Resolution No.: AC/I(21-22).2(II).RPS11

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for: PG

Program: M.Sc.

Program Code: Zoology (RPSZOO)

(Choice Based Semester and Grading System
for the academic year 2022–2023)

Graduate Attributes

In the post graduate courses, S.P.Mandali's Ramnarain Ruia Autonomous College is committed to impart conceptual and procedural knowledge in specific subject areas that would build diverse creative abilities in the learner. The College also thrives to make its science post graduates research/ job ready as well as adaptable to revolutionary changes happening in this era of Industry 4.0.

GA	Graduate Attributes Description **A student completing Master's in Science program will be able to:**
GA 1	Demonstrate in depth understanding in the relevant science discipline. Recall, explain, extrapolate and organize conceptual scientific knowledge for execution and application and to evaluate its relevance.
GA 2	Critically evaluate, analyze and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
GA 3	Access, evaluate, understand and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
GA 4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language.
GA 5	Demonstrate initiative, competence and tenacity at the workplace. Successfully plan and execute tasks independently as well as with team members. Effectively communicate and present complex information accurately and appropriately to different groups.
GA 6	Use an objective, unbiased and non-manipulative approach in collection and interpretation of scientific data and avoid plagiarism and violation of Intellectual Property Rights. Appreciate and be sensitive to environmental and sustainability issues and understand its scientific significance and global relevance.
GA 7	Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills and lead a team for planning and execution of a task.
GA 8	Understand cross disciplinary relevance of scientific developments and relearn and reskill so as to adapt to technological advancements.

PROGRAM OUTCOMES

PO	Description A student completing Master's in Science program in the subject of Zoology will be able to:
PO 1	Identify, explore, understand the concept of ethology and compare the differences in the behaviour.
PO 2	Gain comprehensive knowledge about different animal species and appreciate the differences and similarities, thereby achieving proficiency in handling them experimentally or for research purposes.
PO 3	Understand and learn various behavioural patterns displayed by animals and interrelate to evolutionary pattern.
PO 4	Evaluate and analyse basics of chemical thermodynamics and various biochemical pathways with respect to metabolism.
PO 5	Analyse the various communication pathways taking place inside the cell and interrelate it with genetics.
PO 6	Compare and contrast between Mendelian inheritance, Extension of Mendelian genetics and non-Mendelian genetics
PO 7	Interpret and analyse how morphological change due to change in environment helps drive evolution over a period of time.
PO 8	Compare the different developmental stages of all the animals and connect it to the evolutionary link.
PO 9	Apply the fundamentals and techniques of molecular biology in various fields.
PO 10	Develop an ability to analyse present and interpret various concepts of Immune and Cancer Biology.
PO 11	Understand the broad concepts of Life processes, Endocrinology, Assisted reproductive techniques, Animal biotechnology and develop employable skills.
PO 12	Explore some of the unique migratory patterns of animals and understand their biological rhythms.
PO 13	Apply their knowledge in problem solving and future course of their career development in higher education and research.
PO 14	Develop critical thinking, planning and executing research projects and develop employable skills in the field of Animal Physiology.

Important Note:

In the context of UGC circular of 2006 and the need to understand animal systems better at specialization stages in Zoology, limited anatomical studies of the animals has been introduced at the level of specialization in M.Sc. Zoology. These anatomical studies have been introduced keeping in focus that all aspects of ethics of animal experimentation is informed to the students and that it will be ensured that students are made to understand the ethical use of animals in Biology. In this context, anatomical studies in a limited manner will be used for training with the following conditions:

- The college is agreed to the inclusion of anatomical studies provided, that the students are not asked to kill and cut open live animals.
- The animal specimen if used for anatomical studies will be procured dead from local food market and are items of regular consumption by people.
- The sessions of anatomical studies are arranged in a planned manner to minimize the number of animal specimens used and to reuse the same animal specimen for multiple sessions.
- Further, College will constitute an Anatomical Study monitoring board which will be informed about the use of animals and that the usage will comply to the guidelines of ethical use and handling of animals.
- Students opting for specialization in Zoology M.Sc. will be informed in advance about the inclusion of anatomical studies in the course work.

PROGRAM OUTLINE

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
M.Sc.-I	I	Core-I RPSZOO101	Comprehensive Zoology-I	4
		Core-II RPSZOO102	Biochemistry and Metabolism – I	4
		Core-III RPSZOO103	Bioanalytical techniques and IPR	4
		DSE RPSZOO104	Enterpreneurship in Aquarium Management	2
		AEC RPSZOO105	Emotional well-being through Logic-based thinking	2
			Practical	
		Core-I RPSZOOP101	Comprehensive Zoology-I	2
		Core-II RPSZOOP102	Biochemistry and Metabolism – I	2
		Core-III RPSZOOP103	Bioanalytical techniques and IPR	2
		DSE RPSZOO104	Enterpreneurship in Aquarium Management	2
	II	Core-IV RPSZOO201	Comprehensive Zoology-II	4
		Core-V RPSZOO202	Biochemistry and Metabolism- II	4
		Core-VI RPSZOO203	Molecular Techniques	4
		DSE RPSZOO204	Wildlife Biology	4
		AEC RPSZOO205	Research Methodology	2
			Practical	
		Core-IV RPSZOOP201		2
		Core-V RPSZOOP202	Biochemistry and Metabolism- II	2
		Core-VI RPSZOOP203	Molecular Techniques	2
		DSE RPSZOO204	Wildlife Biology	4

Resolution No.: AC/I(21-22).2(II).RPS11

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Ramnarain Ruia Autonomous College

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Syllabus for: Semester- I& II

Program: M.Sc.

