VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE WITH ZOOLOGY

(MULTIDISCIPLINARY STUDIES)

3-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE IN LIFE SCIENCES with ZOOLOGY
(*Under CCFUP, 2023*)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. in Life Sc. / with Zoology	3rd	V	**SEMESTER-V**							
			Major-A4	ZOOPMJ04	T: Animal Physiology & Biochemistry; P: Practical *(To be studied by students taken* Zoology *as Discipline- A)*	4	3-0-1	15	60	75
			Major-A5	ZOOPMJ05	T: Genetics & Evolutionary Biology; P: Practical *(To be studied by students taken* Zoology *as Discipline- A)*	4	3-0-1	15	60	75
			Major-A6	ZOOPMJ06	T: Ecology & Behaviour of Animals; P: Practical *(To be studied by students taken* Zoology*. as Discipline- A)*	4	3-0-1	15	60	75
			Major (Elective) -1	ZOOMJE-02	Fish & Fisheries OR Biotechnology *(To be studied by students taken* Zoology *as Discipline- A)*	4	3-1-0/ 3-0-1	15	60	75
			Minor-5 (Disc.-C5)	ZOOMIN05	T: Animal Physiology & Biochemistry*; P:* Practical *(To be studied by students taken* Zoology *as Discipline- C)*	4	3-0-1	15	60	75
					Semester-V Total	20				375
		VI	**SEMESTER-VI**							
			Major-B4		*To be decided (Same as MajorA4 fo* Zoology Zoology*. taken as Discipline-B)*	4	3-0-1	15	60	75
			Major-B4		*To be decided (Same as Major–A5 for* Zoology *taken as Discipline-B)*	4	3-0-1	15	60	75
			Major-B4		*To be decided (Same as Major–A6 for* Zoology *taken as Discipline-B)*	4	3-0-1	15	60	75
			Major (Elective) -2	ZOOMJE-02	Reproductive Biology/Wildlife Conservation & Management *(To be studied by students taken* Zoology *as Discipline- A)*	4	3-1-0/ 3-0-1	15	60	75
			Minor -6 (Disc.-C6)	ZOOMIN06	T: Ecology, Ethology & Wildlife Biology; P: Practical *(To be studied by students taken* Zoology *as Discipline- C)*	4	3-0-1	15	60	75
					Semester-VI Total	20				375
					TOTAL of YEAR-3	40	-	-	-	700
			Eligible to be awarded Bachelor of Science in Multidisciplinary Studies with Zoology *on Exit*			126	**Marks (Year: I+II+III)**			2325

MJP = Major Programme (Multidisciplinary), MI = Minor, A/B = Choice of Major Discipline; C= Choice of Minor Discipline; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

MAJOR (MJ)

Paper-MJ A4/B4: Animal Physiology & Biochemistry **Credits 04 (FM: 75)**

About the Course

This course is designed at graduation level to know the process of digestion, physiology of respiration and circulation, renal physiology as well as basic principles of biochemistry and kinetics of enzyme catalyzed reactions. The students will get knowledge about structure and function of carbohydrates, proteins, and lipids and their metabolism. Students will also know the process of nerve impulse propagation along the nerve fibre and synaptic transmission.

Course Outcomes

The student at the completion of the course will be able to:

1. Learn the physiology of digestion, respiration, circulation, excretion, osmoregulation and thermoregulation.
2. Understand the physiology of muscles and its contraction mechanism.
3. Understand the process of nerve impulse propagation and osmoregulation.
4. Interpret structure-functional relationships of carbohydrates, proteins and lipids.
5. Describe the mechanism of enzyme action, enzyme kinetics and inhibition of enzymes.
6. Understand the metabolism of carbohydrates, proteins and lipids through various anabolic and catabolic pathways and their regulation.

