



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in Zoology

SYLLABUS

Master of Science

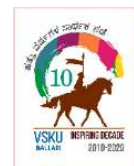
(III Semester)

With effect from:

2021-22



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY



Department of Zoology Jnana Sagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme I to IV Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

III – SEMESTER

With Practical

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	SEE	Total	L	T	P		
THIRD	DSC9	21ZOO3C9L	Reproductive Biology and Artificial Organs	30	70	100	4	-	-	4	3
	DSC10	21ZOO3C10L	Environmental Biology	30	70	100	4	-	-	4	3
	DSE1	21ZOO3E1AL	A) Human Physiology	30	70	100	4	-	-	4	3
		21ZOO3E1BL	B) Biophysics and Biostatistics								
		21ZOO3E1CL	C) Parasitology, Evolutionary Biology and Paleozoology								
	DSE2	21ZOO3E2AL	A) Immunology, Proteomics and Genomics	30	70	100	4	-	-	4	3
		21ZOO3E2BL	B) Biochemistry and Enzymology								
		21ZOO3E2CL	C) Neurobiology and Aging								
	GEC1	21ZOO3G1AL	A) Wild life conservation and management	20	30	50	2	-	-	2	1
		21ZOO3G1BL	B) Entrepreneurial Zoology								
		21ZOO3G1CL	C) Hormones and Diseases								
SEC3	21ZOO3S3LP	Research Methodology	20	30	50	1	-	2	2	1	
DSC9P7	21ZOO3C9P	Reproductive Biology and Artificial Organs Lab	20	30	50	-	-	4	2	4	
DSC10P8	21ZOO3C10P	Environmental Biology Lab	20	30	50	-	-	4	2	4	
Total Marks for III Semester						600				24	

Department Name: Zoology

Semester-III

DSC9: Reproductive Biology and Artificial Organs

Course Title: Reproductive Biology and Artificial Organs	Course code: 21ZOO3C9L
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Understand which factors determine the sex and phenotypic differentiation of the fetus
2. Compare and contrast the structure and functions of the male and female reproductive system. Significance of hormones in pregnancy, parturition and lactation.
3. Analyze the reasons for male and female infertility and narrate about the contraceptives
4. Know the importance of diet, exercise, stress and yoga during ageing.
5. Gather the knowledge about the principles, construction and control algorithms of artificial organs. Student knows the main features of biomaterials and the biocompatibility phenomena.
6. Know state of the art in Artificial Organ domain.

Unit	Description	Hours
1	Sex determination and differentiation: Mechanism of Sex determination, differentiation of gonad and the genital tract. Stem cell renewal in testis Spermatogenesis: structural and molecular events, experimental approaches to study spermatogenesis; Seminiferous epithelial cycle Sertoli cell: structure and function Leydig cell: generation of Leydig cell Steroidogenesis; Leydig and Sertoli cell proliferation during foetal and	11

	postnatal development; Regulation of testicular functions.	
2	<p>Functional morphology and hormonal regulation of male reproductive organs: Epididymis, Vas deferens, Prostate gland, Seminal vesicle, Coagulatory- gland, Cowper's gland</p> <p>Biochemistry of semen and biology of spermatozoa</p> <p>Anatomy of female reproductive system: Histoarchitecture of ovary, Folliculogenesis, Follicular atresia</p> <p>Mechanism of ovulation, Luteogenesis, Luteinization, Luteolysis and Luteal function</p> <p>Physiological role of estrogens</p> <p>Estrous cycle in mammals and its hormonal regulation</p> <p>Menstrual cycle and its hormonal regulation.</p> <p>Female reproductive disorder: amenorrhea, polycystic ovary.</p>	12
3	<p>Implantation: Types of implantation, sequence of events during implantation, decidual cell reaction, delayed implantation, cell adhesion molecules, growth factors, hormonal regulation.</p> <p>Placenta: Types and functions, developmental and physiologic anatomy, Placental hormones.</p> <p>Pregnancy: Corpus luteum, physiological changes during pregnancy, endocrine control of pregnancy, disorders of pregnancy.</p>	10
4	<p>Parturition: onset of parturition, stages of labor, hormonal control of parturition.</p> <p>Lactation: Morphological and functional development of mammary glands. Hormonal control of lactation.</p> <p>Reproductive technologies: In vitro fertilization. Gamete intrafallopian transfer. Surrogate pregnancy, gestational carrier. Fertility control in male and female.</p> <p>Age related reproductive disorders: Perimenopause, premenopause, postmenopausal disorders</p> <p>Effect of diet, nutrition, stress, disease, exercise, and yoga on reproductive aging.</p>	11
5	<p>Design of artificial organs: substitutive medicine, Biomaterial Concentration, Outlook for Organ Replacement, Design Consideration, Evaluation of Artificial Organs.</p> <p>Artificial blood: Artificial Blood: Plasmapheresis, Blood Substitutes, Hemodilution, Classification, Characterisation of substitutes.</p> <p>Artificial Liver: Liver Support Systems, Global Liver Function Replacement, Hybrid Liver Function Replacement.</p> <p>Artificial kidney: Renal Transplantation, Mass Transfer in Dialysis,</p>	12

	Membranes, Hemofiltration, Peritoneal Dialysis Equipment.	
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References:

