

**NATIONAL Education Policy (NEP)
and
NATIONAL CURRICULUM AND CREDIT FRAMEWORK (NCCF)**

Syllabus

2 Year/ 1 Year M.Sc. IN Animal Science
(w.e.f. Academic Session 2026-27)



Kazi Nazrul University
Asansol, Paschim Bardhaman
West Bengal - 713340

Semester - 1

Course Name: Animal Diversity, Computational Biology and Biometry Course Code: MSCASCMC701					
Course Type: Major Coursework (Theoretical)	Course Details: MC-1			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Develop an understanding of the diversity of the animal world.
- Understand the utility of computers in biology and statistics.
- Learn and implement computational approaches in solving biological problems.
- Understand the methodology to use statistics for determining one/more biological responses.
- Study and understand the methods of bioinformatics and biostatistical approaches.
- **Contribution to Indian Knowledge System (IKS):** It helps understand Indian biodiversity, animal classification, and traditional knowledge of animal resources.

<i>Unit</i>	<i>Course content</i>	<i>Hours</i>
I	Biosystematics and Animal Diversity: 1) Basis of taxonomy as applied to the systematics, classification, and nomenclature of the animal kingdom. 2) Concepts of classical, numerical (phenetics), phylogenetic (cladistics), cytological, biochemical, and molecular (genetic) taxonomy. 3) Classification and evolutionary relationships among major invertebrate phyla. 4) Evolutionary significance of larval forms of invertebrates. 5) Classification of protochordates and chordates. 6) Origin, evolution, and distribution of different chordate groups. Adaptive radiation and convergent evolution.	20
II	Organization and Evolution in Animal World: 1) Evolution of unicellular, colonial, and multicellular forms. 2) Levels of organization: tissues, organs, and systems. 3) Evolution of symmetry, coelom, and metamerism. 4) Special features: Canal system in Porifera, polymorphism in Cnidaria, water vascular system in Echinodermata. 5) Evolutionary significance of notochord and endostyle. 6) Evolution of the vertebrate brain, heart, aortic arches, and urinogenital system. 7) Metamorphosis: progressive and retrogressive, neoteny, pedomorphosis. 8) Animal preservation and handling of laboratory animals.	20
III	Computational Biology: 1) Fundamentals of Computational Biology: Historical background, Programming languages in bioinformatics and their uses, Sequence and structural databases NCBI, UniProt, PDB), their classification and utilities, Data formats, submission and retrieval. 2) Tools and Techniques of Computational Biology: Sequence Analysis; Pairwise and multiple sequence alignment using BLAST and FASTA, scoring matrices (PAM, BLOSUM). Phylogeny: Evolutionary analysis, phylogenetic tree construction, and interpretation (NJ, UPGMA, Maximum Parsimony). 3) Structural Computational Biology: Protein secondary and tertiary structure prediction, molecular visualization, and drug docking basics; Preliminary concept on MDS.	20

	4) Concept of Advanced Computational Biology: Genomics and Proteomics; Gene prediction, functional genomics, mass spectrometry data analysis, and pathway mapping.	
IV	Biometry: 1) Introduction and importance of statistics and biostatistics, Classification and tabulation of data. 2) Parameter, Statistic and Observation. Graphical and diagrammatic representation of data. 3) Measures of Central tendency (simple and grouped data). Measures of Dispersion (simple and grouped data). 4) Probability and probability distributions: Binomial, Poisson and Normal. Moments, Skewness and Kurtosis. 5) Correlation and Regression. Sampling methods. 6) Tests of hypothesis: t-test, Z-test, Chi-square test. 7) Design of experiments: Completely randomized design (CRD), Randomized block design (RBD). 8) Analysis of variance and F-test of significance.	20
		80
<i>Pedagogical approaches:</i> Lecture, group discussion, problem solving, project, student seminar.		

Suggested Readings	
1) Mayr E, Ashlock PD (1991). Principles of Systematic Zoology (2nd ed.). McGraw-Hill. 2) Kotpal RL (2019). Modern Text Book of Zoology: Invertebrates (11th ed.). Rastogi Publ. 3) Kotpal RL (2019). Modern Text Book of Zoology: Vertebrates (11th ed.). Rastogi Publications. 4) Jordan EL, Verma PS (2006). Invertebrate Zoology. S Chand & Company Ltd. 5) Jordan EL, Verma PS (2003). Chordate Zoology. S Chand & Company Ltd. 6) Chatterjee A, Chakraborty C (2015). Textbook of Zoology. Nirmala Library. 7) Nelson JS (2006). Fishes of the World (4th ed.). Wiley. 8) Mount DW (2004). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press. 9) Pevsner J (2015). Bioinformatics and Functional Genomics. Wiley-Blackwell. 10) Negi KS (2002). Biostatistics. AITBS Publishers & Distributors. 11) Das NG (2017). Statistical Methods (Vol I and II). McGraw-Hill Education. 12) Sinha JK, Chatterjee AK, Chattopadhyay P (2015). Advanced Practical Zoology. Books and Allied (P) Ltd. 13) Zar JH (2013). Biostatistical Analysis (5th ed.). Pearson.	

Course Name: Microbiology, Parasitology and Immunology Course Code: MSCASCMC702					
Course Type: Major Coursework (Theoretical)	Course Details: MC-2			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Understand the roles of microbes and parasites in causing animal/human diseases.
- Learn the techniques to identify different pathogenic microbes and parasites.
- Know the microbial/parasitic pathogenesis and host immunity.
- Carry out common procedures for combating infectious microbes and parasites.
- Understand the disease-causing potential of microbes and the responses of the immune system.
- **Contribution to Indian Knowledge System (IKS):** It connects with traditional Indian knowledge of health, disease prevention, hygiene, and immunity.

