

MASTER OF SCIENCE (ZOOLOGY) – THIRD SEMESTER

Third Semester			
S. No.	Name of Subject	Credits	Total Marks
1	Principles of Ecology	4	100
2	Computational Biology, Biostatistics and Bioinformatics	4	100
3	Biology of parasitism	4	100
4	Animal Behavior	4	100
5	Practical	6	100
Total		22	

Subject Name: PRINCIPLES OF ECOLOGY

Introduction to ecology, evolutionary ecology, environmental concepts – laws and limiting factors, ecological models. Characteristics of population, population size and exponential growth, limits of population growth, population dynamics, life history pattern, fertility rate and age structure. Competition and coexistence, intra-specific and inter-specific interactions, scramble and contest competition model, mutualism and commensalism, prey-predator interactions.

Nature of ecosystem, production, food webs, energy flow through ecosystem, biogeochemical cycles, resilience of ecosystem, ecosystem management. The biosphere, biomes and impact of climate on biomes.

Environmental Stresses and their management, global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition, coping with climatic variations. Major classes of contaminants. Uptake, biotransformation, detoxification, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and their disposal. Impact of chemicals on biodiversity of microbes, animals and plants. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.

Biodiversity – assessment, conservation and management, biodiversity act and related international conventions. Sustainable development, natural resource management in changing environment. Molecular ecology, genetic analysis of single and multiple population, phylogeography, molecular approach to behavioural ecology, conservation genetics.

Suggested Literature:

1. Field Sampling: Principles and Practices in Environmental Analysis, Conklin, A.R. Jr., (2004), CRC Press.
2. Principles and Standards for Measuring Primary Production, Fahey, T.J. and Knapp, A.K., (2007), Oxford University Press, UK
3. Ecological Modeling, Grant, W.E. and Swannack, T.M., (2008), Blackwell.
4. Fundamental Processes in Ecology: An Earth system Approach, Wilkinson, D.M., (2007), Oxford University Press, UK.

Subject Name: COMPUTATIONAL BIOLOGY, BIOSTATISTICS AND BIOINFORMATICS

Basic components of computers– hardware (CPU, input, output, storage devices), Software (operating systems), Application software; Introduction to MSEXCEL- use of worksheet to enter data, edit data, copy data, move data; Use of in- built statistical functions for computations of mean, S. D., correlation, regression coefficients etc., Use of bar diagram, histogram, scatter plots, etc., Graphical tools in EXCEL for presentation of data; Introduction to MS- WORD word processor- editing, copying, moving, formatting, table insertion, drawing flow charts etc; Introduction to Power Point, image and data handling.

Biostatistics- population, sample, variable, parameter, primary and secondary data, screening and representation of data, frequency distribution, tabulation, bar diagram, histograms, pie diagram, mean, median, mode, quartiles and percentiles, variance, standard deviation, coefficient of variation; Probability and distributions- definition of probability (frequency approach), independent events. Addition and multiplication rules, conditional probability, examples- bernoulli, binomial, poisson and normal distributions; bivariate data- scatter plot, correlation coefficient (r), properties (without proof), interpretation of r, linear regression: Fitting of lines of regression, regression coefficient, coefficient of determination; hypothesis, critical region, and error probabilities, tests for proportion, equality of proportions, equality of means of normal populations when variances known and when variances are unknown: chi-square test for independence, P- value of the statistic, confidence limits, introduction to one way and two- way analysis of variance.

The era of computerized biology information, review of relevant definitions in molecular biology, overview of challenges of molecular biology computing, proteins, secondary structure and folding, RNA secondary structures, introduction to phylogenetic analysis; introduction to bioinformatics; introduction to genomics and proteomics databases- nucleic acid sequence database: Genbank, UCSC, ENSEMBL, EMBL, DDBJ, protein sequence databases: Swiss- prot, PDB, BLAST, PSI- BLAST (steps involved in use and interpretation of results) and HMMER, BLAST vs FASTA, file formats- FASTA, GCG and ClustalW.

Databank search- data mining, data management and interpretation, multiple sequence alignment, genes, primer designing; Protein modeling, protein structure analysis, docking, ligplot interactions, phylogenetic analysis with the program PHYLIP, DISTANCES, GROWTREE etc.; introduction to computational genomics and proteomics- basics of designing a microarray, image analysis and normalization, annotations, protein prediction tools- protein secondary structure, molecular modeling, identification and characterization of protein mass fingerprint, world- wide biological databases, Introduction to programming languages such as “C”.

Suggested Literature:

1. Principles of Biostatistics, Pagano M., Gauvreau, K, (2000), Duxbury Press, USA
2. Bioinformatics for Dummies, Claverie J. M., Notredame C., (2nd Ed., 2007), Wiley Publishing, Inc., New York, USA
3. Bioinformatics: Sequence and Genome Analysis, Mount, D. W. (2nd Ed., 2001), Cold Spring Harbor Laboratory Press, New York, USA

Subject Name: BIOLOGY OF PARASITISM

UNIT 1

Introduction to parasitology; animal associations and host – parasite relationship; distribution of diseases and Zoonosis caused by animal parasites; morphology, life-cycle, mode of infection of Plasmodium, molecular biology of Plasmodium – drug targets, mechanism of drug resistance, vaccine strategies and proteomic approaches.