MJ-A4T/B4T: Animal Physiology & Biochemistry Theory **Credits 03**

Course Contents	Hours
Unit-1 Digestion Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids; Source and Functions of digestive enzymes.	4hrs
Unit-2 Respiration Transport of Oxygen and carbon dioxide in blood; Structure & function of haemoglobin.	4hrs
Unit-3 Circulation Composition of blood; Structure of Heart; Cardiac cycle and cardiac output; Blood clotting system.	4hrs
Unit-4 Excretion & Osmoregulation Structure & function of Kidney and nephron; Mechanism of urine formation; Osmoregulation in vertebrates.	4hrs
Unit-5 Nerve and muscle Structure of a neuron; Origin and propagation of action potential across the nerve fibres; Synaptic transmission; muscle contraction.	4hrs
Unit-6 Reproduction and Endocrine Glands Hormonal control of spermatogenesis and oogenesis; Estrus cycle and menstrual cycle; Structure and function of pituitary, thyroid, pancreas and adrenal glands.	6hrs

Unit 7 Carbohydrate: Structure and Metabolism Types and structures of Carbohydrates; Glycolysis, Krebs cycle and Gluconeogenesis.	5hrs
Unit-8 Lipid: Structure and Metabolism Classification of Lipid; Structure of saturated and unsaturated fatty acids, Phospholipids, Glycolipids, Steroids; β-oxidation of fatty acids.	5hrs
Unit-9 Protein: Structure and metabolism Classification of amino acids and proteins; Primary, secondary, tertiary and quaternary structures of protein; Transamination & deamination.	5hrs
Unit-10 Enzymes Classification of Enzymes; Mechanism of action; Enzyme Kinetics; Enzyme Inhibition; Allosteric enzymes.	4hrs

MJ-A4P/B4P: Animal Physiology & Biochemistry Practical Credits 01

1. Preparation of temporary mounts: Squamous epithelium.
2. Preparation of stained blood film to study various types of blood cells. Calculation of total count and differential count from blood.
3. Preparation of haemin crystals.
4. Determination of Hb from own blood by Sahil's haemoglobin meter.
5. Identification of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland, small intestine, liver, lung, kidney.
6. Qualitative tests of functional groups in carbohydrates.
7. Qualitative test for urea, uric acid and ammonia.

Suggested Readings

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edn. W.H Freeman & Co.
2. Das, D. (2000). Biochemistry. Central Book Agency, Kolkata
3. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
4. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books /Mc Graw Hill.
5. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
6. Sathyanarayana U. and Chakrapani, (2002). Biochemistry –Books & Allied (P) Ltd, Kolkata.
7. Sembulingam and Sembulingam (2012) Essentials of Medical Physiology. 6th Edn. Jaypee Pub, New Delhi.
8. Sherwood, L. (2013). Human Physiology from cells to systems. 8th Edn., Brooks & Cole.
9. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc. 13. Widmaier, E.P., Raff, H.

MJ A5/B5: Genetics & Evolutionary Biology **Credits 04 (FM: 75)**

About the Course

The course is framed to get the knowledge of basic principles of heredity as well the concept evolutionary biology. Students will also get knowledge about the phenomenon of linkage, crossing over, mutation, and mechanism of sex determination. It deals the theories of evolution and speciation and extinction of species on earth.

Course Outcomes

After successfully completing this course, students will be able to:

1. Know the basis of Mendelian and non Mendelian inheritance.
2. Learn about the linkage groups, crossing over and linkage map.
3. Understand the molecular basis of sex determination of human and Drosophila.
4. Know the molecular cause, detection and effect of gene mutation.
5. Understand the prebiotic environment and protobiogenesis.
6. Understand the evolutionary principles that can bring about evolution as well as processes of evolutionary change.
7. Learn about the process of formation of species and extinction of species on earth.