Program Code: Zoology (RPSZOO)

(Choice Based Semester and Grading System
for the academic year 2022-23)

Semester-I
Academic year 2022-2023

Paper Code	Unit	Topic	Credits
Core Paper I RPSZOO101	**Comprehensive Zoology-I**		
	I	Animal Behaviour-I	4
	II	Introduction to model organisms-I- *Hydra* & *Drosophila*	
	III	Developmental Biology	
	IV	Genetics	
Core Paper II RPSZOO102	**Biochemistry and Metabolism – I**		
	I	Biomolecules- a structural and functional approach-I	4
	II	Biochemical Thermodynamics	
	III	Metabolic pathways and Integration of metabolism-I	
	IV	Cell Communication	
Core Paper III RPSZOO103	**Bioanalytical techniques and IPR**		
	I	Microscopy, Spectroscopy and PCR	4
	II	Tracer Techniques and Chromatography	
	III	Biostatistics and computer applications	
	IV	IPR	
DSE RPSZOO104	**Enterpreneurship in Aquarium Management**		
	I	Introduction to Aquarium Fish Keeping	4
	II	Aquarium Fishes	
	III	Maintainence of Aquarium & Fish Transportation	
	IV	Basic requirements of Aquarium Maintenance	
ASE RPSZOO105		**Emotional well-being through Logic-based thinking**	2
	I	Relation between Emotions and Thinking- I	
	II	Relation between Emotions and Thinking- II	
Practical			
RPSZOOP101		Comprehensive Zoology-I	2
RPSZOOP102		Biochemistry and Metabolism – I	2
RPSZOOP103		Bioanalytical techniques and IPR	2
RPSZOOP104		Enterpreneurship in Aquarium Management	2
Grand Total			**26**

Course Code: RPSZOO101

Course Title: Comprehensive Zoology-I

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand and comprehend the broad concepts of animal behaviour and its applications in various fields of research.
CO 2	Compare and contrast the insights of behavioral patterns displayed by different animals.
CO 3	Interrelate the working and different systems and understand the role of model organisms in the field of research.
CO 4	Understand and analyse different concepts in developmental biology.
CO 5	Identify different cell cycle checkpoints and correlate them with cancer.
CO6	Correlate the concept of non-disjunction as a genetic anomaly with different genetic disorders and maternal age.

RPSZOO101	Title: Comprehensive Zoology-I	Credits 4
UNIT–I	***Study of Animal Behavior*** • Development of behaviour: Significance of animal behaviour, influence of environment, hormones and genes. Cognition. • Reflexes and complex behaviour: Latency, after discharge, summation, warm up, fatigue inhibition and feedback control. • Instinctive Behaviour - Fixed action pattern, Types of sign stimuli and releasers as triggers, Genetic basis of instinctive behavior. • Learning- Classical conditioning experiment, latent and insight learning. Social learning; Altruism. • Biological communication- Role of pheromone-Insects social organization; pheromone effects in mammals- Lee Boot, Whitten, Bruce, Collidge and Castro-Vandenberg effects.	**15 Lectures**
UNIT–II	***Introduction to model organisms- Hydra & Drosophila*** • *Hydra* as a model organism: Setting up Artemia hatchery(temperature, salinity, pH, lifecycle and nutritional value), Hydra regeneration, Different types of cells in Hydra. • *Drosophila* as a model organism: Drosophila development: (a) Embryonic development (b) formation of body axes (c) Segmentation genes (d) Homeotic genes and their functions (e) Larval stages (f) Imaginal discs (g) Pupa and metamorphosis (h) Adult morphology.	**15 Lectures**
UNIT–III	***Developmental Biology*** • Basic concepts of Developmental Biology- Potency, induction, determination and differentiation; Apoptosis, Stem	**15 Lectures**