UNIT 2

Morphology, life-cycle, mode of infection of Leishmania, molecular biology of Leishmania – drug targets, drug resistance and vaccine strategies. Morphology, biology, life-cycle, mode of infection of Entamoeba, morphology, biology, life-cycles, mode of infection of Giardia.

UNIT 3

Gastro-intestinal nematodes, morphology, biology, life-cycles, modes of entry of Schistosoma, Wuchereria, Brugia, Ancylostoma, Trichinella and Dracanculus; molecular biology of nematodes, vaccine strategies.

UNIT 4

Immune response and self-defense mechanisms, immune evasion and biochemical adaptations of parasites; parasites of veterinary importance. Parasites of insects and their significance.

UNIT 5

Nematode parasites of plants, morphology, biology, lifecycle and infection of crop plants by plant parasitic nematodes, plant parasitic nematodes, host parasite interactions.

Suggested Literature:

1. Foundations of Parasitology, Roberts L.S. and Janovy J., McGraw-Hill Publishers, New York, USA.
2. Modern Parasitology: A Textbook of Parasitology, FEG Cox., Wiley-Blackwell, U. K.

Subject Name: ANIMAL BEHAVIOR

UNIT 1

Introduction - definition, historical out line, patterns of behaviour, objectives of behaviour, mechanism of behaviour, asking questions. Reflexes- reflex action, types of reflexes, reflex arch, characteristics of reflexes and complex behaviour.

UNIT 2

Orientation primary and secondary orientation; kinesis – orthokinesis, klinokinesis; taxis – different kinds of taxis; sun-compass orientation, dorsal- light reaction.

UNIT 3

Eusociality, social organization in honey bee, polyphenism and its neural control, flower recognition, displacement and translocation experiment, various type of communications, production of new queen and hive, swarming, honey bee as super organism.

UNIT 4

Fixed action pattern: mechanism, deprivation experiment, controversies. FAP- characteristics and evolutionary features. Learning and instincts: conditioning, habituation, sensitization, reasoning. Innate releasing mechanisms: key stimuli, stimulus filtering, and supernormal stimuli, open and closed IRM, mimetic releaser, code breakers.

UNIT 5

Homeostasis and behaviour: motivational system, physiological basis of motivation, control of hunger drive in blow fly and thirst drive in goat, role of hormone, motivational conflict and decision making, displacement activity, models of motivation, measuring motivation. Hormones and pheromones influencing behaviour of animals.

UNIT 6

Altruism – reciprocal altruism, group selection, kin selection and inclusive fitness, cooperation, alarm call. Parental care, parental manipulation, evolutionarily stable strategy, cost benefit analysis of parental care with suitable case studies. Sexual selection: intra sexual selection (male rivalry), inter-sexual selection (female choice), infanticide, sperm competition, mate guarding, sexual selection in human, consequences of mate choice for female fitness, monogamous verses polygamous sexual conflict.

Suggested Literature:

1. Mechanism of Animal Behaviour, Peter Marler and J. Hamilton; John Wiley & Sons, USA.
2. Animal Behaviour, David McFarland, Pitman Publishing Limited, London, UK.
3. Animal Behaviour, John Alcock, Sinauer Associate Inc., USA.
4. Perspective on Animal Behaviour, Goodenough, McGuire and Wallace, John Wiley & Sons, USA
5. Exploring Animal Behaviour, Paul W. Sherman & John Alcock, Sinauer Associate Inc., Massachusetts, USA.
6. An Introduction to Animal Behaviour, A. Manning and M.S Dawkins, Cambridge University Press, UK .

Practical Syllabus:

1. Physical and chemical characteristics of soil.
2. Assessment of density, frequency and abundance of plants and animals in a community using various techniques i.e. transect, quadrat.
3. Study of various environmental stress caused by population explosion.

4. Effects of pesticides and other chemicals in soil.
5. To study the geotaxis behaviour of earthworm.
6. To study the orientational responses of 1st instar noctuid larvae to photo stimuli.
7. To study the orientational responses of larvae to volatile and visual stimuli.
8. Use of excel sheet for data processing.
9. Use of search engines like Scopus, Science direct for reference material collection and management
10. Phylogenetic tree construction using MEGA software
11. Collection of data, designing questionnaire, preparing frequency table, graphic presentation, averaging and correlation analysis.
12. Study of prepared slides and museum specimens of selected parasites of representative groups of protozoans, helminths and arthropods.
13. Demonstration of in vitro culture of Plasmodium
14. Studying the infection of tomato plant by root knot nematode.