Unit	Course content	Hours
I	Microbiology: 1) Cellular Organization: Structural architectures of viruses, including bacteriophages, bacteria, and fungi, and membrane transport. 2) Microbial Physiology & Metabolism: Growth curves, microbial nutrition, key metabolic pathways (glycolysis, fermentation, glyoxylate cycle and ED pathway), reproduction (conjugation, transformation, transduction) and stress response strategies (endospore formation). 3) Medical Microbiology: Sterilization and Disinfection methods, Classification and Mode of action of Antibiotics, Concept of AMR. 4) Traditional knowledge for prevention and treatment of microbes and parasites. 5) Applied Microbiology: Microbial culture and preservation techniques, Microbial remediation, microbe-based industrial enzyme/pharmaceuticals production.	20
II	Basics of Parasitology: 1) Concept of parasitism, types of parasites & hosts. Hyperparasitism in the animal kingdom. 2) Host-parasite interactions: Effects of parasites on hosts. 3) Parasite adaptations: Adaptations to transmission and infectiousness. 4) Taxonomy, morphology, life cycle, pathogenesis & control of (a) <i>Ancylostoma duodenale</i> , (b) <i>Wuchereria bancrofti</i> . 5) Taxonomy, morphology, life cycle, pathogenesis & control of (a) <i>Schistosoma mansoni</i> , (b) <i>Diphyllbothrium latum</i> . 6) Mechanism of action of benzimidazole, praziquantel and ivermectin.	20
III	Intestinal and Blood Protozoans: 1) Amoebiasis: Taxonomy, morphology, life cycle, diagnosis, pathogenesis, prevention and control of (a) <i>Entamoeba histolytica</i> , (b) <i>Entamoeba coli</i> . 2) Taxonomy, morphology, life cycle, diagnosis, pathogenesis, prevention and control of <i>Giardia lamblia</i> . 3) Trypanosomiasis: Taxonomy, morphology, life cycle, diagnosis, pathogenesis, prevention and control of <i>Trypanosoma gambiense</i> , (a) South American Trypanosomiasis (Chagas disease), (b) African trypanosomiasis. 4) Malaria: Taxonomy, morphology and life cycle of <i>Plasmodium</i> . Fever cycle in Malaria. Diagnosis, pathogenesis, prevention and control of Malaria.	20

IV	Immunology: 1) Concept of Immune System and Immunity: Immune Organs and Tissues, Innate immunity (Physicochemical barriers and tissue/cellular factors, humoral factors, complements), Mechanism of pathogen recognition, MHC molecules, antigen processing and presentation, Toll-like receptors and their signaling pathways, Adaptive immunity; Cell-mediated immunity; Structure and function of antibodies, 2) Mechanism of Developing Immunity: Ig superfamily, Generation of antibody diversity, Somatic Hypermutation, Affinity Maturation, Class Switching, Activation and differentiation of B and T cells, B and T cell receptors. 3) Immune System Disorders: Hypersensitivity, Autoimmunity, Cytokine Storm, Immunodeficiency, Immune dysfunction in chronic human diseases. 4) Clinical Immunology: Determination of antigen-antibody interactions (ELISA, RIA, immunofluorescence, FACS), Hybridoma Technology: Monoclonal antibodies in therapeutics and diagnosis, CAR T Cells. Traditional knowledge of boosting immunity. 5) Vaccination: DNA, RNA, and peptide vaccines.	20
		80
Pedagogical approaches: Lecture, group discussion, problem solving, project, student seminar.		

Suggested Readings	
1) Wiley JM, Sherwood LM, Woolverton CJ (2013) Prescott's Microbiology (9th ed.). McGraw-Hill International. 2) Madigan MT, Martinko JM, Dunlap PV, Clark DP (2014). Brock Biology of Microorganisms (14th ed.). Pearson International Edition 3) Black JG (2008). Microbiology: Principles and Explorations (7th ed.). Prentice Hall. 4) Pelczar Jr MJ, Chan ECS, Krieg NR (2004). Microbiology (5th ed.). Tata McGraw-Hill. 5) Bogitsh BJ, Carter CE, Oeltmann TN (2018). Human parasitology. Academic Press. 6) John DT, Petri WA (2006). Markell and Voge's Medical Parasitology. Saunders. 7) Roberts L, Janovy Jr J, Nadler S (2012). Foundation of Parasitology (9th ed.). Roberts and Janovy. McGraw-Hill. 8) Marr J, Nilsen TW, Komuniecki RW, eds. (2002). Molecular Medical Parasitology. Academic Press. 9) Cheng TC (1986). General Parasitology. Academic Press Inc. 10) David TJ, William AP (2006). Markell and Voge's medical parasitology (9th ed.). Elsevier. 11) Pevsner J (2015). Bioinformatics and Functional Genomics. Wiley-Blackwell. 12) Owen JA, Punt J, Stanford SA, Jones PP (2013). Kuby Immunology (7th or later ed.). W. H. Freeman and Company. 13) Murphy K, Weaver C (2016). Janeway's Immunobiology (9th or later ed.). Garland Science/WW Norton & Company. 14) Delves PJ, Martin SJ, Burton DR, Roitt IM (2017). Roitt's Essential Immunology (13th ed.). Wiley-Blackwell. 15) Abbas AK, Lichtman AH, Pillai S (2021). Cellular and Molecular Immunology (10th ed.). Elsevier.	

Course Name: Cell-Molecular Biology and Biotechnology Course Code: MSCASCMC703					
Course Type: Major Coursework (Theoretical)	Course Details: MC-3			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Learn the basics of cytogenetics.
- Understand the importance and scope of biotechnology.
- Learn editing and transfer of DNA.
- Enrich the fundamental knowledge of cloning and transgenesis.
- **Contribution to Indian Knowledge System (IKS):** It integrates modern biological techniques with traditional Indian knowledge of medicinal plants, Ayurveda, and biodiversity conservation for scientific validation and sustainable application.

