MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M. Sc. Zoology

(Choice Based Credit System)

(with effect from the academic year 2024-2025 onwards)

Semester-III				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE VII	GENETICS AND EVOLUTION		5
III	CORE VIII	ANIMAL PHYSIOLOGY		5
III	CORE IX	LAB IN GENETICS & EVOLUTION AND ANIMAL PHYSIOLOGY		5
III	CORE X	MEDICAL LAB TECHNOLOGY		4
III	ELECTIVE V	APPLIED MICROBIOLOGY		3
III	SEC - 2	DAIRY FARMING		2
III	INTERNSHIP	INTERNSHIP /INDUSTRIAL ACTIVITY/FIELD VISIT/ RESEARCH– KNOWLEDGE UPDATING ACTIVITY		2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

GENETICS AND EVOLUTION

Course Objectives:

The main objectives of this course are:

- To understand the principles of inheritance, genetic disorders and gene frequency.
- To acquire knowledge in evolutionary mechanisms and origin of higher categories.

Unit I

Mendelian Principles

Monohybrid cross and law of segregation, modification of 3:1 phenotypic ratio - Codominance, incomplete dominance. Lethality and interaction of genes – Lethality, interactions involving 2 gene pairs, epistatic interactions, interaction involving more than 2 gene pairs, pleiotropy, complementary, supplementary, penetrance and expressivity. Linkage and crossing over-types – mechanism - theories, Genetic and Cytologic Mapping of Chromosomes,Linkage Maps, mapping with molecular markers and mapping using somatic cell hybrids. Polygenic inheritance, heritability and its measurements.

Unit II

Human Genetics: The Chromosomes: Structure, composition and organization, special type of chromosomes, B Chromosomes, karyotypes, Barr bodies. Chromosomal aberrations- Numerical aberrations - Euploidy & Aneuploidy. Structural aberrations, Inversion, Translocation, Deletion, Duplication. Chromosomal Anomalies: Down syndrome, Turner syndrome, Edward Syndrome, Klinefelter Syndrome. Pedigree analysis.Human genome project, Prenatal diagnostics – Amniocentesis, Chorionic Villus sampling. Genetic Counselling- Concepts of Eugenics & Euthenics. Sex linked, sex limited and sex influenced characters.

Unit III

Theories of organic Evolution - Lamarckism and Darwinism – Mutation Theory, Modern Synthesis. Sources of variation in a population – Population, Gene Pool and Gene Frequency, Variations – sources of variations – Mutations, Transposons, Recombinations, Natural Selection and other Evolutionary forces. Natural Selection, Hardy-Weinberg equilibrium, kinds of natural selection – Stabilizing, Diversifying, Directional Selection, Migration, random Genetic Drift.

Unit IV

Molecular evolution: origin of life, principles of molecular evolution studies Molecular divergence - Molecular tools in phylogeny, molecular clock. Phylogenetic

trees, Multiple sequence alignment, construction of phylogenetic trees, classification identification and interpretation of trees. Phylogenetic and biological concept of species. – Speciation-Adaptive radiation - Isolating mechanisms – Allopatricity and Sympatricity - Convergent evolution - Sexual selection - Altruism and evolution.

Unit V

Origin Of Higher Categories

Micro evolution, macro evolution, mega evolution and co evolution. Evolution rates, phyletic gradualism and punctuated equilibrium. Geological time scale; Evolution of man-Origin and evolution of man, Unique hominine characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, molecular analysis of human origin.

Reading list

1. Gardner, E. J., M. J. Simmons and D.P. Snustad. 2006. Principles of Genetics. 8th Edition, John Wiley & Sons. INC. New York, pp-740.
2. Brooker, R. J. 2014. Genetics: Analysis and Principles. 5th Edition, McGraw Hill Publsiher, pp-880.
3. Russell, P.J. 2005. Genetics: A Molecular Approach (2nd Edition). Pearson/Benjamin Cummings, San Francisco, pp-850.
4. https://onlinecourses.swayam2.ac.in/cec21_bt02/preview
5. https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-rna-and-proteinsynthesis/a/the-genetic-code
6. Bergstrom, C. T. and L. A. Dugatkin. 2012. Evolution, Second MEDIA Edition. W.W. Norton & Company, International Student Edition, pp-756.
7. Jobling, M., E. Hollox, M. Hurles, T. Kivisild and C. T. Tyler Smith. 2014. Human Evolutionary Genetics. Second Edition. Garland Sciences, London, pp-650.
8. Veer Bala Rostogi, 2018. Organic Evolution (Evolutionary Biology), Thirteenth Edition Vinoth Kumar Jain, Scientific International (Pvt.) Ltd, New Delhi, pp-590.
9. https://www.flipkart.com/books/evolution~contributor/pr?sid=bks
10. http://www.evolution-textbook.org/
11. https://onlinelibrary.wiley.com/journal/15585646
12. http://darwin-online.org.uk/

Recommended texts

1. Griffiths, A. J. F., H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart. 2012. An Introduction to Genetic Analysis. 11th Edition, W. H. Greeman. New York.