MJ-A5T/B5T: Genetics & Evolutionary Biology Theory **Credits 03**

Course Contents	Hours
Unit 1: Mendelian Genetics and its Extension Basic principles of heredity: Mendel's law- monohybrid cross and dihybrid cross; Exceptions to Mendelian Inheritance; Incomplete dominance and co-dominance; Multiple alleles (ABO blood group); Sex-linked inheritance.	6 hrs
Unit 2: Linkage, Crossing Over and Chromosomal Mapping Kinds of Linkage and crossing over; Recombination frequency as a measure of linkage intensity; two factor and three factor crosses; Interference and coincidence.	6 hrs
Unit 3: Sex Determination Genic balance theory in Drosophila melanogaster; Role of Sxl gene, tra gene and dsx gene in sex determination of Drosophila; Mechanism of Sex Determination in Human; Role of SRY and *Tfm* gene; Dosage compensation in Drosophila & Human.	6 hrs
Unit 4: Mutations Types of gene mutations; Chromosomal aberrations; Nondisjunction of X chromosome in Drosophila & Human; Molecular basis of mutations in relation to UV radiation, Ionizing radiation; ClB method.	6hrs
Unit 5: **History of Life** Conditions of primitive earth & its environment; Origin of Life; RNA World Hypothesis.	3 hrs
Unit 6: Introduction to Evolutionary Theories Lamarckism; Darwinism & Neo-Darwinism.	3 hrs

Unit 7: Processes of Evolutionary Change Heritable variations; Hardy-Weinberg Law: Statement and Evolutionary forces upsetting Hardy-Weinberg equilibrium: Mutation, Migration, Genetic drift & Natural selection in changing allele frequencies; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive).	7 hrs
Unit 8 Speciation and Extinction Reproductive isolation; Allopatric speciation, parapatric speciation, sympatric speciation; Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail); Role of extinction in evolution.	5hrs
Unit 9. Phylogeny Phylogenetic trees: Features, types and examples; Evolution of Human.	3 hrs

MJ-A5P/B5P: Genetics & Evolutionary Biology Practical **Credits 01**

1. Study of Mendelian Inheritance and gene interactions using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes; normal and abnormal (Turner's, Down's and Klinefelter syndrome) from photographs.
4. Study of homology and analogy from suitable specimens/ pictures.
5. Study of a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors and b) Darwin's Finches with diagrams/ cut outs of beaks of different species.

Suggested Readings

1. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
2. Brooker, R.J. (2012). GeneticsL Analysis and Principles. 4th Edn. McGraw Hill.
3. Chattopadhyay, S. (2012). Life: Evolution, Adaptation, Ethology. 3rd Edn. Books and Allied, Kolkata.
4. Futuyma, D. J. (1997). Evolutionary Biology. Sinauer Associates.
5. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Ed. Wiley India.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin,R.C.andCarroll,S.B. (2010). Introduction to Genetic Analysis WH Freeman.
7. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers.
8. Hyde, D. (2009). Introduction to Genetic Principle. McGraw Hill.
9. Kardong, K. (2004). An Introduction to Biological Evolution. McGraw Hill.
10. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
11. Pierce, B.A. (2013). Genetics Essentials: Concepts and Connections. 2 nd Edn. Freeman W.H.
12. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
13. Russel, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
14. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

MJ A6/B6: Ecology & Behaviour of Animals **Credits 04 (FM: 75)**

About the Course

The objective of this course is to take students on a journey through survival of populations and communities in different habitats, interactions between the organisms and environments in nature. It highlights on some of the important aspects animal's behaviour.

Course Outcomes

After completion of this course, the students will be able to -

1. Know the structural and functional aspects of ecology.
2. Know about basic characteristics of population and community.
3. Learn the fascinating range and complexity of behaviour in animals.
4. Learn about the biological rhythm and their application in pharmacology and modern medicine.

MJ A6/B6 T: Ecology & Behaviour of Animals (Theory) **Credits 03**

Course contents:

Course Contents	Hours
Unit 1: Introduction to Ecology, Ecosystem and Biome Definition of ecology and ecosystem; Types, Components and function of ecosystem; Concept of food chain, food web, ecological pyramids & energy flow; Concept of Biome; Concept of habitat & Niche.	8hrs
Unit 2: Population Ecology Characteristics of population: Density, natality, mortality, life tables, fecundity schedule, survivorship curves; age distribution, Exponential and logistic growth, biotic potential; Population regulation: density-dependent and independent factors.	10 hrs
Unit 3 Biotic Community: Community characteristics: stratification, dominance, diversity, species richness, abundance; Ecotone and edge effect; Ecological succession; Gause's Principle with laboratory and field examples.	10 hrs
Unit 4: Patterns of Behaviour Instinct vs. Learned Behaviour; Associative learning- Classical and operant conditioning; Non-assortative learning- Habituation and sensitisation; Imprinting: Filial and sexual imprinting; Types and characteristics of biological rhythms.	10 hrs
Unit 5: Sexual and Social Behaviour Sexual behavior: Intra-sexual selection (male rivalry in Red Deer) and Inter-sexual selection (female choice in peacock). Social behavior: Eusociality; Altruism; Social grooming in Spider monkey; Schooling in fishes.	7hrs

MJ A6/B6 P: Ecology & Behaviour of Animals (Practical) **Credits 01**

1. Estimation of free carbon dioxide, dissolved oxygen & transparency of any water body
2. Estimation of any terrestrial ecosystem/biome through ecological methods like quadrat sampling, determination of minimum size of quadrat. Calculation of density, abundance & frequency any suitable population/community/ecosystem through field work or hypothetical community.
3. Demonstration of nests and nesting behavior of the bird through photographs (Pigeon, Crow, Tailor bird, Weaver Bird) and social insects through photographs (Termite, Ant and Honey bee).
4. To study circadian functions in humans (daily eating, sleep and temperature patterns).
5. Submission of field report after studying any ecosystem/zoological garden/National Park/Sanctuary/Biosphere Reserve.

Suggested Readings:

1. Odum, E.P. (1983) Basic Ecology. Saunders College Publishing.
2. Odum, E.P., (2008) Fundamentals of Ecology. Indian Edition. Brooks/Cole.
3. Ricklefs, R.E. (2000) Ecology (5th edition) Chiron Press.
4. Kormondy, E.J. (2000) Concepts of Ecology (4th edition) Prentice Hallof india Pvt. Ltd.
5. Chapman, J.L. and Reiss, M. J. (2002) Ecology Principles & Applications (2nd edition) Cambridge University Press.
6. Sharma, P.D. (2011) Ecology and Environment. Rastogi Publication.
7. Cain M L, Bowman W D and Hacker S D. 2013. Ecology. 3rd ed. Sinauer associates.
8. Smith TM, Smith R L. 2006. Elements of Ecology. 6th Ed. Pearson Education.
9. Odum EP, Barret GW. 2017. Fundamentals of Ecology. 15th Indian reprint. Cengage learning India Pltd.
10. Alcock J. 2013. Animal Behaviour, Sinauer Associate Inc., USA.
11. Drickamer LC, Vessey SH. 2001. Animal Behaviour. McGraw-Hill.
12. Dujatkin LA. 2014. Principles of Animal Behaviour. 3rd Edn. W.W.Norton and Co.
13. Macfarland, D. 1999. Animal Behaviour (3rd Edition), Addission Wesley Longman Ltd. England.
14. Mandal F. 2010. A Text Book of Animal Behaviour. Pentice Hall India.
15. Mathur R. 2005. Animal Behaviour. Rastogi Pub.

Major Elective

(To be studied by students taken Zoology as Discipline- A)

Major Elective -2: Fish and Fisheries **Credits 04 (Full Marks: 75)**

About the Course

The programme is designed to develop practical and academic skills on fish biology, pond management, water and soil quality management, habitat and stock monitoring.

Learning Outcomes

Upon successful completion of this course the student should able to-

1. Acquire knowledge on taxonomy and morphology of fishes.
2. Understanding of scope and significance of aquaculture.
3. Enrich knowledge on transgenic fish.
4. Learn different types and practices of Aquaculture.