Unit	Course content	Hours
I	Cytology: 1) Ultrastructure and Function: Cell membranes (membrane proteins, active and passive transport), nucleus, mitochondria, Golgi bodies, endoplasmic reticulum, peroxisomes, cytoskeleton. 2) Protein trafficking and transport (cytoplasmic and nuclear). 3) Cell cycle and its regulation; Apoptosis. 4) Cell Signalling: Cell surface receptors and signal transduction pathways (GPCR, RTK, Ca ²⁺ - Calmodulin). 5) Concept of Cancer: Hallmarks of cancer, benign and malignant tumors, tumor suppressor and protooncogenes, mechanism of oncogenesis, anticancer drugs, chemotherapeutics and ethnomedicines.	20
II	Genetics: 1) Non-Mendelian Traits: Incomplete dominance, Codominance, Multiple allelism, Lethal alleles, Expressivity and penetrance, Pleiotropy, Epistasis (Recessive and Dominant), Phenocopy. 2) Operon (<i>Lac</i> and <i>tryp</i>), Transposons. 3) Sex determination and Dosage Compensation in <i>Drosophila</i> and humans; Extra-chromosomal inheritance. 4) Human Genetics: Genetic counselling, Common genetic disorders.	20
III	Molecular Biology: 1) Concept of central dogma. DNA and RNA as genetic materials. 2) DNA replication (types and mechanism) and its inhibitors. 3) Transcription, processing and regulation, transcriptional inhibitors and riboswitches. 4) Translation and its inhibitors and post-translational modifications.	20
IV	Biotechnology: 1) Tools and Techniques of Genetic Engineering: DNA-modifying enzymes (restriction enzymes type I, II & III, ligases, end-modifying enzymes, polymerases, reverse transcriptase). 2) Construction of Recombinant DNA & Gene Cloning: Gene cloning vectors (plasmid, constructed plasmid, bacteriophages, cosmids, phagemids, BAC, shuttle vectors and expression vectors). Construction of chimeric DNA (cohesive-end ligation, use of linkers, blunt-end ligation).	20

	3) Gene Transfer Method (Transfection): Direct gene transfer, electroporation, microinjection, liposome-mediated DNA delivery, gene gun, silicon carbide, DEAE Dextran, PEG-mediated. 4) Concept of transgenic animals. General account of biotechnology in agriculture and medicine. 4) PCR: DNA amplification, primer design, reverse transcriptase and real-time PCR. Sequencing of nucleic acids (Maxam-Gilbert, Sanger’s method).	
		80
<i>Pedagogical approaches:</i> Lecture, group discussion, problem solving, project, student seminar.		

Suggested Readings

- 1) Karp G (2010) Cell and Molecular Biology: Concepts and Experiments (6th ed.). John Wiley & Sons. Inc.
- 2) De Robertis EDP, De Robertis EMF (2006). Cell and Molecular Biology (8th ed.). Lippincott Williams and Wilkins, Philadelphia.
- 3) Cooper GM, Hausman RE (2009). The Cell: A Molecular Approach. (5th ed.). ASM Press & Sunderland, Washington, DC; Sinauer Associates, MA.
- 4) Becker WM, Kleinsmith LJ, Hardin J, Bertoni GP (2009). The World of the Cell. (7th ed.). Pearson Benjamin Cummings Publishing, San Francisco.
- 5) Verma PS, Agarwal VS (2016). Cell Biology. S Chand Pub.
- 6) Rastogi SC (2019). Cell Biology, New Age Int. Pub.
- 7) Rastogi VB (2021). Cell Biology (1st ed.). MedTech.
- 8) Gupta R, Makhija S, Toteja R (2018). Cell Biology: Practical Manual. Prestige Publishers.
- 9) Alberts B (2013). Essential Cell Biology (4th ed.). Garland Science.
- 10) Brown TA (2025). Gene cloning and DNA analysis: an introduction. John Wiley & Sons.
- 11) Lewin B (2008). Gene IX. Jones and Bartlett Publishers.
- 12) Primrose SB (2001). Molecular Biotechnology. Panima Publishing Corporation.
- 13) Glick BR, Pasternak JJ (2010). Molecular biotechnology: Principles and applications of recombinant DNA (4th ed.). ASM Press.
- 14) Smith JE (2009). Biotechnology (5th ed.). Cambridge University Press.
- 15) Ratledge C, Kristiansen B. (Eds.). (2001). Basic biotechnology (2nd ed.). Cambridge University Press.
- 16) Rehm HJ, Reed G, Pühler A, Stadler P (Eds.). (1993–2001). Biotechnology: A multi-volume comprehensive treatise. Wiley-VCH.
- 17) Thieman WJ, Palladino MA (2018). Introduction to biotechnology (4th ed.). Pearson.

Course Name: Practical I Course Code: MSCASCMC704					
Course Type: Major Coursework (Practical)	Course Details: MC-4			L-T-P: 0 - 0 - 10	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60		40	

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Develop an understanding of the diversity structure of animals.
- Identify parasites and learn their medical importance.
- Perform and interpret basic immunological techniques.
- Learn about the procedures to study chromosomes.
- Get hands-on training in the extraction of DNA and RNA.
- Learn about the basics of Bioinformatics and Biotechnology.
- Get an idea of statistical problems and their solutions.
- Engage in **experiential learning**.
- **Contribution to Indian Knowledge System (IKS):** This practical paper strongly supports IKS because it involves biodiversity study, field visits, animal identification, and biological resource documentation. Field-based learning incorporates indigenous knowledge of local animals, ecosystems, traditional animal management, and conservation practices.

Course content	Hours
Biodiversity: 1) Identification with reasons: <i>Amoeba</i> , <i>Sycon</i> , <i>Hydra</i> , <i>Pheretima</i> , <i>Palaemon</i> , <i>Pila</i> , <i>Asterias</i> , <i>Balanoglossus</i> , <i>Branchiostoma</i> , <i>Scoliodon</i> , <i>Labeo</i> , <i>Bufo</i> , <i>Calotes</i> , <i>Columba</i> , <i>Cavia</i> . Larval forms: Ephyra, Trochophore, Zoea, Nauplius, Veliger, Glochidium, Bipinnaria, Brachiolaria, Miracidium, Tornaria, Ammocoetes. 2) Dissection of fish: Brain, heart, afferent branchial system. 3) Dissection of fowl: Brain; (demonstration: heart, arterial system). Bioinformatics: 4) Retrieval of amino acid and nucleotide sequence of a given query. 5) Alignment of amino acid/nucleotide sequence and construction of a phylogenetic tree. Biostatistics: 6) Calculation of central tendency from a given set of grouped/ungrouped data. 7) Probability-based simple problems. 8) Problems of Chi-square tests, t-test and Z-test. Parasitology: 9) Identification with medical importance: <i>Plasmodium</i> , <i>Trypanosoma</i> , <i>Taenia</i> , <i>Ascaris</i> , <i>Wuchereria</i> , <i>Anopheles</i> , <i>Glossina</i> , <i>Pediculus</i> . 10) Study of nematode/cestode from the intestines of a poultry bird. Microbiology: 11) Isolation of Bacteria from soil/water; preparation of pure culture on LB agar plate. 12) Gram staining of bacteria from food/environmental samples. Immunology: 13) Histological study of spleen, thymus and lymph nodes through stained slides/photographs. 14) Determination of blood group and preparation of blood smear to study various types of white blood cells.	160