2. Snustad, D.P., Simmons, M.J. 2015. Principles of Genetics, John Wiley Publications, pp-784.
3. Klug, W. S. and M. R. Cummings, C. A. Spencer. 2005. Concepts of Genetics, Benjamin - Cummings Publishing Company.
4. Harti, D. L. 2002. Essential Genetics, A Genomic Perspective, Jones & Bartlet.
5. Krebs, J. E., E.S. Goldstein, S.T. Kilpatrick. 2018. Lewin's Genes XII, Jones & Bartlet Publisher, pp-613.
6. Verma, P.S., Agarwal, V.K. 2010. Genetics (9th ed.), S.Chand Publishing, New Delhi.
7. Watson, J. D., T. A. Baker S. P. Bell, A. Cann, M. Levine and R. Losick, 2014. Molecular Biology of Gene 7th Edition, Pearson Education RH Ltd. India.
8. Strickberger. M. W. 2000. Evolution. Third Edition, Jones Bartlett Publishers, pp-722.
9. Hall B. K. and B. Hallgrimsson. 2014. Strickberger's Evolution. Fifth Edition, Bartlett Learning, An Ascend Learning Company, pp-642.
10. Sanjib Chattopadhyay. 2008. Evolution, Adaption and Ethology. Books and Allied Pvt. Ltd., Kolkata.

ANIMAL PHYSIOLOGY

Course Objectives:

The main objectives of this course are:

- Students acquire the basic knowledge on physiology of different organs in animals and human.
- Understand the functions of different systems such as digestion, excretion, blood circulatory system, respiration and nervous system of animal relating them to structure and functions of various organs.

Unit I

Digestive system: - Human Digestive Tract & Functions – Digestion – Role of Enzymes in Digestion of Carbohydrates, Protein, Lipids, Absorption – Gastrointestinal Hormone, Intestinal villi. Balanced Diet, Mal Nutrition and BMR. Digestion, absorption, energy balance, BMR.

Unit II

Blood and circulation: Blood corpuscles, hemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, coagglutination, haemostasis. Cardiovascular system: Anatomy of human heart, myogenic heart, Arteries and Veins, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of heart.

Unit III

Respiratory system: Structure & Function of human lung and the respiratory tract. Respiratory Pigments, transport of gases, exchange of gases, neural and chemical regulation of respiration. Excretory system: Structure of the kidney – Nephron Renal Circulation - Urine formation, Renal disorders – Micturition and Dialysis. Regulation of water and electrolytes Balance, Acid Base Balance.

Unit IV

Nervous system: Neurons, action potential, gross neuro-anatomy of the brain and spinal cord, central and peripheral nervous system, Muscles – classification, Ultra Structure of skeletal muscles. Mechanism of Muscular contraction. Neural control of muscle tone and function. Sense organs: Vision, hearing and tactile response.

Unit V

Endocrinology and reproduction: Structure & Function of Endocrine glands, Basic mechanism of hormone action, Hormones & diseases, Neuro Endocrine regulation of reproduction. Thermoregulation: Comfort zone, body temperature- physical, chemical, neural regulation, acclimatization: Stress and adaptation.

Reading list

1. Prosser C. L. 1991, Comparative Animal Physiology. Part A: Environmental and Metabolic Animal Physiology. Wiley-Liss Publishers, pp-592
2. Hoar, S.W. 1983, General and Comparative Physiology,Prentice Hall Publication, pp 928.
3. Randall, D., W. Burggren, K. Frenchand R. Eckert.2001, Animal Physiology Mechanisms and Adaptations, New York: W.H. Freeman and Co., pp-
4. Nelson K. S. 1997. Animal Physiology: Adaptation and Environment, Cambridge University Press, pp- 617.
5. https://swayam.gov.in/nd1_noc20_bt42/preview
6. https://www.classcentral.com/course/swayam-animal-physiology-12894
7. https://swayam.gov.in/nd1_noc20_hs33/preview
8. General and Comparative Physiology – William S. Hoar.

Recommended texts

1. Shepherd, G. M. 1994.Neurobiology, OUP USA Publisher, pp-774.
2. Hainsworth, F.R. 1981. Animal Physiology: Adaptation in function, Addison Wesley Longman Publishers, pp-669.
3. Gorden, M.S. et al., 1977. Animal Physiology: Principles and Adaptation, New York, Third Edition.
4. Ahearn, G.A. et al., 1988. Advances in Comparative and Environmental

Physiology –2, Springer Publishers, pp-252.
5. Hill, R.W. 1976. Comparative Physiology of Animals: Environmental Approach, Longman Higher Education Publisher, pp-656.
6. Textbook of Animal Physiology – R.Nagabhushanam, M.S Kodarkar and R.Sarojini.
7. Gayton, A.C. and Hall, J.E., A Textbook of Medical Physiology, 9thEdn., Harcourt Brace and Company Asia Pvt. Ltd., W.B. Saunders Company.

Lab course in Genetics, Evolution and Animal Physiology

Course Objectives:

The main objectives of this course are:

- To acquire practical knowledge in the principles of Genetics and Evolution and analyse the physiological processes to translate the theoretical understanding

GENETICS

1. Probability and Chi – square testing for Mendel's Laws using color beads
    a) Law of segregation
    b) Law of independent assortment
2. Demonstration of random genetic drift using beads
3. Observation of various genetic traits in human
4. Culture of Drosophila – Demonstration
5. Preparation of buccal smear to show Barr bodies in squamous epithelial cells.

Charts/Slides/Models

1. Down’s syndrome, Klinefelter’s syndrome
2. Turner’s syndrome, Edward syndrome
3. Drosophila mutants – White eye and vestigial wings
4. Human Pedigree Chart
5. Lac operon
6. Sex-linked inheritance: X – Linked inheritance, Y- linked inheritance
7. Lytic and lysogenic cycles
8. Blood groups and Rh factor.

EVOLUTION

1. Study of natural selection in Mendelian population using beads. Calculate Gene frequency and genotype frequency
2. Study on Evolutionary significances of any five fossils.
3. Study of analogy (wings of animals) and homology (Forelimbs and hindlimbs of vertebrates).
4. Estimation of gene and genotype frequencies in the light of Hardy-Weinberg Law based on facial traits.
5. Adaptive radiation – beaks of various birds

6. Prove Hardy Weinberg law using Single and Double-coin tossing method.

Charts / Models / Slides

1. Geographical isolation
2. Phylogram, Mimicry and colouration of animals
3. Connecting Links – Archaeopteryx, Limulus, Peripatus

ANIMAL PHYSIOLOGY

1. Detection of haemin crystals in blood
2. Rate of salt loss and salt gain in fish
3. Effect of temperature on opercular activity of fish
4. Qualitative analysis of excretory product in ammonotelic, ureotelic, and uricotelic animals.
5. Determination of the salivary amylase activity in relation to temperature.
6. Preparation of human blood smear
7. Separation of uric acid crystals from excreta of reptiles / birds.

Charts/Slides/Models/Instrument

1. EEG, ECG, Cardiac muscle, Kymograph, Sphygmomanometer, Pituitary, thyroid, testis and ovary, adrenal, kidney, microvilli

MEDICAL LABORATORY TECHNIQUES

Course Objectives:

The main objectives of this course are:

- Students should understand the different protocols and procedures to collect clinical samples and to learn lab technologies.

Unit I

Scope of medical laboratory technology. Laboratory principles-organisation of clinical Role of medical laboratory technician. Laboratory safety - toxic chemicals and biohazards waste- biosafety level- good laboratory practice -safety measures-cleaning and sterilisation methods, hospital and clinic borne infection and personnel hygiene and health issue.

Unit II

Composition of blood and their function- haemopoiesis- types of anaemia- mechanism of blood coagulation- bleeding time- clotting time- determination of hemoglobin- erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing- haemostasis- bleeding disorder of man – Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count. Blood banking technology, collection and storage.

Unit III

Definition and scope of microbiology- parasites - Entamoeba- Plasmodium- Leishmania and Trypanosome.Computer tomography (CT scan) - Magnetic Resonance imaging - flowcytometry - treadmill test - PET. physiology effect of alcohol, tobacco, smoking & junk food & its treatment - biomedical waste management.

Unit IV

Cardiovascular system- Blood pressure - Pulse - regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) - significance - ultra sonography- Electroencephalography (EEG). Techniques of sample processing; Throat swab, sputum, blood, urine, stool, pus, CSF, other body fluids.

Unit V

Handling and labelling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtome- sectioning, staining - staining methods - vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.

Reading list

1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.
2. Guyton and Hall, 2000. Text Book of medical Physiology, 10th edition, Elseiner, New Delhi.
3. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I,II,III. Tata MC GrawHill, New Delhi.
4. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.

Recommended texts

1. Manoharan,A, and Sethuraman, 2003. Essential of Clinical Heamatology, Jeypee brothers, New Delhi.
2. Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia.Published by Tata McGraw-Hill Education Pvt. Ltd.,
3. Ochei. J., A. Kolhatkar (2000). Medical Laboratory science: Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.

APPLIED MICROBIOLOGY

Course Objectives:

The main objectives of this course are:

- Enable the students to understand the classification and physiology of microbes
- Provide advanced knowledge, understanding and application of various fields of microbiology

Unit I

History and scope of Microbiology - Theory of spontaneous generation – Germ theory of diseases - Koch's postulates - Microbial interactions - Whittaker's five kingdom approach – Carl Woese's three domains concept - Microbes and their types, Viruses, Bacteria, fungi and protozoans – Morphology and classification. Abnormal forms of bacteria, archaebacteria, Mycoplasma and PPLO, Recent trends in microbial taxonomy.

Unit II

Microbial Physiology: Nutritional Requirements and nutritional types of Microbes- - Nutrient transport mechanisms- Passive diffusion, Facilitated diffusion, Active transport, Group translocation and Specific transport system; Types of culture media- Selective, enrichment and differential media. Microbiological techniques: Microbiological Media- Types and composition of media -Sterilization techniques - Methods of pure culture technique- Staining methods – Simple, Differential and Special staining.

Unit III

Food Microbiology

Normal microbial flora of common food – food infection – food poisoning – food preservation – microbiology of milk and milk products – Bakery products – Detection of food borne pathogens – food sanitation – food control agencies – food spoilage – ISI and BIS regulations for packaged drinking water.

Unit IV

Industrial Applications of Microbial Enzymes – Bioreactors and Types –Biopolymers – Biosurfactants –Biofertilizers, Bioleaching of metals-Biodegradation using microbial communities-Xenobiotics and Heavy metals degradation in water and soil – Sewage sludge treatment and utilization; Bioconversion of cellulosic wastes into protein and fuel.

Unit V

Microbial diseases - Causative agents, Mode of transmission, Symptoms, Prevention

& Control - Protozoan diseases: Plasmodium, Entamoeba. Fungal diseases: Mycosis - Mycotoxicosis. Bacterial diseases: Tuberculosis (TB) –Typhoid - Viral diseases: Chicken pox, Hepatitis B, AIDS, Corona and Dengue.

Reading list

1. Dubey RC and Maheswari DK (2012). A Text of Microbiology (Revised edition). S. Chand and Company Ltd., New Delhi.
2. PelczarTR M J Chan ECS and Kreig N R (2006). Microbiology. Fifth edition, Tata McGraw-Hill INC. New York.
3. GeetaSumbali and Mehrotra RS (2009). Principles of Microbiology. First edition, Tata McGraw Hill P. Ltd., New Delhi.

Recommended texts

1. Prescott L M, J P Harley and DA Klein (2005). Microbiology. Sixth edition, international edition, McGraw Hill.
2. Stanier R, Ingraham J, Wheelis M and Painter P (2014) General Microbiology. 5th Edition, Macmillan Press.
3. Kathleen Park Talaro and Barry Chess Foundations in Microbiology10th Edition. 2018. Mc Graw Hill Education Publishers, USA.
4. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Microbiology: An Introduction, 12th Edition (2017) Pearson publishers, USA

DAIRY FARMING

Course Objectives:

- To create awareness on economic importance of Dairy farming.

Unit I

Introduction to Dairy Farming- Advantages of dairying- Classification of breeds of cattle- Indigenous and exotic breeds- Selection of dairy cattle. Breeding-artificial insemination- Dairy cattle management-General Anatomy.

Unit II

Construction of Model Dairy House - Types of Housing - Different Managemental Parameters - Winter Management - Summer Management – Cleaning & Sanitation

Unit III

Feedstuffs available for livestock- Roughages -Concentrates - Energy rich concentrates - Protein rich concentrates - Mineral Supplements - Vitamin Supplements - Feed additives - Feeding management - Calves Feeding - Feeding of adults - Feeding of pregnant dairy animals - Feeding pregnant heifer.

Unit IV

Milk-Composition of milk-milk spoilage-pasteurization - Role of milk and milk products in human nutrition – Dairying as a source of additional income and employment.

Unit V

Contagious disease - Common Bacterial - Protozoal - Helminth and Viral Diseases - Parasitic Infestation –Deworming, Dehorning, Vaccination - Biosecurity.

Reading list

1. The Veterinary Books for Dairy Farmers by Roger W. Blowey.
2. Hand Book of Dairy Farming by Board Eiri.
3. Handbook of animal husbandry TATA, S.N ed., ICAR 1990
4. Prabakaran, R. 1998. Commercial Chicken production. Published by P. Saranya, Chennai.
5. Hafez, E. S. E., 1962. Reproduction in Farm Animals, Lea &Fabiger Publisher.

Recommended texts

1. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20Dairy%20unit.html
2. https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Tata,+S.N.,+ed%22
3. 15.James. N. Marner, 1975. Principles of dairy processing, wiley eastern limited, New Delhi.
4. Baradach, JE. Ryther. JH. and, MC larney WO., 1972. Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley InterScience, NewYork.