	cells, genomic equivalence; imprinting; mutants and transgenic in analysis of development. • Cell aggregation and differentiation in *Dictyostelium* • Axis formation and pattern formation: *Xenopus* • Organogenesis • Vulva formation in *Caenorhabditis elegans* • Regeneration as a replay of development stages (intro, brief account of epimorphogenesis, morphylaxis & compensatory regeneration)	
UNIT –IV	***Genetics*** • Mitosis- Interphase and cell cycle, genetic control of cell cycle, stages of mitosis. • Meiosis: An overview of meiosis, the first meiotic division, the second meiotic division, comparison of spermatogenesis and oogenesis in animal cells. • Non-disjunction and its implications • significance of telomeres; telomeres and cancer) • Genetics of cancer- Relationship of cell cycle to cancer, Oncogenes, Tumour suppressor genes, Mutator genes, Chemicals and radiations as carcinogens. • Alleles and phenotypes: i. Incomplete or partial dominance and co-dominance ii. Epistasis – Dominant and Recessive iii. Complementation analysis iv. Multiple alleles • Lethal alleles (recessive and dominant lethal alleles)- Penetrance and expressivity • Quantitative inheritance: i. Traits controlled by many loci. ii. Location of polygenes iii. Heritability: measurement of heritability • Linkage, crossing over and gene mapping: Chromosomal theory of linkage, Mechanism and types of crossing over, Mapping in prokaryotes and bacterial viruses, Gene mapping in eukaryotes (three-point cross) • Genetic mapping in humans- Physical chromosome mapping: deletion mapping, somatic cell hybridization mapping, mapping by *in situ* hybridization; correspondence of genetic and physical maps.	**15 Lectures**

	• Practical application of chromosome mapping- tracking the inheritance of an allele with coupled DNA markers.	
RPSZOOP101	**Practical Title: Comprehensive Zoology-I**	**Credits 2**
	1. *Hydra* media preparation. **2.** Study of *Hydra* regeneration. **3.** Culturing and maintaining *Drosophila.* **4.** Visualizing different developmental stages of *Drosophila* embryogenesis. **5.** Behavioural interaction between individuals of Siamese Fighter fishes (*Betta splendens*). **6.** Temporary squash preparation of onion/garlic root tip cells to study stages of mitosis and calculating the mitotic index. ***7.*** Temporary squash preparation of Tradescantia pollen to study stages of meiosis. **8.** Temporary preparation of polytene chromosomes from salivary gland cells of Chironomus larva. **9.** Nest construction behaviour and altruism in red ants. **10.** Planting and maintaining of larval host plants of different butterfly species. (Student Activity) **11.** Field activities: field visits- zoos/sanctuaries/national parks.	

References:

1. Sinha, A.K, Adhikari S and Ganguly BB: Biology of Animals (vol. I & II), Central Book Agency, Kolkata
2. Alcock, J. (2001): Animal Behaviour, an Evolutionary Approach. Sinauer associates, INC. Sunderland, Massachusetts. USA
3. Bernard, C. (2004): Animal Behaviour, Mechanism, Development function and evolution. Pearson and Prentice Hall Publication. New York
4. Dunlap, J. C., Loros J. J. and Decoursey P. J. (2004): Chronobiology Biological Timekeeping. Sinuaer Associates, Inc. publishers, Sunderland, Massachusetts, USA
5. Goodenough, J.E., Mc Guire, B. and Wallace, R. A. (1993): Perspectives on Animal Behaviour. John Wiley and Sons, New York.
6. Mandal, F. B. (2010): Textbook of Animal Behaviour. PHI Learning Private Limited, Estern Economy Edition. New Delhi -110001
7. Manning, A. and Dawkins M.S. (1997): Introduction to Animal Behaviour, 5th edition, Cambridge University Press. UK.

8. Scott, G. (2005): Essential Animal Behaviour. Black Well Publishing, University of Hull, UK.
9. Stumpter, T. J. D. (2010): Collective Animal Behaviour; Princeton University Press. Oxford..
10. Robert H. Tamarin: Prin. Of Genetics; 7th Ed. Tata McGraw Hill.
11. Elaine Johansen Mange and Arthur Mange: Basic Human Genetics; Indian Reprint; 1997; Rastogi Publ.
12. A.P. Jha: Genes and Evolution; MacMillon India.
13. William S. Kluge: Concepts of Genetics; M.R.Cummings, Pearson Edu .
14. F Scott. Gilbert, Sinauer Associates Inc: Developmental Biology.
15. T. Subramanian: Developmental Biology; Narosa Publ.
16. Philip Grant: Biology of Developing System; Holt Saunders International Ed.
17. M. W. Strikberger: Evolution;CBS Publ.
18. Sumitra Sen and Dipak Kumar Kar: Cytology and Genetics; Narosa Publ.
19. R.M. Twyman, Bios: Instant Notes- Developmental Biology; Scientific Pub. Ltd.
20. Epstein, R. J. (2003): Human Molecular Biology. Cambridge Univ. Press, Cambridge
21. Watson, J. D., T. A. Baker S. P. Bell, A Cann, M. Levine and R. Losick, (2004). Molecular Biology of Gene V Edition, Pearson Education RH Ltd. India.
22. Bier, E. 2005. Drosophila, the Golden Bug, Emerges as a Tool for Human Genetics. Nature Reviews Genetics 6: 9-23.
23. Fly: http://flybase.bio.indiana.edu:82/
24. Biology of Hydra: https://doi.org/10.1016/B978-0-12-145950-5.X5001-0
25. J.A.Pechenik: Biology of Invertebrates; 4th Ed, Tata McGraw Hill Publication.
26. Russell, W.D. Hunter, McMillan: Life of Invertebrates.
27. Bares, R.D: Invertebrate Zoology, Saunders Publication.
28. Barrington, E J W, (1976): Structure and Functions of Invertebrates.
29. Hyman, L.H: The invertebrates (all volumes), McGraw Hill, Philadelphia, USA

Course Code: RPSZOO102

Course Title: Biochemistry and Metabolism – I

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand and analyse the classification, structures, and functions of Carbohydrates, Lipids and Nucleic acids.
CO 2	Enumerate the law of Biochemical thermodynamics, ETS chain reaction and oxidative phosphorylation concepts.
CO 3	Apply the knowledge of antioxidants and free radicals quenching to cancer research and anticancer activity.
CO 4	Compare and contrast between different metabolic pathways and understand its significance.
CO 5	Analyse and understand the different cell signalling pathways and apply it in the field of cancer genetics.
CO 6	Calculate Normality, Molarity and prepare solutions of different strengths.

RPSZOO102	Biochemistry and Metabolism – I	Credits 4
UNIT-I	***Biomolecules- a structural and functional approach-I*** • Carbohydrates: Monosaccharides- structure, classification, D- and L- isomers, Anomers and mutarotation, open chain and ring forms, pyranose and furanose forms, reactions of monosaccharides, glycocydic bonds and nomenclature. Oligosaccharides, Polysaccharides- homo- and hetero-polysaccharides. • Lipids: Classification: simple and complex lipids, Fatty acids- Even and odd carbon fatty acids, numbering the carbon atoms, saturated and unsaturated fatty acids, cis- and trans-configuration, nomenclature and shorthand representation of fatty acids. Acylglycerols- Mono-, di- and triglycerides, stereospecific numbering of glycerols in glycerides, properties of triacylglycerol. Complex lipids- Phospholipids, Sphingolipids, Sterols and waxes, Amphipathic lipids Membrane lipid bilayers. • Nucleic acids: Types of RNA and DNA- Components: Pentose, Nitrogenous bases, Nucleosides, tautomeric forms of purines and pyrimidines. different forms of DNA double helix. • Glycoproteins: Blood group substances • Glycolipids: Gangliosides • Lipoproteins: Classification and functions- chilomicrons, VLDL, LDL, HDL, and free fatty acid-albumin complex.	15 Lectures
Unit-II	***Biochemical Thermodynamics*** • Biochemical Thermodynamics: Laws of thermodynamics, free energy, entropy, enthalpy, exergonic and endergonic reactions • High energy compounds: ATP, ADP, ATP-ADP cycle, ATP-AMP ratio. • Biological oxidation: Electron transport chain and mitochondria; Oxidative phosphorylation- mechanism, uncoupling of oxidative phosphorylation and its significance. • Free radicals, antioxidants and antioxidant system.	15 Lectures

Unit-III	***Metabolic pathways and Integration of metabolism-I*** • Carbohydrate Metabolism- Glycolysis: Reaction sequence, flow of carbon, conversion of pyruvate to lactate and Acetyl coenzyme-A, significance of pyruvate-lactate interconversion, aerobic and anaerobic glycolysis and energetic of glycolysis. Regulation of glycolysis. Gluconeogenesis: Reaction sequence from pyruvate, gluconeogenesis from amino acids, glycerol, propionate, lactate. Regulation of gluconeogenesis. Glycogen metabolism: Glycogenesis, Glycogenolysis. Regulation of the two pathways. Significance of following pathways: Hexose monophosphate shunt as a multifunctional pathway, Uronic Acid Pathway; Glyoxalate cycle. • Lipid Metabolism- Dynamics of body lipids, mobilization of fats, regulation of hormone sensitive TG- lipase, fate of glycerol and free fatty acids. Fatty acid metabolism: Oxidation of even-carbon and odd-carbon atom fatty acid, oxidation of unsaturated fatty acids, biosynthesis of fatty acids including desaturation, metabolism of phospholipids, cholesterol and alcohol.	**15 Lectures**
Unit-IV	***Cell Communication*** • Cell signalling: Cell surface receptor- G-Protein Coupled Receptor (GPCR), Inotropic Receptor, Enzyme Linked Receptor. Lipid and Steroid based receptor- Intra cellular receptor, Cytoplasmic receptor. Signalling, secondary messenger and regulation through G-protein coupled receptors. Hormones and their receptors, Bacterial and plant two-component systems, Light signaling in plants, Bacterial chemotaxis and quorum sensing. • General principles of cell communication- Cell adhesion molecules (cadherins, selectin, immunoglobin super family, integrin). • Cell Junctions- occluding junction (tight junction septate junction), anchoring junction (adherens junction, focal adhesion, desmosomes, hemi-desmogens), communication junction (Gap junction, Plasmo-desmata)	**15 Lectures**
RPSZOOP102	**Practical Title: Biochemistry and Metabolism – I**	**Credits 2**

	1. Determination of glycogen in the given tissue (liver/ skeletal muscle/ kidney/ brain). **2**. Acid and enzyme hydrolysis of glycogen and colorimetric estimation of the products by 3,5-DNSA method. **3.** Determination of acid value of fats/ oils. **4.** Determination of saponification value of fats/ oils. **5.** Agarose gel electrophoresis of DNA separated from suitable samples. **6**. Solutions and Buffers: Mode of expressing concentration of solutions- Molarity (M), Molality (M), normality (N), Mass concentration, mass fraction, mass percentage or %(w/w), % by volume (v/v), parts per million (ppm) with practical exercises. **7**. Preparation of buffers of different pH using Henderson-Hasselbalch equation and its verification using pH meter.	

References:

1. U. Satyanarayan: Biochemistry- 2nd Ed. 2002, Books and Allied Publ.
2. S.C. Rastogi: Biochemistry- 2nd Ed., Tata McGraw Hill.
3. J.I.Jain, S. Chand and Co. Publ : Fundamentals of Biochemistry- 3rd Ed. 1988.
4. Lehninger, A. L., Nelson, D. L. and Cox, M. M., 2nd Edn.: Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
5. Conn, E. E., Stumpt, P. K., Bruencing, G. and Dol, R. G. (1995): Outlines of Biochemistry. John Wiley, Singapore.
6. Murray, RK., Garner, D.K., Mayes P.A. and Rodwell, V.W. (2003): Harper's Illustrated Biochemistry, 26th Edn. Lange Medical Books, McGraw Hill, New York.
7. www.enzymesIndia.com

Course Code: RPSZOO103

Course Title: Bioanalytical techniques and IPR

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand and comprehend the principle, working and applications of Microscopy, Spectroscopy and Chromatography.
CO 2	Compare and contrast between different types of microscope
CO 3	Illustrate the different Tracer techniques.
CO 4	Develop skills with regards to computer applications like data analysis and SPSS in biostats and solve problems based on t test, z test, chi square test, ANOVA etc.
CO 5	Understand and analyse different concepts in Intellectual property rights.

RPSZOO103	**Bioanalytical techniques and IPR**	**Credits 4**
UNIT-I	***Microscopy, Spectroscopy and PCR*** ● Microscopy: Principles and applications of microscopy: Light microscopy, phase contrast microscopy, fluorescence microscopy, polarization microscopy, confocal scanning microscopy, transmission electron microscopy, specimen preparation for electron microscopy, scanning electron microscopy. ● Spectroscopy: IR,GC MS , LC MS, AAS, ICP-AES, Plasma emission spectroscopy, NMR, 2D NMR ● PCR: Principle steps in PCR, Constraints in PCR, Modifications of PCR techniques and its applications.	**15 Lectures**
UNIT-II	***Tracer Techniques and Chromatography*** ● Tracer Techniques: Radioactive isotopes and autoradiography-Principle, instrumentation & technique: Geiger- Muller counter, Liquid scintillation counters Applications of isotopes in biology. ● Column chromatography: Packing and operation of column, loading the column, eluting the column, collection of elluent, detection of elluent, application. ● Ion exchange chromatography: Ion exchange resins, selection of ion-exchanger, choice of buffers, preparation and use of ion-exchangers, storage of resins. ● HPLC ● HPTLC	**15 Lectures**
UNIT-III	***Biostatistics and computer applications*** • Range, variance, standard deviation and standard error, coefficient of variation. • Testing of hypothesis: Statement for testing the hypothesis, statistical validation using student's "t" test, 'z' test, chi square test, simple and multiple correlation, regression analysis, Introduction to ANOVA (One way and two way), Meaning of level of significance, Test of significance. • Dunett's test • Computer applications: MS word, EXCEL, Power point, SPSS uses.	**15 Lectures**

UNIT -IV	***Intellectual Property Rights*** • Introduction to intellectual property; types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, protection of new GMOs. • International framework for the protection of IP. • IP as a factor in R&D; IPs of relevance to biotechnology and few case studies. • Introduction to history of GATT, WTO, WIPO and TRIPS. • Bioprospecting and Biopiracy • Concept of 'prior art': invention in context of "prior art". Patent databases - country-wise patent searches (USPTO, EPO, India); analysis and report formation.	**15 Lectures**
RPSZOOP103	**Practical Title: Bioanalytical techniques and IPR**	**Credits 2**
	1. Separation of pigments from leaves or flowers by adsorption Column chromatography. **2.** Separation and identification of amino acids by 2D paper chromatography. **3.** Analysis of volatile oils by GC-MS.(Demontsration) **4.** Separations of proteins by ion exchange chromatography. **5.** Activity based learning: Anchrom Lab visit/ Ramnathan lab visit. (Demonstartion of HPTLC technique using animal source) **6.** Patent search and patent filing **7.** DNA amplification using PCR. (Demontsration) **8.** Biostatistics problems- Z-Test. T-Test, Chi Square, ANNOVA. **9.** Data analysis using MS Excel.	

References:

1. Biosafety and bioethics (2006) Rajmohan Joshi. Gyan Publishing House.
2. Biotechnology and Patent laws: patenting living beings (2008) Sreenivasulu, N.S. and Raju C.B. Manupatra Publishers
3. Biological Science; 3rd Ed. D.J.Taylor, N.P.O.Green, G.W.Stou, Cambridge Univ. Press
4. Cell and Molecular Biology- Concepts and Experiments, Gerald Karp. John Wiley & Co.
5. Introductory Practical Biochemistry; S.K.Swahney, Randhir Sing. Narosa Publ.
6. An Introduction to Practical Biochemistry; 3rd Ed. David Plummer. Tata McGraw Hill
7. Complete Reference to Intellectual Property Rights Laws. (2007). Snow White Publication Oct. Craig, W., Tepfer, M., Degrassi, G., & Ripandelli, D. (2008).
8. An Overview of General divisions/csurv/geac/annex-5.pdf

9. Intellectual property law (2008) Lionel Bently, Brad Sherman. Oxford University Press.
10. International Union for the Protection of New Varieties of Plants. http://www.upov.int
11. Karen F. Greif and Jon F. Merz, Current Controversies in the Biological Sciences - Case Studies of Policy Challenges from New Technologies, MIT Press
12. Kuhse, H. (2010). Bioethics: An Anthology. Malden, MA: Blackwell.
13. Bailey, N.T.J., 1994. Statistical Methods in Biology-II Ed., Cambridge University Press
14. Samuel, M.L., 1991.Statistics for Life Sciences, Dellen Publishing Co, San Francisco.
15. Modern Experimental Biochemistry; 3rd Ed. Rodney Boyer, Pearson Education.
16. Principles and Techniques of Practical Biochemistry. Wilson and Walker, Cambridge Univ. Press.

Course Code: RPSZOO104

Course Title: Enterpreneurship in Aquarium Management

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Comprehend the key skills needed to set up an aquarium.
CO 2	To identify and differentiate the different aquarium/ornamental fishes.
CO 3	Formulate fish food that provides with complete nutritional benefits.
CO 4	Analyze the required budget to set up a well maintained home aquarium.

RPSZOO104	Enterpreneurship in Aquarium Management	Credits 4
UNIT-I	***Introduction to Aquarium Fish Keeping*** • Types of aquaria (Salinity, Temperature, Species Selection & Location) Aquarium setup and accessories. • Aquarium Filters and types of filtration methods (Mechanical, Chemical & Biological – Nitrogen Cycle) • Precautions to be taken for an ideal aquarium; Criteria of selection for aquarium fishes • Scope of Aquarium fish Industry.	15 Lectures
UNIT-II	***Aquarium Fishes*** • Exotic and Endemic species of Aquarium Fishes (Exotic Aquarium Fishes – Puffer & Siamese Tiger fish; • Endemic Aquarium Fishes – Zebra Danio & Honey Gourami) • Common characters and sexual dimorphism of Fresh, brackish and Marine Aquarium fishes. • Freshwater ornamental fishes - Guppy, Gold fish and Angel fish. • Brackish ornamental fishes - Black Molly and Sword tail. • Marine ornamental fishes.	15 Lectures
UNIT-III	***Maintainence of Aquarium*** • Anatomy and biology, Feeding, Reproduction, Health, Nomenclature, and distribution of aquarium fish. • Freshwater invertebrates, • Marine invertebrates. • Aquarium Plants • Origin and variety of plants and Caring of live plants.	15 Lectures
UNIT -IV	***Basic requirements of Aquarium Maintenance*** • Budget for setting up and maintenance of Aquarium /ornamental fish farm. • Water quality requirements: Maintenance and Temperature control. • Live fish transport - Conditioning, packing, transport and quarantine methods. Factors and principles associated with live fish transport. • Assembling a tank, Equipment and accessories. • Balanced aquarium: Choosing the bed, Decor and background, Final preparations.	15 Lectures

RSZOOP104	**Practical Title: Enterpreneurship in Aquarium Management**	**Credits 2**
	1. Setting of freshwater aquarium tank. **2.** Identify and describe food and its Types. **3.** Identify and describe aquarium plants (any five). **4.** Identify and describe aquarium fishes (Freshwater, Marine and Brackish water). **5.** Activity based learning: Preparation of different type of fish food. **6.** Develop digital presence for start-ups Lab-1: Website Development. **7.** Develop digital presence for start-ups Lab-2: Search engine optimization. **8.** Develop digital presence for start-ups Lab-3: email campaign. **9.** Entrepreneurship lab-1: Case study on business operation processes. **10.** Entrepreneurship Lab-1: Case study on Market Research.	

References:

1. Aquarium : Fish Keeping C B L Srivastava Published by Kitab Mahal .
2. Marine Aquarium (Fish: Keeping and Breeding Them in Captivity) Boruchowitz, Davie**.** Published by Chelsea House Publications (1998) .
3. Aquarium Setting Up (Fish: Keeping and Breeding Them in Captivity) Axelrod, Herbert R. Published by Chelsea House Publications (1998).
4. The Tropical Freshwater Aquarium Problem Solver: Practical and Expert Advice on Keeping Fish and Plants Sand ford, Gina Published by Voyageur Press (MN) (1998).
5. Aquariums: The Complete Guide to Freshwater and Saltwater Aquariums, Jan 2009 by Thierry Maitre-alain (Author), Chrisitan Piednoir (Author)

Course Code: RPSZOO105

Course Title: Emotional well-being through Logic-based thinking

Academic year 2022-23

Course Description: Much of human existence is engulfed in the emotions of anger, depression, worry, anxiety, guilt, and frustration. From dealing with issues arising in the classroom to the workplace, and the arena of social interaction, intimacy, and friendship, the prospect for happiness is often spoiled by irrational thinking possessed by the human mind. Skills like being able to manage one's emotions and thoughts are important to every student irrespective of their academic areas of interest. This course helps students to use the methodologies in philosophy to work upon these irrational thinking tendencies thereby achieving a healthier state of mind. It focuses on a prominent form of philosophical practice known as Logic-Based Therapy and Consulting (LBT) developed by American philosopher Elliot D Cohen. Upon successful completion of this course, the student will be equipped with the knowledge of overcoming their faulty thinking patterns, ways of refuting them, and skills to replace them with rational patterns. In effect, the students will be able to manage their emotions in a better way by working on their thinking process.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand the connection between thinking patterns, emotions, and behavior.
CO 2	Identify one's faulty thinking patterns (fallacies) and methods for refuting them.
CO 3	Replace faulty thinking patterns with positive and rational thinking patterns.
CO 4	Using philosophical antidotes to promote a healthy state of mind.

RPSZOO105	AEC	Credits *2*

	Emotional well-being through Logic-based thinking	
UNIT-I	***Relation between Emotions and Thinking- I*** ● Fundamentals of emotional well-being. ● Tracing the thoughts behind an emotional problem. ● Some prominent faulty thinking patterns/fallacies causing harm to oneself and others: Demanding perfection, World Revolves Around Me, Damnation, Awfulizing, Can't stipation.	**15 Lectures**
UNIT -II	***Relation between Emotions and Thinking- II*** ● How to refute the fallacies ● Fallacy-Antidotes-Virtues framework ● Some uplifting Antidotal reasoning to overcome the fallacies. ● Corresponding Guiding virtues for the fallacies: Demanding perfection - Metaphysical security World Revolves Around Me - Empathy Damnation - Respect Awfulizing - Courage Can't stipation - Temperance	**15 Lectures**

References:

1. Elliot D Cohen, *What Would Aristotle Do: Self-Control through the Power of Reason*, Prometheus Books, 2003.

Modality of Assessment

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr. No.	Evaluation type	Marks
1.	Two Assignments/Case study/Project/Research paper review	20
2.	One class Test (multiple choice objective question)	20

B) External Examination- 60%- 60 Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of **2hours 30 mins** duration.
2. Theory question paper pattern:

Paper Pattern:

Questions	Options	Marks	Questions on
Q.1	**Any 1 out of 2**	**12**	**Unit- I**
Q.2	**Any 1 out of 2**	**12**	**Unit- II**
Q.3	**Any 1 out of 2**	**12**	**Unit- III**
Q.4	**Any 1 out of 2**	**12**	**Unit- IV**
Q.5	**3 short notes out of 5**	**12**	**All Units**

Practical Examination Pattern:

C) External Examination: 50 Marks

Particulars	Marks
Journal	05
Experimental tasks/ Viva	45
Total	50

Overall Examination & Marks Distribution Pattern

Semester-I

Course	RPSZOO101		RPSZOO102		RPSZOO103		RPSZOO104		Grand Total
	Internal	External	Internal	External	Internal	External	Internal	External	
Theory	40	60	40	60	40	60	40	60	400
Practical	50		50		50		50		200

Semester II

Academic year 2022-2023

Paper Code	Unit	Topic	Credits
Core Paper IV RPSZOO201	**Comprehensive Zoology-II**		
	I	Animal behavior-II	4
	II	Forensic Science	
	III	Migration Physiology	
	IV	Introduction to model organisms- *C.elegans* and *Danio rerio* -II	
Core Paper V RPSZOO202	**Biochemistry and Metabolism- II**		
	I	Biomolecules- a structural and functional approach-II	4
	II	Enzymes and Enzyme kinetics	
	III	Metabolic pathways and Integration of metabolism	
	IV	Regulation of metabolism and inborn errors of metabolism	
Core Paper VI RPSZOO203	**Molecular Techniques**		
	I	Molecular Biology- I	4
	II	Molecular Biology- II	
	III	Bioinformatics	
	IV	Molecular docking and Molecular dynamics simulations	
DSE RPSZOO204	**Wildlife Biology**		
	I	Wildlife Management-I	4
	II	GIS and its interpretation-I	
	III	GIS and its interpretation-II	
	IV	Wild life Photography and Ecotourism	
ASE RPSZOO205	**Research Methodology**		2
	I	Research Methodology	
	II	Library Referencing	
RPSZOOP201		Comprehensive Zoology – II	2
RPSZOOP202		Biochemistry and Metabolism- II	2
RPSZOOP203		Molecular Techniques	2
RPSZOOP204		Wildlife Biology	2
Grand Total			**26**

Course Code: RPSZOO201

Course Title: Comprehensive Zoology-II

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand and comprehend the broad concepts of animal behaviour and its applications in various fields of research.
CO 2	Correlate the different aspects of animal behaviour, social behaviour and learning or memory to evolutionary aspect.
CO 3	Understand & comprehend the deep insight of migration amongst animal and complex biochemical and physiological process that regulate it.
CO 4	Illustrate the wonders in the field of Forensic Science and understanding its role in Crime.

RPSZOO201	Comprehensive Zoology-II	Credits 4
UNIT-I	***Animal behavior-II*** • Learning and memory: Innate behaviour (orientation, kineses, taxes, motivation, tropism, reflex and nest building), learned behaviour (sensitization and habituation, associative learning, imprinting, reasoning, trial-and-error, discrimination, biased and language learning), neural mechanism of learning. Memory- nature, types and anatomy of memory, and memory storage. • Evolution and Genetics of behaviour: Hamilton's rule, kin selection, cost and benefits of sex and sexual selection, phylogeny of behaviour, genetic control of behaviour (single and multiple gene effect). Genetics of burrow shape in Oldfield mouse and Deer mouse. • Social behaviour: Types of social groups, advantages of grouping, social organization- primates. Cost and benefits of sociality. Eusocial behavior.	**15 Lectures**
UNIT- II	***Forensic Science*** • Scope and importance of forensic science • Biological Evidences Collection and Packaging: Recognition of Biological evidences encountered in various cases, Search and Collection of Biological Evidences; transportation of Biological Evidences. • Analysis of Biological Fluid- Saliva; Semen; Vaginal Fluid; Urine; Sweat. • Antiglobulins; Human & Animal Hair morphology; Blood Grouping-Human & Non-human; Analysis of Skeletal Remains. • Forensic Entomology: Basic Principle of Insect Biology; Life Cycle; Estimation of Time of Death; Preservation of Sample.	**15 Lectures**

UNIT-III	***Migration Physiology*** • Introduction • Migration in Salmonid fishes- The Anadronmous Salmonids, Life of Young Fish in fresh water, Smoltification and Seaward migration, Environmental and Endocrine factors in Spawning and migration. • Migration in Birds- Migratory behaviour, Environmental, Genetic and Endocrine factors.	**15 Lectures**
UNIT- IV	***Introduction to model organisms- C.elegans and Danio rerio -II*** ***C.elegans* as a model organism**: Lifecycle, different larval forms, preparation of media, culturing and maintaince of c.elegans. ***Danio rerio* (Zebrafish) as a model organism**: Zebrafish husbandry and setting up of tank, identification of sex, lifecycle, breeding techniques. Studying zebrafish developmental stages of embryos. Nutritional requirements. Importance of zebra fish in research.	**15 Lectures**
RPSZOOP201	**Practical Title** **Comprehensive Zoology – II**	**Credits 2**
	1. To study the repellent activity of lemon extract against the pest. 2. Culturing and maintaing *C.elegans.* 3. Studying the different larval stages of *C.elegans.* 4. To observe the positive and negative taxis of C.elegans against different biotic and abiotic factors. 5. Maintaining the tank of Zebra fish. 6. To study different behavioural patterns of Zebra fish: Light and dark test, Novel tank test, Natural diving response, Mirror biting test, Predator avoidance, Shoaling behaviour, Color Preferences Assay. 7. To Identify and differentiate various types of Finger prints. 8. Fuming Latent Fingerprints with Iodine. 9. Revealing Latent Fingerprints Using Ninhydrin.	
References:		

1. Alcock, J. (2001): Animal Behaviour, an Evolutionary Approach. Sinauer associates, INC. Sunderland, Massachusetts. USA
2. Bernard, C. (2004): Animal Behaviour, Mechanism, Development function and evolution. Pearson and Prentice Hall Publication. New York
3. Dunlap, J. C., Loros J. J. and Decoursey P. J. (2004): Chronobiology Biological Timekeeping. Sinuaer Associates, Inc. publishers, Sunderland, Massachusetts, USA
4. Goodenough, J.E., Mc Guire, B. and Wallace, R. A. (1993): Perspectives on Animal Behaviour. John Wiley and Sons, New York.
5. Mandal, F. B. (2010): Textbook of Animal Behaviour. PHI Learning Private Limited, Estern Economy Edition. New Delhi -110001
6. Manning, A. and Dawkins M.S. (1997): Introduction to Animal Behaviour, 5th edition, Cambridge University Press. UK.
7. Scott, G. (2005): Essential Animal Behaviour. Black Well Publishing, University of Hull, UK.
8. Stumpter, T. J. D. (2010): Collective Animal Behaviour; Princeton University Press. Oxford.
9. Howe K et al. The zebra fish reference genome sequence and its relationship to the human genome. Nature 2013.
10. Pennisi, E. (1998). Worming secrets from the C. elegans genome. Science, 282,1972-1974.
11. Forensic Science in India and the World, Deepak Ratna and Mohd. Zaidi, Alia Law Agency, Allahabad.
12. