

Semester III

MAJOR 3: Cell Biology (Paper Code: UZOOMAJ23003)

Paper Type: Theory + Practical Lab Based [TH+PLB]

Credit: 4 (Theory 3+ Practical 1)

Class Hours: 75 hrs (Theory 45 hrs. + Practical 30 hrs.)

Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)

Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)

Syllabus:

Theory	Class Hour(s)
Unit I: Overview of cells	02
• Basic structure of prokaryotic cells (<i>E. coli</i>). • Major differences between prokaryotic and eukaryotic cells.	
Unit II: Plasma membrane	06
• Structure of plasma membrane: Fluid mosaic model. • Passive transport: Facilitated diffusion of glucose. • Active transport: Transport via Na⁺/K⁺ pump.	
Unit III: Nucleus	05
• Structure: Nuclear envelope and nucleolus. • Types of chromatins. • Packaging of chromatin fibre (Nucleosome model and Solenoid model).	
Unit IV: Cell organelles: Endomembrane system	09
• Endoplasmic Reticulum: Structure and function of RER and SER. • Golgi Apparatus: Organization and function. • Lysosome: Types, function. • Overview of vesicular transport of proteins through GERL system.	
Unit V: Cell organelles: Mitochondria and Centrosome	06
• Mitochondria: Structural organization and function. • Centrosome: Structure and function. Role in cell division.	
Unit VI: Cytoskeleton	05
• Types and function. • Microfilament: Organization, motor protein (myosin). • Microtubule: Organization, motor proteins (kinesin and dynein).	
Unit VII: Cell Division	06
• Cell cycle: Phases and regulation (various checkpoints and Cdks). • Mitosis: Process and significance. • Meiosis: Process and significance.	
Unit VIII: Cell Signaling	06
• G-protein mediated cell signaling <i>via</i> glucagon • Receptor tyrosine kinase mediated cell signaling <i>via</i> insulin	

Practical

30 Hours

- ❖ Study of the microscope: Simple and Compound.
- ❖ Study of Chromosomes: Polytene and Lampbrush chromosomes.
- ❖ Micrometry: Measurement of the microscopic object using a micrometer (Single cell).
- ❖ Study of cell: Preparation of temporary mount of human buccal epithelial cells.
- ❖ Temporary preparation of mitotic cells from onion root tips
- ❖ Temporary preparation of meiotic cells from short-horned grasshopper testes.

Evaluation Structure for end semester practical examination:

1. Measurement of the diameter of a cell using a micrometer (**6 marks**): Calibration of an ocular micrometer using a stage micrometer (3 marks) and measurement of the cell using an ocular micrometer (3 marks).
2. Temporary mount of the buccal epithelial cell (self) (**4 marks**): Preparation (3 marks), Mounting (1 mark).
3. Identification of polytene or lamp brush chromosome (any one) from permanent slide or photograph (**2 marks**): Identification ($\frac{1}{2}$ mark) and characters ($1\frac{1}{2}$ mark).
4. Identification of mitotic/meiotic cell divisional phase (**any two**) from onion root tip/grasshopper testes (from permanent slide or photograph) (**4 marks**): Identification ($\frac{1}{2}$ mark) and characters ($1\frac{1}{2}$ mark).
5. Laboratory Note Book: 2 marks (Based on neatness, inclusiveness, overall presentation, and regularity).
6. Viva-Voce: 2 marks (Testing of Knowledge in the said Course).