MJE-2T: Fish and Fisheries Theory **Credits-03**

Theory	**Hours**
Unit 1: Introduction and Classification General description of fish; Feeding habit, habitat and manner of reproduction; Classification of fish (up to Subclasses).	**08hrs**
Unit 2: Morphology and Physiology Types of fins and their modifications; Locomotion in fish; Hydrodynamics; Types of Scales, Use of scales in classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration; Electric organ; Bioluminescence.	**13hrs**
Unit 3: Fisheries Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Fisheries law and regulations.	**12hrs**
Unit 4: Aquaculture Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Jeol fish culture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish; Fishery by-products.	**12 hrs**

MJE-2P: Fish and Fisheries Practical **Credits 01**

1. Morphometric and meristic characters of fishes
2. Identification of *Torpedo, Tryonyx, Catla, Cirrhinus, Ctenopharyngodon, Chanda, Wallago, Ophiocephalus, Mystus, Clarias, Heteropneustes* and *Anabas*.
3. Identification of different types of scales (through permanent slides/ photographs).
4. Study of crafts and gears used in fisheries.
5. Estimation of pH, salinity, total dissolved solids in water.
6. Study of air breathing organs in *Channa, Heteropneustes, Anabas* and *Clarias*
7. Report on a visit to any Fish farm/ Pisciculture unit/Zebrafish rearing Lab.

Recommended Readings

1. Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
2. D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK.
3. von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli Springer, Netherlands.
4. C.B.L. Srivastava, Fish Biology, Narendra Publishing House J.R. Norman, A history of Fishes, Hill and Wang Publishers.
5. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House. Note: Classification to be followed from: Romar A. S. (1959)

OR

Major Elective -2: Biotechnology **Credits 04 (Full Marks: 75)**

About the Course

This course is designed at graduation level to know the scientific technologies applied in biological sciences. It primary objectives to empower students with latest biotechnology techniques particularly genetic engineering or recombinant DNA technology and their application in medicine and industry for the benefit of living organisms.

Course Outcomes

The student at the completion of the course will be able to:

1. Understand the principles of genetic engineering, how genes can be cloned in bacteria and the various technologies involved in it.
2. Know the applications of biotechnology in various fields like agriculture, industry and human health.
3. Understand about utility of genetic engineering in forensic sciences.

MJE-2T: Biotechnology Theory **Credits 03**

Course contents	Hours
Unit 1: Introduction to Biotechnology Concept and Scope of Biotechnology; Red biotechnology; Green, biotechnology; White biotechnology; Blue biotechnology; Concept of genomics and proteomics.	5 hrs
Unit 2: Gene manipulation through Recombinant DNA Technology **Restriction enzymes (RE):** Characteristics and Types of RE, detailed study of Type II (source, restriction sites, nature of cut). **Cloning vectors:** Characteristics of plasmids, cosmids, phagemids, lambda bacteriophage. **DNA sequencing:** Detailed study of Sanger dideoxy enzymatic chain termination method. **Gene cloning:** Basic steps of DNA cloning and screening of recombinants. Uses of cloned DNA.	15 hrs
Unit 3: Molecular Techniques in Biotechnology Principle, protocol and applications of Agarose and polyacrylamide gel electrophoresis, Southern blotting, northern blotting, western blotting, polymerase chain reaction, DNA micro array (DNA chip), DNA fingerprinting.	10 hrs
Unit 4: Genetically Modified Organisms Production and utility of transgenic animals and crop plants; Methods of introducing transgene for production of transgenic animal: Retroviral Vector Method, DNA microinjection method, Embryonic stem cell method; Production of donor organs.	8 hrs

Unit 5: Application and Ethics of Biotechnology	7 hrs
Recombinant vaccines; Production of insulin and growth hormones; Biosensors; Bioremediation; Gene therapy; Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anaemia & Thalassemia); Risk and ethics of biotechnology.	

MJE-2P: Biotechnology Practical **Credit 01**

1. Plasmid DNA isolation from *Escherichia coli* (Demonstration)
2. Restriction digestion of plasmid DNA(Demonstration).
3. Construction of circular and linear restriction map from the data provided.
4. Finding the correct banding pattern of DNA fingerprint from supplied data.
5. Calculation of transformation efficiency from the supplied data.
6. Project report on animal cloning & Application & ethical Issues.