1. Guyton and Hall. Text book of medical physiology, 2006.
2. Bentely, P.J. *Comparative Vertebrate Endocrinology-UI* Ed, Cambridge University Press, 1998.
3. Degroot, L.J. & Neill, J.D. (Eds). *Endocrinology Vol I-III* W.B. Saunders Co, 2001.
4. Hadley. Mac. E. *Endocrinology*. Prentice Hall International Inc, 1992.
5. Knobil, E and Neill, J.D. (Eds). *Encyclopedia of Reproduction. Vol. I-IV*. Academic Press, 1998.
6. Knobil, E and Neill, J.D. (Eds). *The Physiology of Reproduction II. Vol I and II*. Raven Press Ltd, 1994.
7. Mandal, A. *Handbook of Neuroendocrinology*. EMKAY Publications, 1994.
8. Nelson, R.J. *An Introduction to Behavioural Endocrinology*. Sinauer Associates Inc, 1995.
9. Turner, CD and Bagnara, J.T. *General and Comparative Endocrinology*, 1998.
10. Williams, RM. *Textbook of Endocrinology*. W.B. Saunders.
11. Martin, C.R *Endocrine Physiology*. Oxford University Press.
12. Saidapur.S.K. (Ed). *Reproductive Cycles of Indian Vertebrates*. Allied Publishers Ltd. New Delhi, 1989.
13. 'Tissue Engineering and Artificial Organs' By Joseph D.Bronzino.
14. "Artificial Organs" by Gerald E.Miller Morgan & Claypool Publisher.

DSC10: Environmental Biology

Course Title: Environmental Biology	Course code: 21ZOO3C10L
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Understand the critical issues facing the environment at local, regional, national and global scales
2. Prepares students as professional biologists with strong environment emphasis.
3. To gain the scientific perspective of the issues confronting our present day environment.
4. Analyze the national and global environment issues relating to atmosphere, water, soil and land use, biodiversity and natural resources (global warming, climate change, mineral extraction, and energy resources, environmental impact assessment)

Unit	Description	Hours
1	Our Environment: Atmosphere, Hydrosphere, Lithosphere; Biogeographical realms. Development and evolution of ecosystem; Components of ecosystem; Types of ecosystem including habitats. Energy flow in ecosystem: Food chain, food web; Trophic structure and energy pyramids; ecological energetics. Hydrologic cycle; Biogeochemical cycles (N, C, P cycles).	10
2	Natural resources; Renewable and Non-renewable resources. Forest resources; use and overexploitation; deforestation; conservation and sustainable management. Water resource; use and overutilization of surface and ground water; Floods; Drought; Conflicts over water usage; Dams -benefits and problems; conservation and sustainable management. Food resources: World food scenario; Effects of modern agriculture; Fertilizer-pesticide problems Land resource: Land classification and use ; Land degradation induced landslides, soil erosion, desertification.	12

	<p>Mineral resources (Metallic and Nonmetallic): Distribution, utilization, conservation and management.</p> <p>Energy resources: Conventional and non-conventional resources; Growing energy needs and sustainable management.</p>	
3	<p>Environmental pollution: definition, causes, effects and control measures of:-</p> <p>i) Air Pollution, ii) Water Pollution, iii) Soil pollution, iv) Noise pollution v) Thermal Pollution vi) Nuclear hazards</p> <p>Solid waste management; Causes, Effects and control measures. Biomedical waste management: Causes, effects and control measure Human ecology: values and ethics of human environment; Population growth and related issues; Environment and human health; Human rights.</p>	10
4	<p>Toxic Pollutants and their impact on non-target flora, fauna and humans. Biodegradation, biotransformation, biomagnification and bioaccumulation of toxicants. Monitoring environmental pollutants: Physical and chemical methods; Biological indicators and monitoring. Disaster management: Floods, Earthquake, Cyclone and Landslides. Climate change – global warming, Ozone layer depletion, acid rain.</p>	12
5	<p>Environment and Social issues: Resettlement and rehabilitation of people Waste land reclamation Environmental ethics. Environmental awareness; environmental education - role of educational institutes and Other agencies. Environmental Protection Act and related Acts</p>	12

References:

1. Willmer,P., Stone. Gand Johnston,I. Environmental Physiology of animals. Blackwell Science Ltd.
2. Mckinney, M.L and Schoch, R.M. Environmental Science: Systems and Solutions. Jones & Bartlett Publishers, 1998.
3. Cunningham, W.P. Environmental Science-V Ed. WCB McGraw Hill, 1999.
4. Clesceri, L.S., Greenberg, A.E and Eaton. A.D. Standard Methods for the Examination of Water & Waste Water-XX Ed. American Public Health Association, 1998.
5. Arora, R.K. Air Pollution. Causes & Effective control. Mangal Deep Publications,

Jaipur, 1999.

6. Chakraborti, N.K. Environmental Protection and Law.1994.
7. Chitkara, M.G. Encyclopedia of Ecology, Environment and Pollution. Vol. IXIII, 1997.
8. Chapman, J. L. and Reiss, M. J. Ecology: Principles and Applications. Cambridge University Press, 1999.
9. Eldon, D Enger and Bradly F. Smith. Environmental Sciences, 1995.