Suggested Readings

1. Karp, G. (2009). Cell and Molecular Biology: Concepts and Experiments. VI Edition John Wiley and Sons. Inc.
2. Iwasa J. and Marshall W. (2020). Karp's Cell and Molecular Biology: Concepts and Experiments. IX Edition John Wiley and Sons. Inc. K
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Cooper, G.M. (2018). The Cell: A Molecular Approach. VIII Edition. Sinauer Associates: Oxford University Press, New York
5. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
6. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London
7. Lodish, H., D. Baltimore, A. Berk, L. Zipursky, M. Matsudaira and J. Darnell. (2010). Molecular Cell Biology, III Edition, Scientific American & W. H. Freeman. New York.
8. Powar C B. (2019): Cell Biology, III Edition, Himalaya Publication, Meerut

MAJOR-4: Biochemistry: Fundamentals (Paper Code: UZOOMAJ23004)**Paper Type: Theory + Practical Lab Based [TH+PLB]****Credit: 4 (Theory 3+ Practical 1)****Class Hours: 75 hrs (Theory 45 hrs. + Practical 30 hrs.)****Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)****Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)****Syllabus:**

Biochemistry: Fundamentals [3 Credits, 45 hrs]	
Theory	Class hour(s)
Unit I: Foundation of Biochemistry	06
Chemical basis of life: • Carbon in Biomolecules • Important functional Groups (Alcohol, Ketone, Aldehyde, Carboxylate, Ester, Ether, Amide, Amine) • Important chemical bonds (Covalent, Ionic, Hydrogen, Hydrophobic interaction and van der Waals force)	
Unit II: Carbohydrates	08
Structure and significance: • Monosaccharides – structure of aldoses and ketoses sugars, ring structure of sugars, mutarotation, anomers, epimers and enantiomers • Disaccharides – reducing and non-reducing disaccharides, • Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides.	
Unit III: Lipids	10
Structure and significance: • Building blocks of lipids - fatty acids. • Storage lipids - triacyl glycerol and waxes. • Structural lipids in membranes – glycerophospholipids, sphingolipids, glycolipids, and sterols, • Lipids as signals, cofactors and pigments	
Unit IV: Proteins	09
Amino acids: • Basic structure • Classification of standard amino acids based on R groups. Proteins: • Levels of organization: primary, secondary, tertiary and quaternary, Ramachandran plot.	
Unit V: Nucleic Acids	08
Structure and significance: • Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids. • Types of DNA and RNA	

- Hypo- and Hyperchromaticity of DNA.

Unit VI: Enzymes

04

Types and functions:

- Classification of enzymes based on enzyme activity
- Coenzymes, Cofactors, Isozymes, Allosteric enzymes, Ribozyme,

PRACTICAL: Biochemistry-Fundamentals [1 Credits, 30 Hours]

- Qualitative tests of functional groups in carbohydrates (Molisch's Test, Iodine test, Fehling's Test/Benedict's Test, Barfoed's Test, Seliwanoff's Test)
- Qualitative tests of functional groups in proteins (Biuret test, Millon's test)
- Qualitative tests of functional groups in lipids (Saponification).
- Paper chromatography/TLC of amino acids.
- Demonstration of proteins separation by SDS-PAGE

Evaluation Structure for end semester practical examination:

1. Qualitative study of Carbohydrate/Protein/Lipid (**8 marks**): Table showing principle, procedure, observation and inference (3 marks), Workout (4 marks), Result and inference (1 mark).
2. Paper chromatography/ Thin Layer Chromatography (**8 marks**): Principle (2 marks), Workout (Sample charging, Placing the paper in the chamber, ninhydrin spraying, development of spot) (3 marks), Rf Calculation (2 marks), Identification of analyte (1 mark) [Amino acids to be given (mixture of any two) – Valine, Leucine, Arginine and Lysine]
3. Laboratory Note Book (**2 marks**): (Based on the neatness, inclusiveness, overall presentation and regularity).
4. Viva-voce (**2 marks**): (Testing of Knowledge in the said Course)

Suggested Readings:

1. Nelson, D.L., Cox, M.M. (2017). Lehninger: Principles of Biochemistry (7th ed.). New York, WH: Freeman Company.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

MAJOR 5: Ecology (Paper Code: UZOOMAJ23005)**Credit: 4 (Theory 3+ Practical 1)****Class Hours: 75 hrs. (Theory 45 hrs.+ Practical 30 hrs.)****Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)****Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)****Syllabus:**

Theory	Class Hour(s)
Unit 1: Introduction to Ecology	04
• Autecology and synecology. • Levels of organization. • Laws of limiting factors, Study of Physical factors (light, precipitation, temperature).	
Unit II: Population	15
• Unique and group attributes of population: Demographic factors, life tables, fecundity tables (definitions), survivorship curves, dispersal, and dispersion. • Exponential and logistic growth, r and k strategies, Population regulation - density-dependent and independent factors. • Population Interactions: commensalism, ammensalism, mutualism, predation, competition, and parasitism. • Gause's Principle, Lotka-Volterra equation for competition.	
Unit III: Community	09
• Community characteristics: species diversity, abundance, dominance, richness. • Vertical stratification, Ecotone, and edge effect. • Ecological succession (in reference to hydrosere).	
Unit IV: Ecosystem	12
• Ecosystem structure and function: Types of Ecosystem (Pond, Grassland & Forest Ecosystem) • Food chain: Grazing and detritus food chains, Linear and Y-shaped food chains, Foodweb. • Energy flow through the ecosystem, Ecological pyramids • Nutrient and biogeochemical cycle with an example of Nitrogen cycle	
Unit V: Biomes	05
• Factors that Make a Biome and Biomes classification • Types and characteristics of biomes (Tropical Rainforest, Temperate Forest, Taiga, Tundra, Savannah, Desert, Freshwater, Marine) • Significance of Biomes	

Practical	30 Hours
❖ Determination of population density in a natural/hypothetical community by quadrature method and calculation of Shannon-Weiner diversity index for the same community. ❖ Study of an aquatic ecosystem: • Population density of zooplankton (by Sedgewick Rafter scale) • Estimation of Dissolved Oxygen content (Winkler's method). • Estimation of Total Alkalinity. • Estimation of Free CO₂.	

Evaluation Structure for end semester practical examination:

1. Calculation of the Shannon-Wiener Diversity Index from the provided data **(6 Marks)**: Principle (1Mark), Calculation (4 Marks), Inference (1 Mark).

OR

Calculation of population density of zooplankton **(6 Marks)**: Principle (1 Mark), Calculation (4 Marks), Inference (1 Mark).

2. Estimation of Dissolved Oxygen/Free CO₂/Alkalinity **(10 Marks)**: Principle (2 Marks), Workout (4 Marks), Calculation (3 Marks), Comment (1 Mark).
3. Laboratory Note Book **(2 marks)**: (Based on the neatness, inclusiveness, overall presentation and regularity).
4. Viva-voce **(2 marks)**: (Testing of knowledge in the said Course)

Suggested Reference Books
1. Stilling, P. (2001): Ecology: Theories & Application. 4th Edition 2. Odum, E.P. (2008): Fundamentals of Ecology. Indian Edition. Brooks/Cole 3. Smith, T. M., and Smith R. L. (2016): Elements of Ecology. 8th Ed. Pearson Education. 4. Begon, M., Harper J. L. and Townsend, C. R. (2006): Ecology: Individuals, Populations & communities. 4th Ed. Blackwell Publishing Ltd. 5. Ricklefs, R. E. and Miller, G. L. (2000): Ecology. 4th Ed. W. H. Freeman & Company. 6. Sinclair, A. R. E., Fryxell, J. M. and Caughley, G. (2006): Wildlife Ecology, Conservation, and Management. 2nd Edition. Blackwell Publishing Ltd 7. Krebs, C. J. (2016): Ecology: The Experimental Analysis of Distribution and Abundance. 6th Ed. Pearson India Education Ltd. 8. Sutherland, W. J. (2000): The Conservation Handbook: Research, Management & Policy. Blackwell Publishing Ltd. 9. Sodhi, N.S. and Ehlich, P. R. (2010): Conservation Biology for All. Oxford University Press. 10. Cunningham, W. P. and Cunningham, M. A. (2008): Environmental Science- A Global Concern. McGraw-Hill. 11. Darlington, Philip J Jr. (1966) Zoogeography: The geographical distribution of animals. John Wiley

SEC 3: Pest Management and Medical Diagnostics (Paper Code: UZOOSEC23003)**Paper Type: Theory + Practical Lab Based [TH+PLB]****Credit: 3 (Theory 2+ Practical 1)****Class Hours: 60 hrs. (Theory 30 hrs. + Practical 30 hrs.)****Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)****Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)****Syllabus**

Theory	Class Hour(s)
A. Pest Management	
Unit I: Introduction	02
- Economic classification of different pests - Nature of damages.	
Unit II: Types of Common Pests	03
- Structure-infesting pests: Identification and management. - Invading pests: Identification and management. - Rodents and other vertebrate pests: Identification and management.	
Unit III: Pest infestation detection	02
Types of detection: Physical, Chemical, and Mechanical techniques.	
Unit IV: Types and Basic Concept of Pest Control Techniques	03
- Biological pest control. - Mechanical pest control. - Chemical pest control.	
Unit V: Methods of Pest Control	05
- Pesticides: Preparing formulations, application techniques, health and environmental concerns, and safety protocols. - Common Techniques: Traps, Chemical repellents, Poisoned bait, Fumigation, Bio-pesticides, Electric fencing. - Integrated Pest Management (IPM)	
B. Medical Diagnostics	
Unit I: Introduction to Medical Diagnostics	01
Introduction to Medical Diagnostics and its importance.	
Unit II: Blood – Composition and Function	03
- Blood cell types and their functions - Blood plasma - Basic concept of blood grouping - Types of Anaemia	
Unit III: Urine – Composition and Function	03
- Physical characteristics. - Abnormal constituents in Urine.	
Unit IV: Imaging Techniques	03
Medical imaging: Ultrasonography, X-ray of Bone fracture, PET, MRI, and CT scan (using reference photographs).	
Unit V: Disorders	03
- Diabetes (Type I and Type II): causes, symptoms, diagnosis and prevention. - Thyroidism: types, causes, symptoms, diagnosis and prevention. - Hypertension (Primary and secondary): Causes, symptoms, diagnosis and prevention.	
Unit VI: Infectious Diseases	02

Practical	30 Hours
❖ Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain ❖ ABO Blood grouping and RH factor. ❖ Haematin crystal observation ❖ Estimation of Haemoglobin by Sahli's method. ❖ Pest study (either from museum specimens or photographs) • Structural pests: Termites, Cockroach, Ants, Beetles, Silverfish • Invading pests: Houseflies, Mosquito, Wasps, Spider, Ticks, Mites, Bedbugs, Lice • Vertebrate pests: Rats, House Mice, Birds ❖ Study of damage symptoms: Termites, Ants, Lice, Beetles, Rodents, Birds, ❖ Study of pest detection equipment: Inspection Mirror, LED Flashlight, Infrared Temperature Sensor, Night Vision Cameras, Rodent Traps, Aspirator, pitfall trap.	

Evaluation Structure for end semester practical examination:

1. Identification of specimen (Four) – Diagnostic characters – 1½ Marks, Identification – ½. Total Marks = 8 (2×4) Marks
2. Estimation of Hb by Sahil's method (Principle – 2, Workout – 5, Comment – 1) Total Marks = 8 Marks

OR

Observation and identification of ABO blood group (Principle – 2, Workout – 5, Comment – 1)
Total Marks = 8 Marks

OR

Counting of different leucocytes using Leishman's stain (Principle – 1, Workout – 4, Calculation – 2, Comment – 1) Total Marks = 8 Marks

3. Laboratory Note Book: 2 marks (Based on neatness, inclusiveness, overall presentation, and regularity).
4. Viva-Voce: 2 marks (Testing of Knowledge in the said Course)

Suggested Readings:
1. Carolyn Randall (Ed). 1998. General Pest Management A Guide for Commercial Applicators. Michigan State University Extension 2. Thalya, P.R. and Chandra, R. 2022. Essentials of Pest Management: Key Information on Pest Identification and its Management. Wings Publication. pp. 263. 3. Evans, J. W. 2006. Insect Pests and Their Control. Asiatic Publishing House. pp. 178. 4. Sridhara, S. 2016. Vertebrate Pests in Agriculture. Scientific Publishers. pp. 513. 5. Fischbach, F.T. and Dunning, M.B. (2015) A Manual of Laboratory and Diagnostic Tests. Lippincott Williams & Wilkins, Philadelphia. 6. Cheesbrough M., J. McArthur (1976). A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses, Churchill Livingstone ISBN: 9780443011443 7. Godkar P.B. and Godkar D.P. (2014). Textbook of Medical Laboratory Technology, 3rd Edition, Bhalani Publishing House 8. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand

Semester IV

MAJOR 6: Genetics (Paper Code: UZOOMAJ24006)
Paper Type: Theory + Practical Lab Based [TH+PLB]
Credit: 4 (Theory 3+ Practical 1)

Class Hours: 75 (Theory 45 hrs. + Practical 30 hrs.)

Full Marks: 75 (Theory 40+ Practical 20 +Continuous Evaluation 10 + Attendance 05)

Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)

Syllabus:

Theory	Class Hour(s)
Unit I: Elements of heredity and variation	05
- Mendel and his experiments - Principles of segregation and independent assortment and their chromosomal basis - Test cross - Application of laws of probability to Mendelian inheritance	
Unit II: Extension of Mendelism	08
- Dominance relationships (Complete dominance, Incomplete dominance and Co-dominance) - Multiple Allelism (with reference to human blood group) - Lethal alleles - Pleiotropy - Epistasis (Dominant and recessive epistasis) - Penetrance and expressivity - Phenocopy - Polygenic inheritance - Sex-linked, sex-influenced, and sex-limited inheritance	
Unit III: Cytoplasmic and infective inheritance	04
- Criteria for extrachromosomal inheritance, - Kappa particle in <i>Paramecium</i> - Shell spiralling in snail	
Unit IV: Linkage	08
- Linkage and Crossing Over - Molecular mechanism of crossing over (Holliday model), - Measuring Recombination Frequency and Linkage intensity using three-factor crosses, - Interference and Coincidence	
Unit V: Mutations	08
- Types of gene mutations (Classification), - Types of chromosomal aberrations (Classification with one suitable example of each), - Non-disjunction and variation in chromosome number; - Molecular basis of mutations in relation to UV light and chemical mutagens	
Unit VI: Sex chromosomes and sex determination	04
- Sex chromosome systems: XX/XO, XX/XY, ZZ/ZW, and haploidy/diploidy types - Mechanisms of sex determination in <i>Drosophila</i> - Sex Determination in Human - Dosage Compensation in <i>Drosophila</i> & Human	
Unit VII: Human Genetics	04
- Karyotype, banding, nomenclature of chromosome subdivisions, and genetic map - Genetic disorders: ➤ Chromosomal aneuploidy (Down, Turner, Klinefelter syndromes) ➤ Chromosome translocation (chronic myeloid leukemia) and deletion ("Cri-du-chat syndrome)	
Unit VIII: Recombination in Bacteria and Viruses	04
- Conjugation - Transformation	

Practical	30 Hours
❖ Application of probability in the law of segregation with coin tossing. ❖ Study of mode of inheritance of the following traits by pedigree charts. ❖ Study of human karyotypes and numerical alterations (Down syndrome, Edward syndrome, Patau Syndrome, Klinefelter syndrome, Turner syndrome). ❖ Study of structural chromosome aberrations (dicentric, ring chromosome, and inversion in polytene chromosomes) from prepared slides/ photographs. ❖ Familiarization with techniques of handling <i>Drosophila</i>, identifying males and females: observing wild type and mutant (white eye, wingless, miniature wing, bristle-less, etc.) flies and setting up cultures. ❖ Linkage maps based on conjugation ❖ Chi-square analysis (goodness of fit)	

Evaluation Structure for end semester practical examination:

1. Pedigree analysis (genotyping of the individuals in the pedigree chart (3 marks), analysis (3 marks) and inference (1 marks). Total: 07 marks
2. Identification (one structural aberration, one numerical alteration, and one mutation of *Drosophila*) 3 x 3 marks (characters: 2 marks and identification: 1 mark) = 09 marks
3. Laboratory Note Book: 2 marks (Based on neatness, inclusiveness, overall presentation and regularity).
4. Viva-Voce: 2 marks (Testing of Knowledge in the said Course)

Suggested Readings
1. Simons, M.J., Principles of Genetics (1981) 2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. 3. Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino M.A., Killian D. Concepts of Genetics. 11th edition (2019) Pearson 4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings 5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. 28. 6. Klug, W.S., Concept of Genetics (2013) 7. Brooker, R., Genetics-Analysis and Principles, 7th edition 8. Jorde. L.B., Medical Genetics, 6th Edition (2020) 9. Gardner, J.E., Principles of genetics, 8th Edition (2015)

MAJOR 7: Ethology and Chronobiology (Paper Code: UZOOMAJ24007)

Credit: 4 (Theory 3+ Practical 1)

Class Hours: 75 hrs (Theory 45 hrs. + Practical 30 hrs.)

Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)

Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)

Syllabus:

Theory	Class Hour(s)
Unit I: Introduction to Animal Behaviour	05
• Basic concept of Ethology, • Brief contributions of Karl von Frish, Konrad Lorenz, Niko Tinbergen • Proximate and ultimate causes of behaviour • Significance of animal behaviour study	
Unit II: Patterns of Behaviour	12
• Stereotyped behaviours (Orientation, Reflexes) • Concepts of Fixed Action Pattern (FAP); Sign stimulus; Innate releasing mechanism (IRM) and Action Specific Energy (ASE) • Instinct vs. Learnt behaviour • Associative learning, Classical and Operant conditioning, Pavlov's Experiment, Habituation, Imprinting.	
Unit III: Social and Sexual Behaviour	10
• Social organization in animals (Lions, Monkeys): Eusociality, Co-operation • Altruism (Hamilton's Theory): Reciprocal altruism and Kin selection • Communication: Auditory, Visual, Chemical (Pheromones) and Tactile communication, Bee Dance Language • Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (malerivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.	
Unit IV: Introduction to Chronobiology	08
• Basic concept of chronobiology • Biological oscillation: the concept of average, amplitude, phase and period • Adaptive significance of biological clocks	
Unit V: Biological Rhythm	10
• Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of synchronization and masking; Photic and non-photoc zeitgebers • Photoperiod and regulation of seasonal reproduction of vertebrates; Role of melatonin.	

Practical	30 Hours
• Study of geotaxis behaviour in soil arthropod. • Study of phototaxis behaviour in soil arthropod/insect larvae. • Study of aggressive behaviour of fish (Fighter fish / Lata fish). • Study of learning behaviour of rat (T-maze) • Study of any particular animal behaviour and prepare a report supported by geotagged photographs on that behaviour, in wild or in captivity, emphasizing on the importance of that particular behaviour.	