15) Development of antibody in animal model and determination of antigen-antibody interaction by colorimetric agglutination assay and Ouchterlony's double immuno-diffusion method. 16) Demonstration of ELISA. Cytogenetics: 17) Preparation of polytene chromosomes from Chironomid/<i>Drosophila</i> larvae. 18) Preparation of meiotic chromosomes from the grasshopper testes: Identification of stages. 19) Identification of human chromosomal abnormalities and various genetic diseases from photographs/charts. 20) Analysis of human pedigree and construction of pedigree chart. Biotechnology: 21) Extraction of DNA and RNA from animal tissue. 22) Demonstration of Western Blotting, gel electrophoresis, and PCR. 23) Field visit to any ecosystem/industry/research institute to study animal diversity/research & development and submit a report. 24) Laboratory Notebook/Records.	
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<i>Pedagogical approaches and format for assessments:</i>	
CA (60 marks)	ESE (40 marks)
1) Practical Class Test: 10 2) PPT/Poster Presentation: 10 3) Attendance/Participation in Class: 10 4) Field Visit/Excursion: 10 5) Laboratory Notebook: 10 6) Viva: 10	1) Identification: 2x4 = 8 2) Dissection/Experiment: 2x8 = 16 3) Field/Excursion Report: 5 4) Laboratory Notebook: 5 5) Viva: 6

Suggested Readings
1) Sinha JK, Chatterjee AK, Chattopadhyay P (2015). Advanced Practical Zoology. Books and Allied (P) Ltd. 2) Ghosh KC, Manna B (2015). Practical Zoology, New Central Book Agency, Kolkata. 3) Lal SS (2016). Practical Zoology - Invertebrate. Rastogi Publication. 4) Lal SS (2016). Practical Zoology - Vertebrate. Rastogi Publication. 5) Gupta R, Makhija S, Toteja R (2018). Cell Biology: Practical Manual, Prestige Publishers 6) Alberts B (2013). Essential Cell Biology (4th ed.). Garland Science. 7) Mount DW (2004). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press. 8) Pevsner J (2015). Bioinformatics and Functional Genomics. Wiley-Blackwell. 9) Negi KS (2002). Biostatistics. AITBS Publishers & Distributors. 10) Das NG (2017). Statistical Methods (Vol I and II). McGraw-Hill Education. 11) Zar JH (2013). Biostatistical Analysis (5th edition). Pearson. 12) Rastogi SC, Mendiratta N, Rastogi P (2013). Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery (4th ed.). PHI Learning. 13) Lesk AM (2019). Introduction to Bioinformatics (5th ed.). Oxford University Press. 14) Sonder GJ, Post KW (2005). Veterinary Microbiology: Bacterial and Fungal Agents of Animal Diseases. Cold Spring Harbour Lab. Press. 15) Prescott LM, Harley JP, Klen DA (2005). Microbiology. Wm. C. Brown Publ. 16) Talwar GP (Ed). (1983). A handbook of practical immunology. Vikas Publishing House.

Course Name: Ecosystem and Wildlife Course Code: MSCASCMN701					
Course Type: Minor (Theoretical)	Course Details: MNC-1			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Know the evolutionary and functional basis of animal ecology.
- Understand what makes the scientific study of animal ecology a crucial and exciting endeavour.
- Engage in field-based research activities to understand well the theoretical aspects taught, besides learning techniques for gathering data in the field.
- **Contribution to Indian Knowledge System (IKS):** It directly relates to IKS through biodiversity conservation, sacred groves, and community-based conservation practices.

Unit	Course content	Hours
I	Foundations of Ecology: 1) Structure and function of ecosystem; Abiotic and biotic factors of ecosystem. 2) Ecological pyramid, Food chain and food web; Productivity and ecological efficiencies. 3) Population; Concept of carrying capacity, Exponential and logistic growth; r and K strategies. 4) Brief concept of Population interactions; Niche concept and resource partitioning.	20
II	Essentials of Environment: 1) Ecological succession: Definition and process. 2) Environmental pollution: Air, water, and noise pollution and their control. 3) Biodiversity: Types, hotspots of biodiversity. Threats and major drivers of biodiversity. 4) Environmental movements: Chipko, Silent Valley.	20
III	Value and Conservation of Wildlife: 1) Definition, value and importance of wildlife. 2) Wildlife conservation, ethics, strategies (policy) and importance of conservation; Important features of protected areas in India. 3) Tiger conservation – Tiger reserves in India; Management challenges in tiger reserves. 4) Role of local communities in conservation (Joint Forest Management, sacred groves). Eco-tourism and its impacts on environment and wildlife.	20
IV	Monitoring and Management of Wildlife: 1) Tools and techniques used in wildlife: Use of tools (drone, radio collar, camera trap) and tracking by remote sensing and GIS. 2) Identification and counting of wild animals by fecal sample analysis, hair identification, pug marks, and census methods. 3) Elementary idea on CITES; IUCN Red Data Book. 4) Man-wildlife conflict (definition, causes, and mitigation).	20
		80
Pedagogical approaches: Lecture, group discussion, problem solving, project, student seminar.		

Suggested Readings
1) Odum EP (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole. 2) Ricklefs RE (2000). Ecology (5th ed.). Chiron Press. 3) Krebs CJ (2001). Ecology (6th ed.). Benjamin Cummings. 4) Southwood TRE, Henderson PA (2000). Ecological Methods (3rd ed.). Blackwell Sci. 5) Stiling PD (2012). Ecology Companion Site: Global Insights and Investigations. McGraw-Hill Education. 6) Begon M, Harper JL, Townsend CR (2006). Ecology: Individuals, Populations and Communities (4 th ed.). Blackwell Science. 7) Chapman RL, Reiss MJ (2000). Ecology: Principles & Application. Cambridge University Press. 8) Van Dyke F (2008). Conservation Biology: Foundations, Concepts, Application (2nd ed.). Springer Science and Business Media. 9) Mathur R (2018). Wildlife Conservation and Management (1st ed.). Rastogi Pub. 10) Saha GK, Mazumdar S (2017). Wildlife Biology: An Indian Perspective. PHI Learning.