DSE1: A) Human Physiology

Course Title: A) Human Physiology	Course code: 21ZOO3E1AL
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Understand human physiological processes
2. Draw and explain the role of organs in various organ systems
3. Determine blood grouping of unknown blood samples
4. Relate the association between different organ systems in man
5. Describe and analyse functioning mechanism involved in human body
6. Measure the degree of health based on physiological malfunctions

Unit	Description	Hours
1	Introduction to physiology, Levels of organization, Cell physiology, Homeostatic mechanism of major functional systems. Solubility of gases. Physiology of sense organs. Components of Integumentary system and its function. The immune system: Lymphatic system, three defenses against infection and disorders.	11
2	Digestive system: Functional morphology of GI tract, physiology of digestion and absorption, nutritional requirements, energy metabolism, metabolic disorders, GI disorders. Respiratory system: Respiratory organs. Physiology of respiration: transport of gases, lung capacity, regulation of blood pH, Respiratory system disorders.	11

3	<p>Circulatory system: Human heart, physics of pressure, flow and resistance. Cardio-vascular pathways, cardiac cycle, electric conduction system, ECG, BP and Cardio-vascular diseases. Blood groups, blood composition, hemostasis, blood clotting, blood transfusion.</p> <p>Excretory system: Organs of urinary system, Physiology of excretion, renal failure, dialysis, renal disorders.</p>	11
4	<p>Nervous integration: Organization and overview of functions of nervous system, CNS, PNS, ANS. Neuron structure, classification and properties. Conduction of nerve impulse in myelinated and non-myelinated neurons, synapse. Types of neurotransmitters with examples. The limbic system and higher mental system. Drug abuse and disorders of nervous system.</p> <p>Muscular and skeletal system: Physiology of muscle movement, skeleton, biomechanics and muscle disorders.</p>	13
5	<p>Nutrition and health: balanced diet, nutritional requirements of carbohydrates, proteins, lipids, minerals and vitamins. Dose indication & nutritional disorders. Biosynthesis and inter-convertibility of fuel molecules: glycogen, fats & amino acids. Regulation of metabolism.</p>	10

References:

1. Guyton A C and Hall J E.2006. Text book of medical physiology. 11th edition, Saunders, Philadelphia, USA
2. Martini FH and Nath JL. 2009. Fundamentals of anatomy and physiology. Pearsons Benjami, Cummings. USA
3. Bipin kumar. 2001. Human Physiology. Campus books international, New Delhi.
4. Sarada Subramanyam and Madjavankutty. Text book of Human Physiology revised by H.D Singh, S. Chand Publishers.
5. Anne Waugh and Allison Grant. Ross and Wilson- Anatomy and Physiology in health and illness. 14th edition, Elsevier.
6. Cindy Stanfield. 2010. Principles of human physiology 4th edition.
7. Ranade VG, PN Joshi and Shalini Pradhan. 1982. A text book of practical physiology, PVG Prakashan, Pune.
8. Knut Schmidt- Nielsen. Animal Physiology: Adaptation and environment. Cambridge University Press.
9. Richard Hill, Gordon Wyse and Margaret Anderson. Animal Physiology. Sinauer Associates, Inc. Publishers. Sunderland, Massachusetts.
10. Valerie C. Scanlon and Tina Sanders. Essentials of anatomy and physiology, fifth edition.

DSE1: B) Biophysics and Biostatistics

Course Title: B) Biophysics and Biostatistics	Course code: 21ZOO3E1BL
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Define variables used in the statistics methodology
2. Apply the statistical methods in everyday chores and in basic research
3. Relate physical principles with the life processes
4. Perform statistical analysis using precise tools and techniques
5. Calculate and infer results using software techniques

Unit	Description	Hours
1	Biophysics: The system concept, ten pillars: variables: variable, function, limits, increments, instantaneous rate of change, the differential and integral calculus, distribution of observations, expression of deviations, indices & log and infinite series. Physical forces: mechanical, osmotic and electrical. Radioactivity: Biotraces – ionization, disintegration, penetration and their uses. Matter waves, sound and ultrasound: properties, Weber-Fechner law, ear, mechanoreceptors. Physiological effects of intense matter waves and their applications. Neurosonic surgery.	12
2	Electromagnetic radiations and matter: structure of matter, EM radiations, interaction of EM radiations and living matter. Microscopy: Interference, phase-contrast and electron microscopy and their uses. Bioenergetics: laws of thermodynamics, drive towards equilibrium, Redox- system, measurement of ΔH , ΔF and $T\Delta S$. Membrane potential, negative entropy change in living systems.	11
3	Biostatistics: Introduction to biostatistics, analysis of biological data, types of variables, probability. Hypothesis testing, confounding	11

	<p>variables: randomizing, matching and statistical control.</p> <p>Tests for nominal variables: Chi-square test, G-test of goodness-of-fit, G-test of independence, Fischer's exact test, Cochran-Mantil-Haenszel test for repeated tests of independence.</p>	
4	<p>Descriptive statistics: Measures of central tendency, Statistics of dispersion, standard error of the mean and confidence limits, Tabulation and graphical representations.</p> <p>Tests for one measurement variable: student's t-test for one and two samples, independence, normality, homoscedasticity and heteroscedasticity, data transportation. One way ANOVA, nested ANOVA, two way ANOVA, paired t-test and Wilcoxon signed rank test.</p>	11
5	<p>Regression: Correlation of linear regression, Spearman rank correlation, curvi-linear regression. Analysis of covariance, Multiple regression, simple logistic regression and multiple logistic regression.</p> <p>Multiple tests: Multiple comparisons and meta analysis.</p> <p>Basic operations of biostatistics tools and techniques: SPSS, MATLAB, MS-EXCEL, MINITAB and Graph pad PRISM.</p>	11

References:

1. E J Casey. Biophysics: concepts and mechanisms. Reinhold publishing corporation, New York.
2. John McDonald. Handbook of Biological Statistics. Third edition, Sparky House Publishing, Baltimore, Maryland, USA.
3. Gerald Belle et al. Biostatistics: A methodology for the health Sciences. Second edition, Wiley Interscience, A John Wiley and sons inc. Hoboken, New Jersey.
4. Siegmund Brandt. Data Analysis: Statistical and computational methods for scientists and engineers. Fourth edition, Springer.
5. Stephen Looney. Biostatistical methods, volume 184. Humana Press, Totowa, New Jersey.
6. Wayne W Daniel. Biostatistics: a foundation for analysis in the health sciences.
7. Christian Heumann and Michael Schomaker Shalabh. Introduction to statistics and data analysis, Springer.
8. Massimiliano Bonamente. Statistics and analysis of scientific data, second edition, Springer.