Evaluation Structure for end semester practical examination:

1. Study of aggressive behaviour of fish (**8 marks**): Principle (2 marks), Observation and recording of behaviour (4 marks), Inference (2 marks)

OR

- Study of learning behaviour of rat (**8 marks**): Principle (2 marks), Observation and recording of behaviour (4 marks), Inference (2 marks)
2. Study of geotaxis/phototaxis behaviour in soil arthropod/insect larvae (**4 marks**): Principle (2 marks), Notes on Observation (2 marks)
3. Submission of field report (**4 marks**)
4. Laboratory Note Book (**2 marks**): (Based on neatness, inclusiveness, overall presentation, and regularity).
5. Viva-voce (**2 marks**): (Testing of Knowledge in the said Course)

Suggested Reference Books
1. Alcock, J. (2009): Animal Behaviour: An evolutionary approach. 9 th Ed. Sinauer Associate Inc., USA
2. Drickamer, L.C., Vessey, S.H. and Jacob, E. (2002): Animal Behaviour. 5th ed. McGraw Hill
3. Sherman, P. W. and Alcock, J. Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
4. Mathur, R. (2023). Animal Behaviour. 6 th Ed. Rastogi Publications.
5. Manning & Dawkins (1998): An Introduction to Animal Behaviour .5th ed. Cambridge.
6. Dunlap, J.C., Loros, J.J. DeCoursey , P. J.(eds). (2004): Chronobiology Biological Timekeeping. Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
7. Saunders, D.S.(2002). Insect Clocks. C.G.H. Stee, X,Vafopoulou, R.D. Lewis (eds.). 3 rd Ed. Barends and Noble Inc. New York, USA
8. Kumar, V. (2002) Biological Rhythms: Narosa Publishing House, Delhi/ Springer-Verlag,Germany.

MAJOR 8: Environment and Public Health (Paper Code: UZOOMA)24008)

Paper Type: Theory + Practical Lab Based [TH+PLB]

Credit: 4 (Theory 3+ Practical 1)

Class Hours: 75 hrs (Theory 45 hrs. + Practical 30 hrs.)

Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)

Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)

Syllabus:

Environment and Public Health [3 Credits, 45 hrs]	
Theory	Class hour(s)
Unit I: Introduction	03
• Sources of Environmental hazards, • Hazard identification and accounting, • Fate of toxic and persistent substances in the environment, • Biomagnification.	
Unit II: Climate Change	08
• Greenhouse gases and global warming, • Acid rain, • Ozone layer destruction, • Effect of climate change on public health	
Unit III: Pollution	10
• Sources, effects and control of air, water, noise pollution	
Unit IV: Waste Management Technologies	12
• Sources, types and characteristics of waste, • Sewage disposal and its management, • Solid waste disposal, • Biomedical waste handling and disposal, • Nuclear waste handling and disposal, • Waste from thermal power plant	
Unit V: Diseases	12
• Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid, filariasis	

PRACTICAL: Environment and Public Health [1 Credits, 30 Hours]
• Determination of pH in water and soil • Determination of turbidity of water body • Estimation of Cl, Hardness in water samples from different locations • Counting of dust particle in ambient air medium. • Visit to Auto/vehicle (Emission) pollution testing centre and submission of a report.

Evaluation Structure for end semester practical examination:

1. Determine the pH of water / soil **(4 marks)**: Principle (1 Mark), Workout (2 marks), comment (1 mark).

Or

Determine the turbidity of water body **(4 marks)**: Principle (1 Mark), Workout (2 marks), comment (1 mark).

Or

Calculate the dust particle in the ambient air and write its significance **(4 marks)**: Workout (3 marks), comment (1 mark).

2. Estimation of Cl/Hardness **(8 Marks)**: Principle (1 Marks), Workout (4 Marks), Calculation (2 Marks), Comment (1 Mark).

3. Submission of report **(4 marks)**

4. Laboratory Note Book **(2 marks)**: (Based on the neatness, inclusiveness, overall presentation and regularity).

5. Viva-voce **(2 marks)**: (Testing of knowledge in the said Course)

Suggested Readings:
1. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999. 2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996. 3. Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998. 4. Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V. N. University Press, New York, 2003. 5. Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.