry	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

- The major objective of this course is to make students aware of the extent to which the tiniest of microorganism (viruses) leave their impact on human and animal health as well as in agriculture.
- Students will get acquainted with the structures and replication strategies of bacterial, plant and human viruses.
- Students will gain in-depth knowledge of how viruses infect their host, spread across a population, and cause diseases.
- They will learn of preventive measures used for protection against viral infections, and control
- They will acquire knowledge of emerging and re- emerging viruses in context to public health threats taking coronavirus as the case study.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Student will be able to describe the nature, properties and structure of viruses, and be knowledgeable about sub-viral particles, giant viruses and viral taxonomy.
- Student will be able to discuss bacterial viruses, their salient features, and replication strategy of important bacteriophages.
- Elaborate on plant viruses, modes of transmission and their economic importance.
- Student will be able to evaluate the salient features and replication strategies of important human viruses, and will have understood the concept of oncogenesis, DNA and RNA cancer-causing viruses.
- Student will be able to describe how to prevent viral infections using vaccines and antiviral compounds.

- Student will be able to assess the problems of emerging and re-emerging viruses, having an understanding of the rise of coronavirus as the major public health crisis along with the implemented management protocols.

SYLLABUS OF DSC-12

UNIT – I (9 hours)

Introduction to Virology: History of virology. Nature and general properties of viruses, concept of viroids, virusoids, satellite viruses, prions, giant viruses (mama, mimi and pandora virus), virophages (Sputnik). Structure of viruses: Capsid symmetry, enveloped and non- enveloped viruses. Isolation, purification and cultivation of viruses. Viral taxonomy: Classification and nomenclature of different groups of viruses.

UNIT – II (8 hours)

Bacteriophages: Diversity, one step multiplication curve. T4 phage: Unusual bases, terminal redundancy, lytic cycle, assembly, maturation and release of progeny virions. Lambda phage: genome structure, concept of early and late proteins, lytic cycle and lysogeny. ϕ X174 phage: Overlapping genes, and rolling circle replication.

UNIT – III (3 hours)

Plant Viruses: Diversity, modes of transmission (non-persistent, semi persistent and persistent), salient features of replication of Geminivirus. Economic importance of plant viruses : adverse and beneficial effects. Virus-like particles (VLPs) and their applications in medicine.

UNIT – IV (18 hours)

Human Viruses: Diversity, routes of transmission: vertical and horizontal (vector-borne, air-borne, oral-faecal borne) infection cycle. Replication of Human Immuno Deficiency Virus (HIV) and Polio Virus. Overlapping genes. Partial double stranded genomes: Hepatitis B. Segmented genomes: Influenza virus. Non-segmented genomes: Picornavirus. Assembly with example of Polio virus. Oncogenic viruses: types of oncogenic DNA and RNA viruses. Emerging and Re-emerging viruses: H1N1, Dengue, Ebola, Zika virus and associated pandemics and epidemics. Case study of the SARS-CoV2 Corona virus as the recent public health threat: emergence, epidemiology, management protocols, emergence of variants, global impact

UNIT – V (7 hours)

Prevention and Control of Viral Diseases: Antiviral compounds and their mode of action: AZT, ritonavir, lamivudine. Interferons and their mode of action. General principles of viral vaccines: live attenuated vaccines, inactivated viral vaccine, subunit vaccine, recombinant viral vaccine.

Practical component

UNIT 1: (22 hours)

Structure and isolation of viruses: Principle and use of electron microscopy to study virus structure. Use of electron micrographs for studying the structural characteristics of the following viruses: Bacterial viruses: ϕ X174, T4, λ . Plant viruses: caulimovirus, gemini, tobacco ringspot, cucumber mosaic and alfalfa mosaic viruses. Human viruses: rhabdovirus, influenza, paramyxovirus, hepatitis B and retroviruses.