DSE1: C) Parasitology, Evolutionary Biology and Paleozoology

Course Title: C) Parasitology, Evolutionary Biology and Paleozoology	Course code: 21ZOO3E1CL
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Outline classification of different parasites
2. Evaluate diseases based on disease etiology
3. Develop aesthetic sense of nature and develop a sense of commitment to protect nature and biodiversity
4. Forecast based on the theories of evolution of life span and ageing,
5. Illustrate and assess fossils based on carbon dating

Unit	Description	Hours
1	Parasitology: Origin and evolution of parasitism. Outline classification of pathogenic microbes. Types of hosts and parasites, effects of parasites on hosts. Food and water borne diseases. STDs, Disease etiology, epidemiology, pathogenicity, diagnosis, prophylaxis and therapeutic treatments.	11
2	Pathogenic protozoa: Amoebiasis, Kala-azar and Giardiasis. Pathogenic nematodes: Etiology of Wuchereria and Ascaris. Arthropods as parasites and vectors: life cycle of mosquitoes, ticks and mites, housefly and roach. Chemical and biological control measures.	11
3	Evolutionary biology: Overview of landmarks in evolutionary biology. Biopoiesis. Evolution through ages. Evidences of organic evolution. Evolution of man. Recent developments in Lamarckian concepts. Evolution of sex, evolution of inbreeding and outbreeding. Darwinism: Contributions of Charles Darwin and Neo-darwinism.	11
4	Origin of higher categories: Phyletic gradualism, punctuated equilibrium	11

	and adaptive walks on rugged landscapes. Micro and macro evolution. Evolution of life histories: evolution of age and size at maturation. Life history tradeoffs - optimality arguments and trade off surfaces with evidences. Evolution of clutch, size and reproductive investment. Evolution of life span and ageing.	
5	Paleozoology: Survey of life through different geological time scale. Formation and types of fossils and fossilization. Taphonomy. Assessment of fossil records. Carbon dating of fossils, trace fossils and living fossils. Significance of fossils, geological time scale and associated fauna.	12

References:

1. Alpheus S Packard. A text book of Entomology: the anatomy, physiology, embryology and metamorphoses. Mac Milan Company, London.
2. CK Jayaram Panniker. Text book of medical parasitology, edited by Sougata Ghosh. 8th edition.
3. Margherita Raineri and Erki Tammiksaar. Evolutionary biology: Exobiology and evolutionary mechanisms. Edited by Pierre Pontarotti. Springer
4. Mary Ann Clark, Jung Choi and Matthew Douglas. Biology 2e. Openstax, Texas.
5. Richard and Kliman. The Encyclopedia of Evolutionary biology.
6. Quantitative paleozoology, Cambridge Press.
7. David Raup and Steven Stanley. Principles of Palentology-Second edition.
8. Susan Gray. 2012. Palentology: a study of pre-historic life. Childrens press.

DSE2: A) Immunology, Proteomics and Genomics

Course Title: A) Immunology, Proteomics and Genomics	Course code: 21ZOO3E2AL
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Understand the role of different immune cells and their function
2. Developed ideas on immune dysfunction and their consequences
3. Emphasises on the development of the immune system and mechanisms by which our body elicit the immune response.
4. Acquire knowledge and understanding of fundamentals of genomics and Proteomics.
5. Study about transcriptomics and metabolomics and their applications in various applied areas of biology.
6. Evaluate the usefulness of immunology in different pharmaceutical companies.
7. Apply their knowledge and design immunological experiments to demonstrate innate, humoral or cytotoxic T lymphocyte responses.
8. Explain principles of basic methods of genomic and proteomic analysis

Unit	Description	Hours
1	Acquired immunity: Naturally acquired, artificially acquired and adaptive, Humoral and cell mediated immunity. Immunogens, haptens; Major Histocompatibility Complex: MHC genes, MHC and immune responsiveness and disease susceptibility. Biology of cells of the immune system: Hematopoiesis, Microphages (Neutrophils), Macrophages, T-Lymphocytes, B-Lymphocytes, Dendritic cells and NK cells. B cell maturation, activation and differentiation; T-cell maturation, activation and differentiation and T-cell receptors. Cancer immunotherapy; autoimmune disorder; NK cells in chronic viral infection and malignancy.	11
2	Antigen-antibody interactions Precipitation, agglutination and complement mediated immune reactions; advanced immunological	11

	techniques: RIA, ELISA, Western blotting, ELISPOT assay, immuno fluorescence microscopy, flow cytometry and immunoelectron microscopy; CMI techniques: lympho-proliferation assay, mixed lymphocyte reaction, cell cytotoxicity assays, apoptosis, microarrays, transgenic mice, gene knock outs.	
3	Importance of proteomics, Separation technique- 2DPAGE, 2-DE (BN-PAGE), image analysis, Mass- spectrophotometry, LC-TMS, MALDI, and SALDI. Protein interaction, DNA- Protein interaction, Yeast two hybrid system and their applications.	11
4	<u>Databases and search engines in proteomics, Protein-Protein interactions – Protein microarrays. Disease related proteins and drug discovery, Disease diagnosis, identification and characterization of novel proteins, protein engineering principles, techniques of proteomics in cancer research.</u>	11
5	Introduction to Genomics, Anatomy of prokaryotic and eukaryotic genome, content of genome, C value paradox, repetitive DNA, tools to study genome diversity (PCR/ RFLP). Genetic maps, physical maps, EST and transcript maps, functional maps, comparative genomics and collinearity/synteny in maps. Genomics in medical practice, personalized medicine, DNA polymorphism and treatment of diseases	12

