S.V. UNIVERSITY, TIRUPATI :: SVU COLLEGE OF SCIENCES

M. Sc., VIROLOGY

COURSE PATTERN, CURRICULAM AND SCHEME OF EXAMINATION CBCS Pattern

(With effect from the Academic year 2024-2025)

SEMESTER - III								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	301	Core course – 7: Animal and Human Virology	4	4	70	30	100
2		302	Core Course – 8(A): Molecular Virology Core Course – 8(B): Agricultural and Veterinary Viruses and their Management	4	3	50	25	75
3		303	Core Course – 9(A): Animal and Human Virus Diseases. Core Course – 9(B): Emerging and Re-emerging Virus Diseases	4	3	50	25	75
4	P	304	Practical V (related to CC 8 & 9)	6	2	35	15	50
5	SOC	305	Skill Oriented Course – 5(A): Applied Virology Skill Oriented Course – 5(B): Clinical Virology	4	3	50	25	75
6		306	Skill Oriented Course – 6(A): Industrial Biotechnology Skill Oriented Course – 6(B): Medical Lab Technology	4	3	50	25	75
7	P	307	Practical VI (related to SOC 5 & 6)	6	2	35	15	50
8	OOTC (Open Elective)	308	Open Online Transdisciplinary Course – 2 **VIR-308: GENERAL VIROLOGY (Optional)** **(Open Elective- Theory)**	--	2	70	30	100
			Total	**36**	**22**	**340**	**260**	**600**
*	Seminar / tutorials / remedial classes and Quiz as part of internal assessment			4	-	-	-	-

- CC (Core Courses) – 7th Core Course is mandatory and 8th & 9th Core Courses Student can choose one from each code

- *SOC (Skill Oriented Courses) – Student can choose one from each code

- *Open Online Transdisciplinary Course (OOTC) - Students can choose any relevant course of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc.,

- *Practical - V relating to 5th & 6th Core Courses and Practical - VI relating to 5th & 6th Skill Oriented Courses (SOC)

SEMESTER - IV								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	***** OOSDC (Skill Development Courses)	401	Open Online Skill Development Courses					
		401(A)	**Environmental Biotechnology (Skill development course-Theory)**	4	4	70	30	100
		401(B)	**Pharmaceutical Biotechnology (Skill development course-Theory)**	4	4	70	30	100
2	PW	402	Project Work – Orientation Classes	24	12	300	0	300
	Conducting classes for competitive exams, communication skills, UGC / CSIR and NET / SLET examinations			12	-	-	-	-
			Total	**36**	**20**	**300**	**200**	**500**
Total Semesters				**144**	**84**	**1530**	**670**	**2200**

VIR-308: GENERAL VIROLOGY (Optional)
(Open Elective- Theory)

Lecture: 4 hours/week	**Internal test Assessment: 30 Marks** **Seminars and assignments**
Tutorial: Textbooks, E-learning resources, study materials, PowerPoint lectures	**Semester End Examination: 70 Marks**
Semester: III	**Credits: 4 Credits**

Course Educational Objectives:

1.To understand the history, properties, nomenclature and classification of viruses and development of virology

2. To learn about methods used for isolation, cultivation, and purification of viruses.

3..To acquire knowledge about the methods used for quantitation of viruses and major characteristics of bacteriophages, algal and fungal viruses.

4. To acquire knowledge about replication strategies, management of viruses and sub viral agents.

UNIT-I

History & classification of viruses: History, origin and evolution of viruses, Criteria used for naming and classification, Current ICTV classification of viruses of bacteria, plants and animals and humans.

Morphology and properties of viruses: Physical- morphology and structure, sedimentation, electrophoretic mobility, buoyant density; Biochemical- chemical composition, nucleic acids, proteins, enzymes, lipids, carbohydrates, polyamines, cations, virus stability; Biological- Host range, inclusion bodies and transmission.

Transmission of viruses: Non-vector and vector mode of transmission of viruses.

UNIT-II

Laboratory Biosafety: Biosafety levels, containment facilities, virology laboratory design and guidelines

Isolation, cultivation and maintenance of viruses: Isolation and cultivation of plant experimental plants and tissue culture) and animal viruses (experimental animals, embryonated eggs, organ cultures, primary and secondary cell cultures, suspension and monolayer cell cultures, cell strains, cell lines).