Semester - 2

Course Name: Environmental Biology and Ethology Course Code: MSCASCMC801					
Course Type: Major Coursework (Theoretical)		Course Details: MC-5		L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Understand the evolutionary and ecological basis of animal behaviour and ecology.
- Develop field research and ecological data collection skills.
- Apply concepts to analyze animal behaviour in different environments.
- Evaluate the role of behaviour in wildlife conservation and management.
- Critically interpret scientific information on animal ecology and behaviour.
- **Contribution to Indian Knowledge System (IKS):** It connects with Indian ecological values, animal behaviour, and harmony between humans and nature.

Unit	Course content	Hours
I	Ecosystems and Populations: 1) Environment and ecosystem: Structure and function of ecosystem; Abiotic and biotic factors of ecosystem. 2) Ecological pyramid, Food chain and food web; Productivity and ecological efficiencies. 3) Population: Concept of carrying capacity, Exponential and logistic growth; r and K strategies. 4) Brief concept of population interactions; Niche concept and resource partitioning.	20
II	Biodiversity, Communities, and Conservation: 1) Ecological succession: Definition and process. 2) Community characteristics: Diversity, species richness, abundance, and evenness. 3) Biodiversity: Types, hotspots of biodiversity. Threats and major drivers of biodiversity. 4) Environmental Movement: Chipko, Silent Valley, Bishnoi.	20
III	Ecotoxicology: 1) Ecotoxicology: Principles of acute and chronic toxicity; Bioconcentration, bioaccumulation, and biomagnification; Dose-response. 2) Heavy metals (Cd, Hg, Pb, As) and pesticide toxicity. 3) Environmental pollution: Air, water, and noise pollution and their control. 4) Elementary idea on biotransformation reactions – Phase I and Phase II. 5) Clinical toxicology: Paracetamol, Aspirin.	20
IV	1) Introduction to Ethology: Origin and history of ethology; Brief profiles of Karl Von Frisch, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen. Proximate and ultimate causes of behaviour. 2) Patterns of Behaviour: Stereotyped behaviours (Orientation, Reflexes); Individual behavioural patterns; Instinct vs. learned behaviour; Associative learning, Classical and operant conditioning, Habituation, Imprinting. Biological clocks: basic components, functions, regulation, and Indian traditional knowledge on rhythm biology. 3) Social Behaviour: Concept of society; Communication and the senses; Altruism; Insects' society; Foraging and territorial behaviour.	20

4) Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), mating systems, Courtship behaviour and Parental care.	
	80
<i>Pedagogical approaches:</i> Lecture, group discussion, problem solving, project, student seminar.	

Suggested Readings

- 1) Odum EP (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole.
- 2) Ricklefs RE (2000). Ecology (5th ed.). Chiron Press.
- 3) Krebs CJ (2001). Ecology (6th ed.). Benjamin Cummings.
- 4) Southwood TRE, Henderson PA (2000). Ecological Methods (3rd ed.). Blackwell Sci.
- 5) Stiling PD (2012). Ecology Companion Site: Global Insights and Investigations. McGraw-Hill Education.
- 6) Begon M, Harper JL, Townsend CR (2006). Ecology: Individuals, Populations and Communities (4th ed.). Blackwell Science.
- 7) Chapman RL, Reiss MJ (2000). Ecology - Principles & Application. Cambridge University Press.
- 8) Dash MC (2001). Fundamentals of Ecology (2nd ed.). Tata McGraw-Hill Company.
- 9) Enger ED, Smith BF (2008). Environmental Science: A study of Interrelationships (11th ed.). McGraw-Hill Higher Education.
- 10) Natarajan P, Arumugam N (2018). Animal Behaviour (1st ed.). Saras Publication.
- 11) McFarland D (1999). Animal Behaviour (3rd ed.). Pitman Publishing Limited, London, UK.
- 12) Manning A, Dawkins MS (2012). An Introduction to Animal Behaviour (6th ed.). Cambridge University Press, UK.
- 13) Alcock J (2005). Animal Behaviour (8th ed.). Sinauer Associates Inc., USA.
- 14) Shukla JP (2021). Fundamentals of Animal Behaviour (1st ed.). Atlantic.
- 15) Agarwal VK (2010). Animal Behaviour (1st ed.). S Chand & Company.

Course Name: Animal Biochemistry, Physiology and Developmental Biology Course Code: MSCASCMC802					
Course Type: Major Coursework (Theoretical)	Course Details: MC-6			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Understand the basic principles of animal biochemistry and metabolism.
- Explain the structure and functions of proteins, enzymes, lipids, and nucleic acids.
- Understand animal physiology, hormonal regulation, and developmental processes.
- Learn the mechanisms of growth, reproduction, and embryonic development.
- Apply knowledge of biochemistry and physiology in animal health and research.

Unit	Course content	Hours
I	Fundamental Biochemistry: 1) Biochemistry of Carbohydrates: Open-chain and ring structures; types, properties; optical activity, isomerism and epimerism, mutarotation, and biological importance. 2) Biochemistry of Protein: Structure and classification of amino acids, d/l nomenclature, Peptides and Proteins; Hierarchical organization of protein structure, classification and properties. 3) Biochemistry of Enzymes: Nomenclature and classification of Enzymes; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action and catalysis; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max}, Lineweaver-Burkplot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action. 4) Biochemistry of Lipids: Structure and classification, Fatty acids, Alcohols, Oil, Wax, properties, biological significance. 5) Biochemistry of Nucleic Acids: Structures of Nucleotide, DNA, RNA, Linking number; Supercoiling; Differences among different types of DNA and RNA. 6) Thermodynamics: Laws of thermodynamics, free energy change (ΔG), and coupled reactions. Biochemistry of Metabolism: 7) Carbohydrate Metabolism: Gluconeogenesis, Glycogenolysis and Glycogenesis, Cori Cycle, Sequence of reactions and regulation of glycolysis, Phosphate pentose pathway, Citric acid cycle, ETC) 8) Protein Metabolism: Basic concept of synthesis and degradation of amino acids; Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids. 9) Lipid Metabolism: Synthesis and β-oxidation of saturated fatty acids); Nucleic acid Metabolism (Synthesis (de novo & salvage) and degradation of nucleotides). 10) Metabolic defects: Diabetes, Obesity, MASP, Alkaptonuria, Gout.	30