References:

1. Abul K. Abbas, Andrew H. H. Lichtman, and Shiv Pillai, Cellular and Molecular Immunology. 9th Edition.
2. Paul, W. E. 2012. Fundamental Immunology. New York: Raven Press.
3. Brown T. A. 2007, Genomes 3. Garland Science Publishing, New York.
4. Dunham, I., 2003. Genome Mapping and sequencing. Horizon Scientific
5. Primrose, S. B., and R. M. Twyman. 2006. Principles of gene manipulation and Genomics, Blackwell Publishing MA. USA.
6. Murphy, K., Travers, P., Walport, M., & Janeway, C. 2012. Janeway's Immunobiology. New York: Garland Science. Paul, W. E. 2012. Fundamental Immunology. New York: Raven Press
7. Proteomics Research: New Frontiers in Functional Genomics (Principles and Practice) 1997. Edited by M.R. Wilkins. K.L. Williams, R.D. Apel and D.F. Hochstrasser, Springer Verlag, New York.
8. 2-D Proteome Analysis Protocols Edited by Andrew J. Link, 1998. Humana Press.



DSE2: B) Biochemistry and Enzymology

Course Title: B) Biochemistry and Enzymology	Course code: 21ZOO3E2BL
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Students can get the detailed knowledge in enzyme activity and kinetics.
2. Understand the mechanism of action and regulation and about the way of enzyme application and exploitation
3. Expose students to various laboratory techniques in areas of biochemistry.

Unit	Description	Hours
1	Basic principles, instrumentation and applications of microscopy. Bright field, phase-contrast, fluorescence and confocal microscopy. Electron microscope – scanning and transmission electron microscopy. Blotting techniques: Western, Southern and Northern blotting: principle and methodology. PCR- conventional, reverse-transcriptase and real-time PCR. Primer designing and sequence analysis.	11
2	Structure of monosaccharide's, oligosaccharides and polysaccharides, glycoproteins and glycolipids. Structure and properties of fatty acids, storage and membrane lipids, phospholipids and cholesterol, Composition and synthesis of lipoproteins and their transport in the body. Structure, composition and properties of nucleic acids. Structure and properties of amino acids, Structure of protein (Primary, Secondary, Tertiary and Quaternary), essential and non-essential amino acids. Structure and properties of vitamins, co-enzymes. Biosynthesis of vitamins, role of vitamins in the metabolism.	11
3	Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, glycogen storage diseases, pentosuria, galactosemia. Disorders of Lipids – Plasma lipoproteins, cholesterol, triglycerides &	11

	<p>phospholipids in health and disease, hyperlipidemia. Inborn Errors of Metabolism – Phenylketonuria, albinism, maple syrup urine disease, sickle cell anemia, Histidinemia.</p> <p>Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney.</p>	
4	<p>Nomenclature and classification of enzymes according to I.U.B. Convention, specificity and active site. Isolation and purification of enzymes. Active site - determination of active site amino acids - chemical probe, affinity label, and site-directed mutagenesis, intrinsic and extrinsic regulations. Coenzymes - prosthetic group, classification - vitamin and nonvitamin coenzymes, folate coenzymes, coenzyme role of vitamin B12.</p>	11
5	<p>Enzyme specificity, Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, mechanism of serine proteases - chymotrypsin, lysozyme, and ribonuclease. Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Enzymes as thrombolytic agents, antiinflammatory agents, digestive aids. Therapeutic use of asparaginase, streptokinase.</p>	12

References:

1. Dixon, M., and E. C. Webb. "Enzyme inhibition and activation." *Enzymes* 3 (1979): 126-136.
2. Palmer, T. *Understanding Enzymes*, 4th ed., Prentice Hall/Ellis Horwood, London (1995).
3. Price, Nicholas C., and Lewis Stevens. *Fundamentals of Enzymology*. Oxford Science Publications. Second edition. New York, 2001.
4. Buchholz, Klaus, Volker Kasche, and Uwe Theo Bornscheuer. *Biocatalysts and enzymetechnology*. John Wiley & Sons, 2012.
5. Copeland, Robert A. *Enzymes: a practical introduction to structure, mechanism, and data analysis*. John Wiley & Sons, 2004
6. Voet D., Voet J.G, *Biochemistry* 4th Edition. John Wiley and Sons, 2011.
7. Nelson, D. C. and Cox, M.M., *Lehninger Principles of Biochemistry*, 5th Edition, W. H. Freeman, 2010.
8. Berg J.M., Tymoczko J.L. and Stryer L., *Biochemistry*. 7th edition, W.H. Freeman and Co. New York, 2011.
9. Wilson, Keith, and John Walker, eds. *Principles and techniques of biochemistry and molecular biology*. Cambridge university press, 2010.