Isolation of bacterial and plant viruses: Isolation and enumeration of bacteriophages (PFU) from water/sewage samples using double agar layer technique. Qualitative analysis of lytic and lysogenic phage by observation of plaque phenotypes (clear versus turbid). Isolation of plant viruses from infected leaves followed by locally inoculating healthy plant leaves to confirm isolation and infectivity. Use of the local lesion assay to observe characteristic lesions formed on the plant leaves and measure of infectivity of the virus by enumeration of the number of local lesions on the inoculated leaves.

Unit 2: (8 hours)

Isolation and propagation of animal viruses: Principle and working method of using chick embryo cultivation technique. Demonstration of the method using videos. Cytopathic effects of viruses: observation of the physical attributes of virus-infected cells of different types with suitable photographs and images.

Essential/recommended readings

Theory:

1. Fields Virology: DNA Viruses (Vol 2) by P.M. Howley, D.M. Knipe, J.L. Cohen, B.A. Damania. 7th edition. Walters Kluwer, Netherlands. 2021.
2. Fields Virology: Emerging Viruses (Vol 1) by P.M. Howley, D.M. Knipe, S. Whelan. 7th edition. Walters Kluwer, Netherlands. 2020.
3. Principles of Virology, Molecular biology, Pathogenesis and Control by S. Flint, L. Enquist, R. Krug, V. Racaniello, A. Skalka. 5th edition. ASM press, USA. 2020.
4. Plant Viruses: Diversity, Interaction and Management by R.K. Gaur, S.M.P. Khurana, and Y. Dorokhov. CRC Press. Taylor & Francis Group. 2018.
5. Principles of Molecular Virology by A.J. Cann. 6th edition. Academic Press, Elsevier Netherlands. 2016.
6. Introduction to Modern Virology by N.J. Dimmock, A.L. Easton and K.N. Leppard. 7th edition. Wiley-Blackwell Publishing. 2016.
7. Understanding Viruses by Teri Shors Jones. 3rd edition. Jones and Bartlett Learning, USA. 2016.
8. Plant Virology by R. Hull. 5th edition. Academic Press, USA. 2014.
9. Virology: Principles and Applications by J. Carter and V. Saunders. 2nd edition. John Wiley and Sons, UK. 2013.
10. Plant Viruses by M.V. Nayudu. Tata McGraw Hill, India. 2008.
11. Basic Virology by E.K. Wagner, M.J. Hewlett, D.C. Bloom. 3rd edition. Wiley-Blackwell Publishing. 2007.
12. Virology by J.A. Levy, H.F. Conrat and R.A. Owens. 3rd edition. Prentice Hall, USA. 2000.

Practicals:

1. Benson's Microbiological Applications, Laboratory Manual in General Microbiology by A. Brown and H. Smith. 15th edition. McGraw-Hill Education, USA. 2022.
2. Bacteriophages by D., Harper, S., Abedon, B., Burrowes, and M. McConville. 1st edition. Springer, Switzerland. 2021.
3. Freshney's Culture of Animal Cells by R. I., Freshney and A. Capes-Davis. John Wiley and Sons. U.K. 2021.
4. Microbiology: A Laboratory Manual by J. Cappuccino and C.T. Welsh. 12th edition. Pearson Education, USA. 2020.
5. Manual of Clinical Microbiology, 2 Volume set by K. C., Carroll, M. A., Pfaller, M. L., Landry, A. J., McAdam, R., Patel, S. S., Richter and D. W. Warnock. 12th edition. ASM Press. USA. 2019.
6. Experiments in Microbiology, Plant Pathology and Biotechnology by K. R. Aneja. 5th edition. New Age International Publishers, India. 2017.
7. Practical Plant Virology by J., Dijkstra and C., Jager. Springer Science and Business Media. Germany. 2012.
8. A Colour Atlas of Virology by J. Versteeg. Mosby International. Taiwan. 1990.

Suggestive readings

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.