II	Physiology: 1) Muscle contraction: Types, ultrastructure of skeletal muscles, muscle proteins. Properties of skeletal muscle. Physiology of skeletal muscle contraction. Neuromuscular junction. 2) Circulation: Physiology of human heart w.r.t. junctional tissues and valves, cardiac cycle, cardiac output, Frank-Starling law of the heart; neural integration of cardiovascular function, electrocardiogram. Mechanism of blood coagulation (intrinsic and extrinsic pathways). Common disorders of circulatory system. 3) Neural Physiology: Organization, neurons, and glial cells- types and structure. Structure of the brain. Limbic system coordination with other systems. Ionic basis of resting and action potentials. Nerve impulse and its transmission (myelinated and non-myelinated). Synapse types and synaptic transmission. Structure of reflex arc and mode of Reflex action. Physiology of vision and hearing. Diseases related to the nervous system (symptoms): Alzheimer's disease, Parkinson's disease, Huntington's disease, and Neurofibromatosis.	20
III	Endocrinology: 1) Overview of the endocrine system; Autocrine, paracrine, juxtacrine, and endocrine modes of action. 2) Functions of endocrine glands: Pineal, pituitary, thyroid, pancreas, adrenal, testes, and ovary; hormones secreted by them. Placental hormones. 3) Mechanism of hormone action: Signal transduction pathways for steroidal and non-steroidal hormones. 4) Regulation of endocrine secretion. Hypothalamus and neuroendocrine control of anterior pituitary. Disorders related to endocrine dysfunction (general idea).	10
IV	Developmental Biology: 1) Gametogenesis: Oogenesis, Spermatogenesis. 2) Fertilization: Merits and demerits of external and internal fertilization; Mechanism of fertilization; Polyspermy inhibition in Sea urchin and Human. 3) Cleavage: Types of eggs and cleavage; Patterns of cleavage; Role of yolk during cleavage. 4) Blastulation: Blastocyst; Fate map of early blastula of chick. 5) Gastrulation: Morphogenetic movements (invagination, involution, ingression, epiboly) and formation of three germ layers. Concept of embryonic induction and organogenesis. 6) Extra-embryonic membranes in chick. Axis formation in <i>Drosophila</i> . Types and functions of placenta. 7) Regeneration: Epimorphic (Axolotl limb), morphallactic (<i>Hydra</i>), and compensatory (mammalian liver). 8) Concept of stem cell therapy and teratogens.	20
		80
Pedagogical approaches: Lecture, group discussion, problem solving, project, student seminar.		

Suggested Readings
1) Nelson DL, Cox MM (2017). Lehninger Principles of Biochemistry (7/8th ed.). WH Freeman. 2) Berg JM, Tymoczko JL, Gatto GJ, Stryer L (2015). Biochemistry (8th ed.). WH Freeman. 3) Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA (2018). Harper's Illustrated Biochemistry (31st ed.). McGraw-Hill Education. 4) Voet D, Voet JG, Pratt CW (2016). Fundamentals of Biochemistry: Life at the Molecular Level (5th ed.). John Wiley & Sons. 5) Barret K, Brooks H, Boitano S, Barman S (2010). Ganong's Review of Medical Physiology (23rd ed.). Lange Medical. 6) Guyton AC, Hall JE (2006). A Textbook of Medical Physiology (11th ed.). Saunders. 7) Keele CA, Neil E (1989). Samson Wright's Applied Physiology (13th ed.). Oxford.

- 8) Tortora GJ, Derrickson BH (2009). Principles of Anatomy and Physiology (12th ed.). John Wiley and Sons, Inc.
- 9) Chatterjee CC (2020). Human physiology: VOL 1 & 2 (13th ed.). CBS Publishers.
- 10) Balinsky UK (2012). Embryology (5th ed.). Thompson Brooks Cole (India) Pvt. Ltd.
- 11) Carlson BM (2014). Human Embryology and Developmental Biology (5th Ed.). Elsevier
- 12) Gilbert SF (2010). Developmental Biology, IX Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA.
- 13) Rastogi VB (2012). Chordate Embryology (1st ed.). Kedar Nath Ram Nath
- 14) Verma PS, Agarwal VK (2005). Chordate Embryology. S. Chand & Company Ltd., New Delhi.

Course Name: Entomology, Fisheries and Livestock Management Course Code: MSCASCMC803					
Course Type: Major Coursework (Theoretical)	Course Details: MC-7			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Understand insect classification, morphology, and internal body systems, and explain the process and hormonal regulation of metamorphosis in insects.
- Identify major agricultural pests and beneficial insects, and evaluate different pest management strategies IPM.
- Distinguish major fish groups, and apply knowledge of different aquaculture systems.
- Develop an understanding of the breeds of small and large ruminants.
- Understand the importance and scope of animal husbandry and small ruminant rearing.
- Learn the basics of management of domestic animals.
- Develop entrepreneurship in applied entomology, fisheries and livestock.
- **Contribution to Indian Knowledge System (IKS):** Contributes to IKS through traditional knowledge of insects, fisheries, indigenous livestock breeds, and animal husbandry practices. It connects modern animal science with Indian practices of sustainable farming and animal management.

Unit	Course content	Hours
I	General Entomology: 1) Classification of insects up to orders. 2) General body plan and morphology of insects. 3) General structure of insect body systems: Integumentary, digestive, circulatory, respiratory, and excretory systems. 4) Metamorphosis: Types, hormonal control.	20
II	Applied Entomology: 1) Beneficial insects: General idea, economic importance. 2) Common pests of paddy, sugarcane, jute, cotton, and stored grains in India (damage and management). 3) Basics of pest control measures: Physical, cultural, chemical, and biological. 4) Concept of Integrated Pest Management (IPM).	20
III	Fisheries: 1) Outline classification of fishes up to sub-classes. Distinctive characters of major fish orders: Cypriniformes, Siluriformes, Clupeiformes, Perciformes, Mugiliformes, Synbranchiformes. 2) Concept of different culture systems: Extensive, intensive, semi-intensive, fresh water, brackish water, coastal, hill stream, cage, pen, and race way. 3) Inland fisheries: Cultivable fishes, pond management, composite culture, induced breeding. 4) Indian traditional knowledge on fishing gears. Fish products. 5) Common diseases of fish. 6) Concept of prawn culture, pearl culture, shellfish culture, and ornamental fish.	20
IV	Livestock Management: 1) Cattle breeds: Sahiwal, Red Sindhi, Gir, Tharparkar, Hariana, Bachaur, Holstein Friesian, Jersey, Brown Swiss; buffalo breeds: Murrah, Niliravi, Surti, Jaffarabadi, Mehsana and Bhadawari.	20