10. Bisen, Prakash Singh, and Anjana Sharma. Introduction to instrumentation in life sciences. CRC Press, 2012.

DSE2: C) Neurobiology and Aging

Course Title: C) Neurobiology and Aging	Course code: 21ZOO3E2CL
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 3 h
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Understand the challenges that an aging population poses to the society and the economy.
2. Understand the impact of aging on the metabolism. This includes recognizing major effects of starvation and the role that caloric restriction has in prolonging lifespan.
3. Understand the major mechanisms of aging including telomere shortening, increased free radicals, DNA methylation etc.
4. Understand the role of biomarkers of aging.
5. Recognize the most common techniques used in research and clinic to measure anatomical effects of aging with particular emphasis on the brain.
6. Recognize changes in cognitive performance and executive function in aging patients.
7. Understand the major clinical features of neurodegenerative diseases.
8. Describe the role of depression in neurodegenerative disease and its management.

Unit	Description	Hours
1	Gross anatomy of adult brain, organization of the nervous system, subdivision of the nervous system, concept of CNS, ANS & PNS, meninges. The scalp, skull, meninges and cerebrospinal fluid, vertebral column, cutaneous nerve supply of head and neck limb and trunk.	11
2	Neurons and glial cells, Resting Potential & Action potential, Propagation of Nerve Impulses, Degeneration & regeneration /repair of nerve fibers. Pain production, pathways and analgesics, head ach & referred pain. Integrative functions of thalamus, cerebellum, basal ganglia & Cerebral cortex. Blood brain barrier, Blood CSF barrier, Spit Brain, EEG.	11
3	Neurophysiological basis of sleep, wakefulness. Learning, Memory, Emotion & Speech.	11

	Sleep disorders. Memory retrieval, Amnesia, Mood Disorders, Schizophrenia, Depression, Aphasia, stress management. Neuroimaging –CT, MRI, Myelography; Interventional Radiology – PET(Positron Emission Tomography) – CVA, Epilepsy, etc., Single - Photon Emission Computed Tomography, MR Spectroscopy, Magnetic Source imaging.	
4	Effect of Ageing on the brain function. Biological changes of ageing, Ageing theories, Ageing process Psychosocial aspects of ageing, Age related changes, Personality changes, Social changes, Changes in family and living arrangement, Depression, Coping with psychosocial changes of aging. Energy needs of old, Formulation of diet for elderly, Diet related degenerative changes, Physical activity	11
5	Fever, Anaemia, Vertigo, Anorexia, Loss of memory, Respiratory disease, Heart disease, Kidney disease, Stroke, Musculoskeletal disorder, CNS related health Problem, Digestive problem, Vision, Hearing, Sleep disturbances, Perimenopausal problem	12

References:

1. Theoretical Neuroscience – Computational and Mathematical Modeling of Neural System by Dayan and Abbot, 1st Edition, The MIT Press, 2001.
2. Neuroinformatics for Neuropsychology by Vinoth Jagaroo, Springer, 2009.
3. Neuroinformatics by Chiquito Joaquim Crasto, Humana Press, 2007.
4. Neuroinformatics: an overview of the Human Brain Project by Stephen H. Koslow, Michael F. Huerta, Routledge, 1997.
5. Gwyther, L.P. (2000). Family issues in dementia: Finding a new normal. *Neurologic Clinics*, 18, 993-1010.
6. Barnes, C.A. (1998). Memory changes during normal aging: Neurobiological correlates. In: J. Martinez and R. Kesner (Eds), *Neurobiology of Learning & Memory* (pp. 247-287). San Diego, CA: Academic Press.
7. Astur, R.S. (2002). Humans with hippocampus damage display severe spatial memory impairments in a virtual Morris water task. *Behavioural Brain Research*, 132, 77-84.
8. *Basic Geriatric Nursing*, Gloria Hoffman World, Edition 5, Illustrated Publisher Mosby 2011.
9. *Principle and practice of geriatric Medicine*, M. S. John Pathy, Alan J. Sinclair, John E. Morley

GEC1: A) Wild life conservation and management

Course Title: A) Wild life conservation and management	Course code: 21ZOO3G1AL
Total Contact Hours: 28 (02 L-0-0)	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 1 h
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Understand historical aspects of Wildlife conservation in India and India's conservation present day conservation priorities.
2. Undertake situation analysis for conservation.
3. Understand and practice applications of emerging tools and techniques in wildlife conservation.

Unit	Description	Hours
1	Brief Details of: Introduction, importance of wild life conservation – Economic, ecological, aesthetic, Scientific, Recreational, Medicinal. Wild life categories: Endangered, Threatened, Vulnerable, rare; data deficient categories, Red data book. Causes of wildlife depletion: Degradation and destruction of natural habitats, Exploitation for commercial purposes, Deforestation, Agricultural expansion and grazing, Urbanization and industrialization, Forest fires. National parks, Wildlife sanctuaries, wildlife reserves, privately owned wildlife reserves & Biosphere reserves, Single species / single habitat based conservation programmes (e.g. Project tiger, Project Elephant, Valley of flowers, etc.) Umbrella species, flagship species	10
2	International conventions on conservation ; Important International conventions & treaties on nature & conservation, India's role & contribution , Ex- situ & in-situ conservation, Conservation Breeding (e.g. Vulture, Pygmy hog, Gharial etc.), Institutions and their role in conservation; Traditional knowledge, Traditions & cultures, Women in conservation Traditional Societies (e.g. bedas, kadu kurubas, tribles)	9

	peoples)	
3	Role of NGOs in conservation; International NGOs; UNEP, GEF, WCS, Bird Life International Important NGOs in India & their contributions , WWF, ATREE, BNHS, WTI, Kalpavriksha etc. Important NGO movements, Chipko movement, Narmada Bachavo Aandholan, Pani Panchayats, Seed Movement etc. – Wildlife and legislation: Constitutional provisions, National and International guidelines and protocols. Wildlife and forest protection acts.	9