Suggested Readings

1. Primrose & Twyman. Principles of Gene Manipulation and Genomics. 7th edition.
2. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
3. Brooker, R.J. 1999. Genetics-Analysis and Principles. Addison-Wesley Longman, Inc.New, California.
4. Grifith, A.J.F., Miller, J.H., Suzuki, D.T. Lewonton, R.C., Gelbart, W.M., (2000). An Introduction to Genetic Analysis.VII edition. W.H.Freeman, New York.
5. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
7. Dubey, R.C., 2014. Advanced Biotechnology, S. Chand & Company Ltd., New Delhi.
8. Weaver. Molecular Biology of Gene. 5th edition.

Major Elective -3: Reproductive Biology **Credits 04(Full Marks: 75)**

About the Course

The course is designed to details study of reproductive system and foetal development and senescence. This course will explain the process of pregnancy, parturition, lactation, infertility and reproductive cycles.

Course Outcomes

Upon successful completion of this subject, students should be able to:

1. describe the structure of the organs of the reproductive system in males and females and indicate how this relates to function.
2. understand the hormonal, tissue and behavioural changes reproductive cycles and their hormonal regulations.
3. Learn the processes involved in pregnancy, parturition and lactation.
4. understand different reproductive diseases and process of infertility.

MJE-3T: Reproductive Biology Theory **Credits 03**

Course contents:

Course Contents	Hours
Unit 1: Reproductive System Elementary Concept: Sexual differentiation, Puberty; Histo-architechture of testis in human; Role of steroid in physiology & reproduction; Histo-architechture of ovary in human; Physiology of ovulation, menstrual cycle and oestrus cycle.	12 hrs
Unit 2: Foetal Development and Senescence Implantation and formation of the foetus and placenta; Pregnancy; Foetal development; Labour and birth; lactation and neonatal life; Menopause.	13 hrs
Unit 3: Evolution of Reproductive Mechanism and Regulation Evolution of human reproductive strategy; Evolutionary impact on sexual behaviour; Hormonal effects on maternal-infant bonding; Parturition; Society's effects on reproduction; Role of stress, anorexia, steroids & endocrine disrupting chemicals in the environment as well as on human reproduction.	12 hrs
Unit 4: Reproductive Health Sexual dysfunctions: Sexually transmitted diseases; Cancers of the reproductive system; Adenomyosis: gland-like growth into myometrium; Birth Control; Assisted Reproduction Technologies; Intrauterine devices (IUD), endometriosis, fibroids, Endometritis: chronic infection of uterus, congenital uterine anomalies; Ovarian cysts, pelvic varicosities. Infertility in male and female: causes, diagnosis and management; Modern contraceptive technologies.	13 hrs

MJE-3P: Reproductive Biology (Lab) **Credits 01**

1. Examination of histological sections from photomicrographs/permanent slides of rat/human or any suitable mammalian organism: testis, epididymis and accessory glands of male reproductive system; ovary, fallopian tube, uterus (proliferative and secretory stages), glands of female reproductive system.
2. Sperm count and sperm motility in rat/suitable specimen.
3. Observation of menustrual /oestrus cycle stages.
4. Study of modern contraceptive devices.

Recommended Readings

1. Thomas W.S. (2014) Langman's Medical Embryology (13th edition) Lippincott,
1. Williams & Wilkins, Baltimore.
2. Gary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2014) Larsen's Human
3. Embryology (5th edition) Elsevier.
4. Gilbert, S.F. (2016) Developmental Biology (11th edition) Sinauer.
5. Jones, R.E. and Lopez, K.N. (2014). Human Reproductive Biology. 4 th Edn. Elsevier.
6. Hatcher, R.A.et al. The Essentials of Contraceptive Technology. Population Information Programme. 6. Khurana, I (2012). Medical Physiology for undergraduate students. Elsevier.
7. Lewis, V. (2007). Reproductive endocrinology and Infertility. Landes Bioscience, USA.
8. Plant, T.M. And Zelenik, A.J. [Ed} (2015). Knobil and Neill's Physiology of Reproduction. 4th. Edn. Vol I. Elsevier.
9. Shoupe, D. and Kjos, S.L. (2006). The Handbook of Contraception. Humana Press.
10. Strauss, J.F. and Barbieri, R.L. (). Yen and Jaffe's Reproductive Endocrinlogy. 7th Edn. Elsevier. 11. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley& sons.