2) Breeds of goats: Sannen, Toggenberg, Boer, Jamunapari, Barbari, Betal, Black Bengal, Surti, Chegu, Changthangi and Ganjam; Breeds of sheep: Merino, Rambouillet, Garole, Nilgiri, Bikaneri/Magra, Sonadi, Malpura, Nali, Pugal, Chokla and synthetic breeds 3) Different methods of marking animals, with advantages and disadvantages of each method. Dental formula of cattle and Buffalo and ageing of animals-determination of age by use of dentition. Grooming, Dipping, Castration (open and closed methods), Isolation, and Quarantine. 4) Housing systems, Layout, and design of different buildings for dairy animals. Differences between conventional and loose systems of housing. Differences between the head-to-head and tail-to-tail systems of housing. Management and care of calves at the time of birth and later; management of heifers and detection of heat in cows and heifers; management and care of pregnant, lactating, and dry animals. Care and management of goats and sheep.	
	80
<i>Pedagogical approaches:</i> Lecture, group discussion, problem solving, project, student seminar.	

Suggested Readings

- 1) Richards OW, Davies RG (1977). Imms General Text Book of Entomology (Vol I) Structure, Physiology & Development. Chapman & Hall.
- 2) Richards OW, Davies RG (1977). Imms General Text Book of Entomology (Vol II) Classification & Biology. Chapman & Hall.
- 3) Chapman RF (2013). The Insects: Structure and Function. Cambridge University Press.
- 4) Gullan PJ, Cranston PS (2014). The Insects: An Outline of Entomology. Wiley Blackwell.
- 5) Tembhare DB (1997): Modern Entomology. Himalaya Publishing House.
- 6) Nelson JS (2006): Fishes of the World (4th ed.). Wiley.
- 7) Srivastava CBL (1999). Fish Biology. Narendra Pub. House.
- 8) Jhingran VG (1991). Fish and Fisheries of India, 3rd ed. Hindustan Pub. Corp. John Wiley & Sons.
- 9) Pillay TVR, Kutty MN (2005). Aquaculture: Principles and Practices (2nd ed.). Blackwell Publ.
- 10) ICAR (2011). Handbook of Fisheries and Aquaculture. ICAR, New Delhi.
- 11) Banerjee GC (2019). A Textbook of Animal Husbandry. 8th edition. Oxford.
- 12) Singh GD (2021). Animal Husbandry. Anmol Publishers.
- 13) Ghosh N (2019). Livestock Production Management. PHI Learning Pvt Ltd.
- 11) Sastry NSR, Thomas CK (2021). Livestock production and management. Kalyani Publ.
- 14) Gupta SK, Amrutkar S (2020). Comprehensive Book on Goat Farming. Narendra Publ House.
- 15) Tormey JL, Lowry RC (2023). Animal Husbandry. MJP Publishers.
- 16) ICAR (2015). Handbook of Animal Husbandry. Promilla Publisher.
- 17) Campbell D (2017). Sustainable Livestock Production. Koros Press.

Course Name: Practical II Course Code: MSCASCMC804					
Course Type: Major Coursework (Practical)	Course Details: MC-8			L-T-P: 0 - 0 - 10	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60		40	

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Understand aquatic ecosystems and biodiversity assessment methods.
- Develop skills in ecological sampling and environmental analysis.
- Study animal behaviour and biological responses through practical experiments.
- Apply biochemical and physiological techniques in animal studies.
- Identify developmental stages, insects, and aquatic organisms.
- Engage in **experiential learning**.
- **Contribution to Indian Knowledge System (IKS):** Promotes the Indian tradition of observing, documenting, and sustainably utilizing biodiversity, natural resources, agriculture, fisheries, and ecological systems through scientific and field-based knowledge.

Course content	Hours
Ecology and Environment: 1) Study of an aquatic ecosystem: Spot identification of zooplanktons (up to Class). 2) Determination of pH, dissolved O ₂ (Winkler's Method), free CO ₂ and Chloride in water. 3) Sampling using the quadrat method (estimate density, frequency, abundance, and calculate Important Value Index). 4) Biodiversity Indices (calculate Shannon-Wiener Index, Simpson's Index, and species richness using field data). Toxicology: 5) Probit analysis for LC ₅₀ determination (from the data provided). 6) Study of tissue damage using trypan blue dye. Behavioural Biology: 7) Study the phototaxis behaviour in insect larvae and geotaxis behaviour in earthworms. 8) Study of circadian functions in humans (daily eating, sleep and temperature patterns). Biochemistry: 9) Qualitative test for reducing sugars (Benedict's test), starch (iodine test). 10) Estimation of total protein (Lowry method), DNA (DPA method) and RNA (Orcinol method), total lipid (Sudan III method), and cholesterol (ZAK's method). 11) Assay of salivary amylase under optimum conditions and determination of the enzyme kinetics. Physiology: 12) Haematology: blood film, TC, DC, estimation of haemoglobin, blood group, use of sphygmomanometer. 13) Microtomy: Tissue processing, block preparation, section cutting and staining. 14) Identification of mammalian tissues: stomach, intestine, pancreas, liver, kidney, testis, ovary, thyroid, adrenal, and pituitary. Developmental Biology: 15) Study of developmental stages of frog through permanent slides/photographs: cleavage, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages). 16) Study of development of chick embryo: 24, 48, 72, and 96 hours. 17) Study of developmental stages and life cycle of <i>Drosophila</i> from stock culture.	160