References (indicative)

1. Aaron, N.M., Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A., 1973.25
2. Ali, S and S.D. Ripley. 1969. The Handbook of Birds of India and Pakistan. Oxford University Press – New Delhi
3. Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly, Wildlife Ecology, Conservation and Management, Blackwell Publishing, U.S.A., 2006.
4. Apte, Deepak, The Book of Indian Shells, Oxford University Press, Mumbai. 2006.
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12. Hosetti, B.B. 2003. Wetlands conservation and management, Pointer publishers, Jaipur, India.
13. Hosetti, B.B. Concepts in Wildlife Management, Daya Publishing House, Delhi. 1997.
14. Katwal/Banerjee, Biodiversity conservation in managed and protected Areas, Agrobios, India, 2002.
15. Negi, S.S. 2002. Hand book of National Parks, Wildlife Sanctuaries and Biosphere reserves in India. Indus Publ., New Delhi.
16. Negi, S.S., Biodiversity and its conservation in India, Indus Publishing Co., New Delhi. 1993.
17. Singh, S.K. Text Book of Wildlife Management. IBDC, Lucknow. 2005

GEC1: B) Entrepreneurial Zoology

Course Title: B) Entrepreneurial Zoology	Course code: 21ZOO3G1BL
Total Contact Hours: 28 (02 L-0-0)	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 1 h
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Develop knowledge of decision making on appropriate technique based on the environment and conditions.
2. Develop entrepreneur qualities especially in selecting the right business at the right environment.
3. Develop small scale business based on the available sources.

Unit	Description	Hours
1	<p>Sericulture: History and present status - Sericulture in India - Types of silkworms and distribution.</p> <p>Silkworm rearing technology, Food plant cultivation, seed production, reeling, re-reeling, twisting, doubling and weaving.</p> <p>Diseases and pests of Silkworm: Protozoan, Viral, Bacterial and fungal diseases.</p> <p>Silkworm pests: —Indian Uzifly and Dermistid beetles</p>	9
2	<p>Apiculture: Introduction and present status. Distribution and behavior of <i>Apis dorsata</i>, <i>Apis cerana indica</i>.</p> <p>Structure & Morphology, Life cycle, colony organization, division of labour and communication.</p> <p>Beekeeping equipments, beekeeping and its products.</p> <p>Diseases and pests of Bees: Bacterial, fungal and viral diseases.</p>	10

	Bee pests: Mites, beetles and moths. Management of pests and diseases.	
3	Oyster culture: History and present status. Seed production of oysters and collection methods. Habitat management – Preparation of nurseries, Feed and nutrition, Factors affecting nurseries and development. Edible oysters and Pear oysters. Predators, Diseases and Environmental factors that affect oysters.	9

References

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol.-II: Silkworm Rearing and Silk Reeling.
3. Hisao Aruga. (1994). Principles of Sericulture (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

GEC1: C) Hormones and Diseases

Course Title: C) Hormones and Diseases	Course code: 21ZOO3G1CL
Total Contact Hours: 28 (02 L-0-0)	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 1 h
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Describe the major clinical disorders associated with the adrenal gland (Addison's disease, Cushing's disease, Cushing's syndrome, hyperaldosteronism, congenital adrenal hyperplasia).
2. Explain signs, symptoms and investigations related to endocrine disorders and explain the scientific bases for common disease presentations by Integrating basic sciences with clinical sciences of the endocrine system.
3. Describe the anatomical and histological structure, development, and function of the different organs of the endocrine system.
4. Elucidate the various hormones produced and regulated by the endocrine system.
5. Knowledge about the diseases affecting hypothalamus, pituitary, parathyroid and thyroid.

Unit	Description	Hours
1	Endocrine glands and hormones Pituitary gland: General organization and hormones Diseases: dwarfism, gigantism, acromegaly, diabetes insipidus Thyroid: General organization and hormones Diseases: goiter, myxoedema, cretinism Parathyroid gland: General organization and hormones Diseases: osteoporosis and tetany Islets of Langerhans: General organization and hormones	10

	Disease: diabetes mellitus (type I and type II)	
2	<p>Adrenal gland: General organization and hormones</p> <p>Diseases: Addison's disease, Cushing's syndrome</p> <p>Testis: General organization and hormones</p> <p>Male infertility</p> <p>Cryptorchidism</p> <p>Ovary: General organization and hormones</p> <p>Diseases: polycystic ovarian disease, hirsutism, and hyperandrogenism</p>	9
3	<p>Hormones and cancer</p> <p>Hormones and stress</p> <p>Obesity, and eating disorders</p> <p>Melatonin, sleep disorders, and jet lag</p>	9
<p>References</p> <ol style="list-style-type: none"> 1. Hadley, M.C.: Endocrinology, Prentice Hall, International Edition, 2000. 2. Wilson and Foster, Williams Text Book of Endocrinology 10th edition, W.B. Saunders Company Philadelphia, 2005. 		

SEC3: Research Methodology

Course Title: Research Methodology	Course code: 21ZOO3S3LP
Total Contact Hours: 28 (01 L-0-02P)	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 1 h
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Understand the concept of research and different types of research in the context of biology
2. Analyze the ethical aspects of research
3. Evaluate the different methods of scientific writing and reporting
4. Execute the research problem

Unit	Description	Hours
1	Basic Concept of Research: Research-definition and types of research (Descriptive <i>vs</i> analytical; applied <i>vs</i> fundamental; quantitative <i>vs</i> qualitative; conceptual <i>vs</i> empirical). Research methods <i>vs</i> methodology. Literature-review and its consolidation; Library research; field research; laboratory research.	9
2	Research Design and Methods: Basic Principles, need of research design, features of good design, important concepts relating to research design. Developing a research plan: Exploration, Description, Diagnosis, Experimentation.	9
3	Ethics and Art of Scientific Writing: Authors, acknowledgements, reproducibility, plagiarism, Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Power-point presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.	10
References (indicative) 1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi. 2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing		

for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.

3. Ruzin, S. E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.
4. Kothari, C. R. (1980). Research Methodology: Research and techniques, New Delhi: New Age International Publishers.
5. Kumar, R. (2011). Research Methodology: a step-by-step guide for beginners (3rd edition). London, UK: TJ International Ltd, Padstow, Cornwall.

DSC9P7: Reproductive Biology and Artificial Organs Lab

Course Title: Reproductive Biology and Artificial Organs Lab	Course code: 21ZOO3C9P
Total Contact Hours: 56 (0-0-4P/week)	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 4 h
Summative Assessment Marks: 30	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Perform vaginal smear technique to identify the phases of oestrous cycle.
2. Illustrate the reproductive dysfunctions.
3. Justify the artificial control of reproduction.
4. Explain the male and female reproductive systems and sexual dimorphic characteristics.
5. Identify the histological slides of reproductive organ/tissues
6. Comment on merits and demerits of contraceptive devices/methods
7. Illustrate the technique of gonadectomy.
8. Distinguish the male and female anatomical features of reproductive system in mammals.

SL No	List of experiments	Hours
1	Study of mammalian reproductive system: ovary and female accessory reproductive organs, and testis and male accessory reproductive organs in rat.	
	Histology of testis and ovary of different age groups of rats to understand the sequence of events related to spermatogenesis and folliculogenesis and ageing effect.	
2	Histology of accessory sex organs	
3	Comparative account of Ovary and Testis in non-mammalian vertebrates – T.S. of fish, amphibia, reptiles and birds.	
4	Pathology of reproductive system: Males- Cryptorchid testis, prostate cancer; Females- Polycystic ovary, endometriosis.	
5	Vaginal smear preparation to study oestrous cycle.	
6	Study of sperm morphology, abnormalities and sperm count in rat	

7	Surgical sterilization of male and female rats.	
8	Pseudopregnancy and delayed implantation in adult lactating rats.	
7	Mounting spermatozoa – Grasshopper/Frog/Chick/Rat	
8	Demonstration class : Pregnancy testing by using HCG kit.	
9	Identification of types of placenta sections	
10	Study of contraceptive devices	

References:

1. Knobil, E and Neill, J.D. (Eds). The Physiology of Reproduction II. Vol I and II. Raven Press Ltd, 1994.
2. Mandal, A. Handbook of Neuroendocrinology. EMKAY Publications, 1994.
3. Nelson, R.J. An Introduction to Behavioural Endocrinology. Sinauer Associates Inc, 1995.
4. Turner, CD and Bagnara, J.T. General and Comparative Endocrinology, 1998.
5. Williams, RM. Textbook of Endocrinology. W.B. Saunders.
6. Martin, C.R Endocrine Physiology. Oxford University Press.
7. Saidapur S. K. (Ed). Reproductive Cycles of Indian Vertebrates. Allied Publishers Ltd. New Delhi, 1989.
8. 'Tissue Engineering and Artificial Organs' By Joseph D. Bronzino.
9. "Artificial Organs" by Gerald E. Miller Morgan & Claypool Publisher.

DSC10P8: Environmental Biology Lab

Course Title: Environmental Biology Lab	Course code: 21ZOO3C10P
Total Contact Hours: 56 (0-0-4P/week)	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 4 h
Summative Assessment Marks: 30	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Apply information learned through readings and other media posted with the learning management system (LMS)
2. Comprehend the interdisciplinary (e.g. agricultural science, biology, chemistry, ecology, economics, geology, history, policy, etc.) concepts integral to environmental science
3. Analyze current environmental issues and evaluate potential solutions
4. Relate the features of human populations to different types of environmental degradation
5. Assess the costs/benefits of conservation vs. remediation or technological solutions.
6. Recognize the impact of globalization on the environment
7. Recognize the ecological footprints left by different peoples of the Earth
8. Work effectively in a group to teach select environmental concepts to elementary children through the Experiential Environmental Education (E3) project.

SL No	List of experiments	Hours
1	Field visit to forest patch – data collection and report preparation	
2	Field visit to wetland – data collection and report preparation	
3	Field visit coast - data collection and report preparation	
4	Water quality analysis	
5	Collection of fauna from wetland and diversity analysis	
6	Estimation of density and relative abundance of species using quadrats and plotless methods.	
7	Estimation of species diversity: introduction to indices	

8	Estimation of primary productivity.	
9	Ecological adaptations of the Plant and animal species in the hydrophytes, mesophytes and xerophytes.	
10	Water quality assessment techniques	
11	Air quality assessment techniques	
12	Data analysis related to Environmental issues	
13	Estimate/ Analyse the impact of Urbanization	
14	Problems associated with urbanization	
15	Field trips to locations illustrating urbanization issues, such as a recycling center	
16	water treatment facility, or ecological restoration site	
17	Conducting research on an environmental topic	

References:

1. EIA – A Biography Clark, B. D., Bissel, B. D. and Watheam, P. School of Forestry and Environment, SHIATSDeemed University, Allahabad.
2. Environmental Impact Assessment Canter, L. W. Graw, Mc, , Hill Publication, New York.