OR

Major Elective -3: Wildlife Conservation & Management Credits 04(Full Marks: 75)

About the Course

The course introduces the students to wildlife management. It is a brief account of the tools used by wildlife managers. Topics will give an exposure to the students with adequate knowledge of various biodiversity monitoring methodologies, conservation and management issues of threats to wildlife, impact of topography on wildlife, different techniques to sample wildlife and conservation issues.

Course Outcomes

1. The students will develop an understanding of how animals interact with each other and their natural environment.
2. The course will make the students familiar with the wildlife related problems, like conflicts of wild animals with human and to identify the causes of the depletion of wildlife.
3. The students will understand to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.
4. The students will be able to work in field with fundamental basic knowledge and techniques.

MJE -3T: Wildlife Conservation & Management (Theory) Credits 03

Course Contents	Hours
Unit 1: Basic Concept of Wildlife Definition, Importance of wildlife, Categories of wildlife; Wildlife wealth: local to global (West Bengal, India & World); Threats to wildlife: Cause of depletion of wildlife; Factors responsible for extinction of animals.	9 hrs
Unit 2: Wildlife Habitat Ecology Types of ecosystem sustaining wildlife: Concept of biomes – Definition, features, types (overview only – Alpine, Grassland, Forest, Desert & Aquatic); Importance of wetland with special reference to Ramsar site. Population dynamics in wildlife: Animal movement; Territory & Home range; Impact of introduced species on preexisting flora and fauna of wildlife.	9 hrs
Unit 3: Identification, Sampling and Wildlife Census Technique Wildlife Census Technique: Objective & Considerations; Total & Sample counts; Elementary idea about Direct & Indirect Census techniques. Concept of pug marks, bird census method, camera trap, wildlife telemetry, remote sensing, GIS & GPS.	9hrs
Unit 4: Protected Area Concept Types of protected areas and the concept of zoning within the protected areas with special reference to wildlife corridor; Problems & Prospects of Protected area. Elementary idea of National Park, Sanctuary, Biosphere Reserve, UNESCO World Heritage site in India.	9 hrs

Unit 5: Wildlife Conservation & Management Wildlife conservation objectives; Captive breeding techniques and reintroduction tools and techniques to control the menace of wild animals; Human wildlife conflict, resolution and mitigation; Special management programmes – Project Tiger & Project Elephant; The Wild Life (Protection) Act, 1972.	9 hrs

MJE -3P: Wildlife Conservation & Management (Practical) Credits 01

1. 1.Identification and study of selective flora and wildlife fauna from live specimen/model/photograph in campus, media, museum, Zoological/Botanical garden or any in-situ/ex-situ site through field trip for conservation along with their habit, habitat, ecology, conservation initiative and other related issue and submission of a report.
2. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
3. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses etc.).
4. Demonstration of different field techniques for flora and fauna and Trail /transect monitoring for abundance and diversity estimation of animals/plants (direct and indirect evidences).
5. Identification of endemic reptiles, birds and mammals.

Recommended Readings

1. Caughley, G., and Sinclair, A.R.E. (1994) Wildlife Ecology and Management. Blackwell Science.
2. Woodroffe, R., Thirgood, S. and Rabinowitz, A. (2005) People and Wildlife, Conflict or Co-existence? Cambridge University.
3. Bookhout, T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000) The Conservation Handbook: Research, Management and Policy. Blackwell Sciences.
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.
6. Saha, G. and Mazumar S. (2017). Wildlife Biology: An Indian Perspective. PHI. Learning Pvt. Ltd. Delhi.

MINOR (MI)

(To be studied by students taken Zoology as Discipline- C)

MI-5/C5: Same as Minor-5 (ZOOMIN05) of Zoology (Hons.) programme **Credits 04**
Full Marks: 75

MI-6/C6: Same as Minor-6 (ZOOMIN06) of Zoology (Hons.) programme **Credits 04**
Full Marks: 75