Entomology: 18) Identification with economic importance: <i>Bombyx mori</i>, <i>Kerria lacca</i>, <i>Leptocorisa acuta</i>, <i>Pyrilla perpusilla</i>, <i>Apion corchori</i>, <i>Helicoverpa armigera</i>, <i>Sitophilus oryzae</i>. 19) Mounting: Types of insect antennae and legs. 17) Dissection: Digestive system, reproductive system, and nervous system of cockroach. Aquaculture and Fisheries: 20) Identification with economic importance: <i>Penaeus monodon</i>, <i>Pinctada fucata</i>, <i>Perna indica</i>, <i>Labeo rohita</i>, <i>Clarias magur</i>, <i>Oreochromis</i>, <i>Monopterus</i>, <i>Pampus argenteus</i>, <i>Lates calcarifer</i>. 21) Mounting: Types of scales in fish. 22) Dissection: Pituitary of carp. 23) Field visit to economically important insect rearing/ aquaculture/ ecologically important places and submit a report. 24) Laboratory Notebook/Records.	
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<i>Pedagogical approaches and format for assessments:</i>	
CA (60 marks)	ESE (40 marks)
1) Practical Class Test: 10 2) PPT/Poster Presentation: 10 3) Attendance/Participation in Class: 10 4) Field Visit/Excursion: 10 5) Laboratory Notebook: 10 6) Viva: 10	1) Identification: 2x4 = 8 2) Dissection/Mounting/Experiment: 2x8 = 16 3) Field/Excursion Report: 5 4) Laboratory Notebook: 5 5) Viva: 6

Suggested Readings
1) Sinha JK, Chatterjee AK & Chattopadhyay P (2015). Advanced Practical Zoology. Books and Allied (P) Ltd. 2) Ghosh KC & Manna B (2015). Practical Zoology, New Central Book Agency, Kolkata. 3) Lal SS (2016). Practical Zoology - Invertebrate. Rastogi Publication. 4) Lal SS (2016). Practical Zoology - Vertebrate. Rastogi Publication. 5) Southwood TRE, Henderson PA (2000). Ecological Methods (3rd ed.). Blackwell Sci 6) Paul A (2022). Practical Zoology. Books & Allied Pvt. Ltd., Kolkata. 7) Sadasivan S, Manikam A (2022). Biochemical Methods (3rd ed.). New Age International Pvt. Ltd. 8) Boyer R (2002). Modern Experimental Biochemistry (3rd ed.). Pearson India. 9) 10)

Course Name: Public Health and Hygiene Course Code: MSCASCMN801					
Course Type: Minor (Theoretical)	Course Details: MNC-2			L-T-P: 5 - 0 - 0	
Credit: 5	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		70

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

- Understand the principles of community health and preventive medicine.
- Analyze determinants of health at individual, family, and community levels.
- Understand the importance of zoonotic, emerging and re-emerging diseases.
- Take preventive measures to prevent any disease incidence in the community.
- **Contribution to Indian Knowledge System (IKS):** Integrates India's traditional holistic approach to health, hygiene, nutrition, sanitation, environmental care and disease prevention with modern public health practices for promoting individual and community wellbeing.

Unit	Course content	Hours
I	Concept of Health & Disease: 1) Definitions of health and disease, physical health, mental health, spiritual health and social wellbeing. Concept and scope of community health. 2) Health indicators and determinants of health, morbidity, mortality rate, pathology and pathological basis of the study of disease. 3) Role of health systems and government policies implemented to control diseases.	20
II	Communicable Diseases: 1) Principles of communicable diseases. Prevention and control of communicable diseases. 2) Aetiology, pathogenesis and treatment of tuberculosis, anthrax, rabies and influenza. 3) Immunisation, vaccine-preventable diseases. 4) Infectious disease epidemiology, contamination, infestation, contagious disease, epidemic, endemic, sporadic, pandemic and zoonotic diseases.	20
III	Non-communicable Diseases: 1) Principles of non-communicable diseases. Prevention and control of non-communicable diseases. 2) Epidemiology of cardiovascular diseases, diabetes, cancers. Lifestyle modification and preventive strategies. 3) Diseases caused by metabolic defects, environmental hazards, deficiency diseases. 4) Predisposing causes of diseases: definitive, viable, nutritional and physical causes - traumatic injuries.	20
IV	Environment and Nutrition: 1) Water, sanitation, and hygiene (WASH). Air pollution and health impacts. 2) Waste management and vector control. 3) Occupational hazards and preventive strategies. 4) Principles of nutrition in health and disease. Traditional Indian Systems of Health, Hygiene and Preventive Healthcare: 5) Ayurveda, Yoga, Dinacharya (daily healthy practices), Ritucharya (seasonal health practices), traditional sanitation, nutrition and community health practices.	20
		80

Pedagogical approaches: Lecture, group discussion, problem solving, project, student seminar.

Suggested Readings

- 1) Park K (2021). Park's textbook of preventive and social medicine (26th ed). Banarsidas Bhanot Publishers.
- 2) Gupta MC, Mahajan BK (2013). Textbook of preventive and social medicine (4th ed). Jaypee Brothers Medical Publishers.
- 3) Beaglehole R, Bonita R, Kjellström T (2006). Basic epidemiology (2nd ed). World Health Organization.
- 4) Detels R, Gulliford M, Karim QA, Tan CC (Eds). (2015). Oxford textbook of global public health (6th ed). Oxford University Press.
- 5) Gordis L (2014). Epidemiology (5th ed). Elsevier Saunders.
- 6) Kumar P, Clark M (2016). Kumar & Clark's clinical medicine (9th ed). Elsevier. (Useful for integrating preventive medicine with clinical practice.)
- 7) WHO (2010). International health regulations (2005) (2nd ed). World Health Organization.
- 8) Jha P, Chaloupka FJ (2000). Tobacco control in developing countries. Oxford University Press.
- 9) Bonita R, Beaglehole R, Kjellström T (2006). Basic epidemiology (2nd ed). World Health Organization.
- 10) Sundar S (2018). Textbook of community medicine: Preventive and social medicine. CBS Publishers & Distributors.
- 11) Kumar R (2017). Essentials of community medicine. CBS Publishers & Distributors.
- 12) Holland WW, Detels R, Knox G (Eds). (2007). Oxford textbook of public health (5th ed). Oxford University Press.
- 13) Friis RH, Sellers TA (2020). Epidemiology for public health practice (6th ed) Jones & Bartlett Learning.
- 14) Leavell HR, Clark EG (1965). Preventive medicine for the doctor in his community: An epidemiologic approach. McGraw-Hill. (Classic text introducing levels of prevention.)
- 15) WHO (2014). World health statistics 2014. World Health Organization.

Course Name: Vocational Course Course Code: VC201					
Course Type: VC (Practical)	Course Details: RDC-1			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30		20	

Course Learning Outcomes:

After the completion of the course, the students will have the ability to:

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Guideline