Purification of viruses: Extraction of viruses from tissues, clarification, and concentration of viruses in clarified extracts by physical and chemical methods, further purification of viruses by rate zonal / equilibrium density gradient centrifugation, Criteria of virus purity,

Quantitation and preservation of purified virus preparations.

UNIT-III

Assay of viruses: Infectivity assay methods (plaque, pock, end point, local / systemic assay of plant viruses), physical (EM), serological (HA, HI, immunofluorescence, ELISA) and molecular (viral protein and nucleic acid based) approaches.

Bacteriophages: Biology of major RNA (MS2) and DNA (Lambda) bacteriophages, Replication of M13 and T_4 bacteriophages

Mycophages and phycoviruses: Biology of viruses of Fungi and Algae.

UNIT-IV

Replication: Introduction to virus replication, steps involved in virus replication and general strategies. Baltimore classification of replication strategy

Management of viruses: Cultural practices, Sanitation, control of vectors, vaccines, antiviral drugs and chemotherapy.

Subviral agents : Viroids, Virusoids, Prions, Sattellite virus

Course Outcomes: At the end of the course the student will be able to

CO1: Learn the discovery, nature, origin and evolution of viruses and the physical, biochemical, and biological properties of viruses, criteria used for nomenclature and classification of bacteria, plant and animal viruses.
CO2:Describe the methods used for isolation, cultivation, and purification of viruses and criteria of purity.
CO3: Define biological, physical, biochemical, and serological methods used for quantitation of viruses, major characteristics of important plant and animal virus families and major characteristics of bacteriophages, algal and fungal viruses.
CO4: Understand the about replication strategies, management of viruses and biology of subviral agents.

Learning Resources and Suggested Books:

1. Evidence-Based Diagnosis: An Introduction to Clinical Epidemiology 2nd Edition, by Thomas B. Newman, Michael A. Kohn (2020).2 edition, Publisher: Cambridge University Press.
2. Virusphere: From Common Colds to Ebola Epidemics--Why We Need the Viruses That Plague Us (2020). 1st edition, Frank Ryan (Author), Publisher: Prometheus.
3. Guide to Clinical and Diagnostic Virology (2019), (ASM Books) 1st Edition, by ReetiKhare, Publisher: ASM Press.
4. Virology (2019), P. Saravanan.
5. Recent Advances in Animal Virology (2019) 1st Edition, Kindle Edition, by Yashpal Singh Malik, Raj Kumar Singh, Mahendra Pal Yadav, 471 pages, Publisher: Springer
6. Virology (2017) Ren Warom, Titan Books.
7. Virus: An Illustrated Guide to 101 Incredible Microbes (2016), 1st Edition (ASM Books) Fourth Edition, by Marilyn J. Roossinck, Carl Zimmer,Publisher: Princeton University Press.
8. A Planet of Viruses: (2015) 2nd ed, by Carl Zimmer (2015) University of Chicago Press.
9. Schaechter's Mechanisms of Microbial Disease (2012).Fifth, North American Edition, by N. Cary Engleberg MD, Terence Dermody , Victor DiRitaPublisher: LWW; Fifth, North American edition
10. Introduction to Modern Virology. (2001). 5th ed. Dimmock et al., Blackwell Sci. Publ.
11. Plant Virology. (2001). 4th edi. By R. Hull. Academic Press.
12. Fundamental Virology, 4th ed. (2001). D.M. Knipe and P.M. Howley.
13. Principles of Virology: (2000). by S.J. Flint et al., ASM Press.
14. Basic Virology, (1999). By Waginer and Hewelett, Black Well Science Publ.
15. Veterinary Virology. 3rd ed. (1999). Murphy et al., Academic Press.
16. Principles of Molecular Virology. (1997). 2nded. A. Cann. Academic Press.
17. Medical Virology. (1994). 4th edition. D.O. White and F.J. Fenner. Academic Press. Plant Virology. (2001). 4thed. By R. Hull. Academic Press.
18. Field's Virology Vol 1 and 2. B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L.Melnick, T.P. Monath, B. Roizman, and S.E. Straus, eds.), (2007) 3rd Edition. Lippincott-Raven,Philadelphia, PA.
19. Principles of Molecular Virology. (1997). 2nded. A. Cann. Academic Press.
20. Virology: (1994). 3rded. Frankel Conrat et al, Prentice Hall.

VIR-401A: ENIVIRONMENTAL BIOTECHNOLOGY
(Skill development course-Theory)

Lecture: 4 hours/week	**Internal test Assessment: 30 Marks** **Seminars and assignments**
Tutorial: Textbooks, E-learning resources, study materials, PowerPoint lectures	**Semester End Examination: 70 Marks**
Semester: IV	**Credits: 4 Credits**

Course Educational Objectives:

1.To understand the structure and types of ecosystem , environmental pollution and earth microbial biodiversity

2. To learn about methods used to detect environmental pollutants, biogeocycles and bioabsorption

3..To acquire knowledge about application of environmental biotechnology and biodegradation , solid waste management, Effluent treatment and waste water treatment

4. To acquire knowledge about Environmental monitoring using microorganisms, Global environmental issues and environmental laws.

Unit-1

Basic concepts of Environmental biotechnology: Introduction, Ecosystem- Structure and types of Ecosystem- atmosphere, hydrosphere and lithosphere.

Environmental pollution: Types of pollution and control strategies- water, soil, air and oil pollution.

Microbial Diversity: Influence of Microorganisms on earth environment- Types of Soil Microbial flora and their functions, rhizosphere, phyllosphere, microbial interactions in the soil.

Unit-II

Importance of Biogeochemical cycles: Carbon cycle, Nitrogen cycle and Phosphorous cycle

Methods to detect Environmental pollution: Chemical Analysis- Spectroscopy, GC-MS, ICP-MS; Biological Analysis- Cytotoxic tests, DNA probes, Bioindicators; Remote sensing and sensor Networks-Satellite Remote Sensing.

Bioabsorption : Microorganisms in metal absorption, factors effecting bioabsorption

Unit-III

Applications of Environmental Biotechnology: Bioremediation of environmental pollutants, biodegradation of Xenobiotics- pesticides, surfactants, degradative plasmids; phytoremediation, bioleaching of ores (biomining) and biodiesel production.

Solid waste management: composting and vermi composting, biogas production, methanol production .

Effluent treatment : Distillery, pharmaceutical and dairy effluents

Wastewater treatment : physical, chemical and biological treatment processes, microbiology of waster water treatments; Aerobic processes- Activated sludge, Oxidation ditches, Trickling filter, Towers, Rotating discs, Rotating drums, Oxidation ponds; Anaerobic processes- Anaerobic digestion, Anaerobic filters, Upflow anaerobic sludge blanket reactors, BOD and COD

UNIT-IV

Environmental monitoring: using Microorganisms, Xenobiotic compounds, biomagnifications, bioindicators, biosensors and biochips. GMOs- Risks associated with GMOs in environmental application

Global Environmental issues: Global warming, green house effect and biodiversity

Environmental laws: The Environmental Protection Act, 1986, The Biological Diversity Act, 2002, The Biodiversity Rules. Environmental regulation and Safety, Environmental auditing

Course Outcomes: At the end of the course the student will be able to

CO1: Learn the structure and types of ecosystem , environmental pollution and earth microbial biodiversity

CO2:Learn about methods used to detect environmental pollutants, biogeocycles and bioabsorption

CO3: Learn about application of environmental biotechnology and biodegradation , solid waste management,Effluent treatment and waste water treatment

CO4:Learn about Environmental monitoring using microorganisms ,Global environmental issue and environmental laws.

Learning Resources and Suggested Books:

1. Environmental biotechnology: theory and application (2011) Gareth M. Evans, Gareth G. Evans, Judy Furlong. John Wiley & Sons Ltd. West Sussex,UK
2. Environmental Biotechnology: Principles and Applications(2010) M. Moo-Young, W.A. Anderson, A.M. Chakrabarty. Springer publisher
3. Environmental Biotechnology (2010) M. H. Fulekarby. Science Publishers Department of Life Sciences, University of Mumbai, India,
4. Environmental Chemistry 9th edition(2009) Stanley E. Manahan, CRC Press.
5. Environmental chemistry 5th edition(1997) A.K.De.
6. Environmental Biotechnology :Principlesand applications(2001) Bruce E. Rittmann and Perry L. McCarty. McGraw Hill, Newyork
7. Industrial and Environmental Biotechnology(2001). Ahmed N, Qureshi, F.M. and Khan, O.Y. Horizon Press.

VIR-401B: PHARMACEUTICAL BIOTECHNOLOGY
(Skill development course-Theory)

Lecture: 4 hours/week	**Internal test Assessment: 30 Marks** **Seminars and assignments**
Tutorial: Textbooks, E-learning resources, study materials, PowerPoint lectures	**Semester End Examination: 70 Marks**
Semester: IV	**Credits: 4 Credits**

Course Educational Objectives:

1.To understand the pharmaco kenitics and pharmaco dynamics and the industrial applications of pharmaceutical biotechnology .
2. To learn about the applications of cell cultures and r-DNA technology in pharmacy and pharmacogenomics
3. To acquire knowledge about the large scale production of pharmaceutical products drug discovery and hybridoma technology.
4. To acquire knowledge about biopharmaceuticals, biotherapetics, immunotherapetics and their applications in pharmaceutical industry

Unit I

Introduction to Pharmaceutical Biotechnology: Pharmacological principles: Routes of Drug administration, Pharmacokinetics: Definition and Concept of ADME (Absorption,distribution,metabolism and Excretion) in drug development,
Pharmacodynamics: principles of drug action, mechanism and factors influencing drug action drug metabolism and adverse effects
Pharmaceutical biotechnology and industrial applications: Enzyme immobilization and applications, Biosensors in Pharmaceutical Industries, Concepts of Protein Engineering, Microbes for Enzyme production- Amylase, Penicillinase

Unit II

Applications of Cell cultures: Stem cells and their applications, tissue engineering, virology and genetic engineering, cytotoxicity, vaccine production, drug screening and development
r-DNA Technology applications in medicine : Production of Therapeutic proteins- Insulin, Growth hormones; Vaccine development - Hepatitis B and HPV vaccines; Gene therapy- Replacing defective genes ; Disease diagnosis and Research- DNA Fingerprinting
Pharmacogenomics: Drug selection, predicting drug response, Right drug to the right person concept. Pharmacogenomics of Cancer and coronary Artery Disease

Unit III

Large scale production of Biopharmaceuticals :Downstream processing and optimising of fermentors ,Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring; Introduction to Microbial biotransformation and applications, Large scale production, fermenter design and its various controls, Study of the production of penicillins, Griseofulvin etc.

Drug discovery and pharmainfomatics: Discovering a drug, target identification and validation, identifying the lead compound, optimization of lead compound. Impact of genomics on drug discovery, gene chips.

Hybridoma technology- Production, Purification and Applications of monoclonal antibodies Immunoblotting techniques- ELISA, Westren blotting, Neutralization Assays.

Unit IV

Biopharmaceuticals/ Biotherapeutics : General method of the preparation of bacterial vaccines, toxoids, viral vaccines, antitoxins, serum-immune blood derivatives and other products relative to immunity, Storage conditions and stability of vaccines

Immunotherapy: Types of Immune check points and Inhibitors, CAR T-cell therapy, Monoclonal antibodies, cancer vaccines, cytokines, adverse effects.

Applications of biopharmaceuticals: Production and analysis of biopharmaceuticals, Role of biopharmaceuticals inn treatment of various health disorders, delivery of bio pharmaceuticals, clinical trails

Course Outcomes: At the end of the course the student will be able to

CO1: Learn the pharmacokenitics and pharmacodynamics and the industrial applications of pharmaceutical biotechnology .

CO2: Learn about the applications of cell cultures and r-DNA technology in pharmacy and pharmacogenomics

CO3: Understand about the large scale production of pharmaceutical products drug discovery and hybridoma technology.

CO4: Learn about biopharmaceuticals, biotherapetics,immunotherapetics and their applications in pharmaceutical industry

Learning Resources and Suggested Books:

Reference Books:

1. Pharmaceuticals biochemistry(2011) Harbanslal, . CBS Publishers and distributors Pvt. Ltd,Chennai.
2. Pharmaceutical Biotechnology, 1st edition(2009) Carlos A. Guzmán and Giora Z. Feuerstein.Springer publishers
3. Industrial Proteomics: Applications for Biotechnology and Pharmaceuticals(2005) Daniel Figeys (Ed.). Wiley, John & Sons
4. Pharmaceutical Biotechnology Drug Discovery and Clinical Applications(2004)O. Kayser and Muller R.H. WILEY-VCH
5. Applied Biopharmaceutics & Pharmacokinetics(2004) Leon Shargel, Andrew B. C. Yu, Susanna Wu-Pong, and Yu Andrew B. C. McGraw-Hill Companies
6. Directory of approved biopharmaceutical (2004) Stefania Spada, Garywalsh.
7. Biopharmaceutical, Biochemistry & Biotechnology(2003) Gary Walsh.
8. Industrial pharmaceutical biotechnology (2002) Heinrich Klefenz.
9. Bioinformatics – from Genomes to Drugs. Volume I& II (2002)Thomas Lengauer (Ed.).

M.Sc., DEGREE EXAMINATION MODEL QUESTION PAPER-2024/25
THIRD SEMESTER
BRANCH: VIROLOGY
THEORY-VIR-308: GENERAL VIROLOGY
(OPEN ELECTIVE)
(w.e.f. 2024-2025)

Time: 3 Hours Max. Marks: 70

SECTION – A

Answer any Four questions. All questions carry equal marks (4× 5 = 20)

1. Morphology of viruses.
2. Inclusion bodies.
3. Cell lines
4. Criteria of virus purity
5. HA & HI.
6. Lambda phage
7. virusoids
8. anti viral drugs

SECTION – B

Answer All the questions. All questions carry equal marks. (4 × 12.5 = 50)

9. a) Explain criteria of the ICTV classification of viruses.

(OR)

b) Write a detailed note on transmission of viruses.

10. a) Describe the methods used for the Isolation and cultivation of animal viruses.

(OR)

b) Elaborate on Extraction, clarification, concentration and purification of viruses.

11. a) Discuss different Infectivity methods used for assay of viruses.

(OR)

b) Write a detailed note on biology of Mycophages and algal viruses.

12. a) Describe the steps involved in replication process in viruses

(OR)

b) Write the characteristics of subviral agents.

M.SC. DEGREE EXAMINATION, MODEL QUESTION PAPER - 2025/26
FOURTH SEMESTER
BRANCH: VIROLOGY
THEORY-VIR-401A: ENVIRONMENTAL BIOTECHNOLOGY
(SKILL DEVELOPMENT COURSE)
(w.e.f. 2024-2025)

Time: 3 Hours Max. Marks: 70

SECTION – A

Answer any Four questions. All questions carry equal marks (4 × 5 = 20)

1. Lithosphere
2. Phyllosphere.
3. Carbon cycle
4. Biosensors
5. Phytoremediation.
6. BOD.
7. GMOs-Risks.
8. Environmental auditing.

SECTION – B

Answer All the questions. All questions carry equal marks. (4 × 12.5 = 50)

9. a) What are the different types of environmental pollution? Describe the control measures for oil pollution.

(OR)

b) What is Microbial diversity and write the different types of soil microbial flora and their functions in the ecosystem

10. a) Explain the role of biogeochemical cycles in the ecosystems

(OR)

b) Write various types of methods used to detect Environmental pollution and describe in detail about biological analysis

11. a) What is biodegradation? Describe the microbial degradation of xenobiotics.

(OR)

b) Give an account on solid waste management

12. a) Write an essay on global warming

(OR)

b) Write an account on Environmental Laws and their implementation

M.Sc., DEGREE EXAMINATION, MODEL QUESTION PAPER - 2025/26
FOURTH SEMESTER
BRANCH: VIROLOGY
THEORY-VIR-401B: PHARMACEUTICAL BIOTECHNOLOGY
(SKILL DEVELOPMENT COURSE)
(w.e.f. 2024-2025)

Time: 3 Hours Max. Marks: 70

SECTION – A

Answer any Four questions. All questions carry equal marks (4 × 5= 20)

1. ADME
2. Biosensors in pharmaceutical Industries
3. Cytotoxicity
4. DNA Finger printing
5. Lead compound.
6. Right drug to right person
7. CAR T-cell therapy
8. Monoclonal antibodies

SECTION – B

Answer All the questions. All questions carry equal marks. (4 × 12.5= 50)

9. a) Define Pharamaco dynamics and write the principles and mechanism of drug action

(OR)

b) Explain the role and applications of Biosensors in pharmaceutical industry

10. a) Write the applications of r-DNA Technology in medicine

(OR)

b) Define pharmacogenomics? Explain the pharmacogenomics of cancer disease

11. a) Give an account on Downstream processing and write a detailed account on the production of penicillin

(OR)

b) Write a detailed account on *In silico* methods of drug discovery

12. a) Name some of the biopharmaceuticals and describe the steps involved in virus vaccine production

(OR)

b)Describe the Immunotherapy and its applications in pharmaceutical Industry