

1. Course offered :: UG, PG , PhD - Semester / Year wise

- List of UG Courses (B.V.Sc& AH) As per latest MSVE Guidelines) ,
B.Tech. (D.T.) and B.F.Sc as per ICAR – V Deans Committee – 2016.

Sr No	Course No.	Title	Credit	Course offered in the Year
	VMC	Veterinary Microbiology	3+2=5	UNIT-1 (GENERAL AND SYSTEMATIC VETERINARY BACTERIOLOGY), UNIT-2 (VETERINARY MYCOLOGY), UNIT-3 (MICROBIAL BIOTECHNOLOGY), UNIT-4 (VETERINARY IMMUNOLOGY AND SEROLOGY), UNIT-5 (GENERAL AND SYSTEMATIC VETERINARY VIROLOGY) Second Year

- List of PG Courses (MVSc) Veterinary Microbiology

Sr No	Course No .	Title	Credit	Semester
1	VMC 501	General Bacteriology*	2+1=3	I
2	VMC 502	Systematic Veterinary Bacteriology	2+1=3	II
3	VMC 503	General Virology*	2+1=3	I
4	VMC 504	Systematic Veterinary Virology	2+1=3	II
5	VMC 505	Principles of Veterinary Immunology*	2+1=3	II
6	VMC 506	Veterinary Mycology*	1+1=2	II
7	VMC 507	Vaccinology	2+0=2	III
8	VMC 508	Techniques in Microbiology	0+2=2	I
9	VMC 509	Techniques in Molecular Microbiology	1+2=3	I
10	VMC 510	Molecular Immunology	1+1=2	III
11	VMC 511	Mucosal Immunology	1+0=1	III

12	VMC 512	Introduction to Microbial Bioinformatics	1+0=1	III
13	VMC 591	Master's Seminar*	1+0=1	III
14	VMC 599	Master's Research	0+30=30	III-IV

Lecture Schedule – UG, PG , PhD - Theory / Practical Schedule – Approved by BoS –
Subject wise

Veterinary Microbiology UG

1 I Introduction and history of Microbiology, Highlights of developmental history of Veterinary Microbiology, Scope of Veterinary Microbiology

2 I Classification and nomenclature of bacteria, Unicellular organisms- Prokaryotes and Eukaryotes, Kingdom Prokaryote and its four division (Bergey's Manual of Systematic Bacteriology), Basis of classification and nomenclature of microorganisms

3 IV Historical development of immunology

4 I Microscopy and Micrometry: Lenses and the Bending of Light, The Light Microscope, Newer Techniques in Microscopy

5 I Bacterial stains and techniques: Preparation and Staining of Specimens, Dyes and Simple Staining, Differential Staining, Special staining, Structure and morphology of bacteria. Morphology: Shape, size, arrangement and morphological variations. Structure: Structure of bacterial cell, cell wall, cytoplasmic membrane, cytoplasm, ribosome, mesosomes, chromatin material, Capsule, flagella, fimbriae, endospore, plasmids, inclusions (volutin / metachromatic granules etc).

6 IV Lymphoid organs: Central and peripheral lymphoid organs, Cells involved in immunity: Lymphocytes: T and B lymphocytes, macrophages, neutrophils, NK Cells, Dendritic cells etc.

7 I Growth and nutritional requirement of aerobic and anaerobic bacteria. Growth requirements: Temperature, pH, gases (oxygen, carbon dioxide etc), moisture etc. Nutrition: Nutritional types (Autotrophs, heterotrophs, phototrophs, lithotrophs etc), Nutrient requirements (Macro and micronutrients)

8 I Normal, opportunistic and saprophytic bacterial flora: Types and sources of infection, method of transmission of infection, Transmission of infection- Modes of transmission, direct & indirect contact etc., Sources of infection-animal, human, insects, inanimate objects

9 IV Types of Immunity, Immunity: Definition, types of immunity- innate immunity, mechanisms of innate immunity (non-specific defense, Acquired immunity – active and

passive immunity, (Immune response: Humoral and cellular immune response; Primary and secondary immune response)

10 I Pathogenicity, virulence, determinants of virulence, Factors determining the ability of organism to produce disease, pathogenicity, virulence, invasiveness, toxigenicity, Resistance and susceptibility of host, Host factors- breed, species, individual factors- age, physiological & nutritional status, use of antibiotics or corticosteroids etc, Epizootic and enzootic diseases

11 I Bacteremia, septicaemia and toxemia, endotoxins, exotoxins, antitoxins, toxoids

12 IV Antigen: Definition, properties and types of antigen (T dependent and T independent Antigens, heterophile Antigens, cross reacting Antigens), specificity of antigens, blood group antigens, Antigenic determinant / epitope, Mitogens and factors affecting immunogenicity, Adjuvants

13 I Bacterial genetics (Mutation, Transformation, Transduction and Conjugation), plasmids and antibiotic resistance, Phenotypic and Genotypic variations, Chromosomal DNA, plasmids, F factor, Col factor, R Factor, Methods of transmission of genetic material in microorganisms: Transformation, Transduction, Conjugation etc

14 I Antibiotic resistance: Genetic mechanisms, mutational, plasmid-mediated

15 IV Antibody: Structure, properties and functions of different classes of immunoglobulins. Theories of antibody production; Hybridoma technique and monoclonal antibodies.

16 I *Staphylococcus aureus* (Short description of *Staphylococcus hyicus*, *Staphylococcus intermedius*, *Staphylococcus epidermidis*)

17 I *Streptococcus* (*Streptococcus pyogenes*, *Streptococcus equi*, *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Streptococcus uberis*)

18 IV Serological reactions: Antigen-antibody reactions: General features of antigen-antibody reactions, antibody affinity, avidity, specificity; forces binding antigen and antibody, Principle and applications of : Precipitation, agglutination reactions; complement fixation, neutralization

19 IV Serological reactions: Principle and applications of : cytolysis, toxin-antitoxin neutralization, immunofluorescence, enzyme immunoassays, phagocytosis, opsonic index

20 I Genus: *Corynebacterium* (*Corynebacterium pseudotuberculosis*, *Corynebacterium bovis* and *Rhodococcus equi*)

21 I Genus-*Trueperella* (*Trueperella pyogenes*, *Trueperella* spp.)

22 IV Major histocompatibility complex (MHC) structure, function and gene organization; Structure of BCR and TCR

23 IV Antigen processing and presentation

24 I *Listeria monocytogens*, *Listeria ivanovii* and *L. innocua*

25 I *Erysipelothrix rhusiopathiae*

26 IV Complement system: Activation pathways and biological consequences

27 I Genus: *Bacillus* (*Bacillus anthracis*, Short description of anthracis - *Bacillus subtilis* and *Bacillus cereus*)

28 I Genus: *Mycobacterium* (*Mycobacterium tuberculosis*, *Mycobacterium bovis*, *Mycobacterium avium*) 29 IV Cytokines: general properties, major types and function

30 I *Mycobacterium avium* subsp. *Paratuberculosis*

31 I Genus: *Clostridium* (Types of *Clostridia* - Histotoxic, Neurotoxic, Hepatotoxic, Enteropathogenic etc. *Clostridium chauvoei*, *Clostridium perfringens*)

32 IV Hypersensitivity: Definition, types of hypersensitivity- immediate and delayed hypersensitivity, mechanisms of different types of hypersensitivity reactions

INTERNAL ASSESSMENT I

33 I *Clostridium tetani*, *Clostridium botulinum*, Short description of other *Clostridia*

34 I Genus: *Actinomyces* (*Actinomyces bovis*, *Actinomyces viscosus*, *Actinomyces hordeovulneris*, *Actinobaculum suis*, *Actinobacterium pyogenes*) Genus: *Nocardia* (*Nocardia farcinica*, *Nocardia asteroides*) *Streptomyces* and *Dermatophilus congolensis*

35 IV Autoimmunity: Definition, mechanisms, classification of autoimmune disorders. Immunological tolerance.

36 I Enterobacteriaceae family (*E. coli*, *Klebsiella pneumoniae*, *Salmonella*, *Yersinia pestis*, *Proteus mirabilis*, *Proteus vulgaris*)

37 I *Pseudomonas aeruginosa* and *Burkholderia mallei*, *B. pseudomallei*

38 IV Concept of Immunity to Microbes, Vaccines and other biological. Biologicals: Vaccines – inactivated, live and modern vaccines their advantages and disadvantages, adjuvants, quality control of vaccines

39 I *Pasteurella multocida*, *Mannheimia hemolytica*

40 I *Actinobacillus lignieresii*

41 V Introduction and History : Highlights of developmental history of veterinary virology. General properties of virus, comparison of viruses & other microorganisms, definition of different terms.

42 I *Histophilus somni*, *Haemophilus parasuis*, *Avibacterium paragallinarum*, *Tylorella equigenitalis*

43 I *Brucella abortus*, *B. melitensis*, and other *brucella* spp. short description

44 V Structure of Viruses : Morphology & Structure of viruses - shape, size, symmetry, capsid, envelope, pepleomers etc. Chemical composition of viruses – nucleic acid, proteins, lipids, carbohydrates, Resistance of virus to physical and chemical agents.

45 I *Vibrio cholera*

46 I *Campylobacter fetus* sub spp. *fetus*, *Campylobacter fetus* sub spp. *veneralis*, *C. jejuni*

47 V Classification of viruses : Taxonomy and nomenclature of viruses, Criteria used in classification of viruses, Classification of viruses, Subviral agents, Prion's etc.

48 I *Bordetella bronchiseptica* and *Moraxella bovis*

49 I Gram negative anaerobes: *Bacteriodes fragilis*, *Dichelobacterianodosus* and *Fusobacterium necrophorum*

50 V Replication of viruses: Single step growth curve, essential steps involved in multiplication. Replication of DNA viruses. Replication of RNA viruses.

51 I *Leptospira borgpeterseni* serovar Hardjo , *L. inetrogans* serovar Hardjo, and other *Spirochaetes* (*Brachyspira*, *Borrelia anserina*)

52 I *Mycoplasma mycoides* sub spp. *mycoides*, *Mycoplasma bovis*, *Mycoplasma capricolum* sub spp. *capripneumoniae*, *M. gallisepticum*, and other *mycoplasma* spp. short description

53 V Genetic and Non-genetic viral interaction : Mutation, recombination, genetic reassortment and reactivation. Transcapitation, complementation, phenotypic mixing and polyploidy.

54 I *Coxiella burnetti*, *Neorickettsia*, *Ehrlichia ruminantium*,

55 I *Anaplasma*, *Rickettsia*

56 V Virus – cell interactions & Viral Pathogenesis : Types of interactions, Cytocidal changes in virus infected cells, mechanisms of cell damage. Noncytotoxic changes in virus infected cells, Inclusion bodies. Route of entry and its impact, Host specificity, tissue tropism, Spread, Mechanism of targeting specific tissues and organs, mechanism of virus shedding.

57 I *Chlamydia trachomatis*, *C. suis* and *Chlamydia psittaci*, *C. abortus* *C. pecorum*

58 I Emerging bacterial pathogens

59 V Oncogenesis: Cell transformation, Oncogenes and oncoproteins, Mechanism of activation of Cellular oncogenes by virus infection.

60 I Re-emerging bacterial pathogens

61 I Transboundary bacterial pathogens

62 V Latency and Immunopathology: Viral persistence, viral strategies to evade host defense mechanisms, persistent infection and chronic damage to tissues and organs, Immunopathology of viral infections, infection induced damage to immune system, autoimmune disease, hypersensitivity.

63 II Introduction, History, Scope of Mycology and Classification of Mycoses

64 V Birnaviridae: Infectious bursal diseases

INTERNAL ASSESSMENT II

65 II General properties of fungi, Growth, Nutrition and Reproduction of fungi

66 V Reoviridae: Rotaviruses, Bluetongue virus, African horse sickness virus

67 II Study in relation to cultural isolation, growth, morphological, biochemical and antigenic characteristics as well as epidemiology, pathogenesis, diagnosis and control of fungal diseases caused by the genera:

68 V Paramyxoviridae: New castle disease virus

69 V Paramyxoviridae: Canine distemper, PPR virus

70 II Candida and Cryptococcus

71 V Rhabdoviridae: Rabies virus, Ephemeral fever virus

72 II Aspergillus and Penicillium

73 V Bornaviridae: Borna virus

74 II Dermatophytes and Malassezia

75 V Orthomyxoviridae: Swine, Equine, Avian influenza viruses

76 II Rhinosporidium and Sporotrichum

77 V Coronaviridae: Infectious Bronchitis virus, Transmissible gastroenteritis virus

78 II Mycetoma and Zygomycetes

79 V Arteriviridae: Equine viral arthritis virus

80 II Mycotic mastitis, Mycotic abortion and Mycotoxicoses

81 III Basic concepts and scope of Recombinant DNA technology

82 V Picornaviridae: FMD virus, Duck viral hepatitis virus

83 V Caliciviridae: Feline calicivirus

84 III Gene cloning, Cloning vectors and expression vectors

85 V Togaviridae: Equine encephalomyelitis viruses (WEE, EEE and VEE)

86 V Flaviridae: Swine fever virus, BVD virus

87 III Transformation and transfection

88 V Retroviridae: Visna/maedi virus, Equine infectious anemia virus

89 V Retroviridae: Lymphoid leucosis virus, Bovine leukemia virus

90 III Southern, Northern and Western blotting

91 V Poxviridae: Capripoxvirus, Avipoxvirus, Cowpoxvirus

92 V Asfarviridae: African swine fever virus

93 III Bioinformatics, Gene banks

94 V Herpesviridae: Bovine herpes viruses, Equine herpes viruses, Pseudorabies virus

95 V Herpesviridae: Infectious laryngotracheitis virus, Marek's disease virus

96 V Herpesviridae: Malignant catarrhal fever virus, Duck plague virus

97 III Application of molecular and biotechnological techniques: Polymerase chain reaction, Nucleic acid hybridization

INTERNAL ASSESSMENT III

98 V Adenoviridae: Infectious canine hepatitis virus, Egg drop syndrome virus, Fowl adenovirus

99 V Papillomaviridae: Papillomatosis

100 III DNA library

101 III DNA sequencing

102 V Parvoviridae: Canine parvoviruses, Feline panleucopenia virus

103 III DNA fingerprinting

104 V Circoviridae: Chicken anemia virus

105 III IPR

106 V Prions: Scrapie, Bovine spongiform encephalopathy

107 III Ethics and regulatory issues in Animal Biotechnology

108 V Emerging, re-emerging & transboundary viruses & viral infection: Equine morbillivirus, Porcine reproductive and respiratory syndrome virus, Nipah, Hanta virus, Ebola and Marburg viruses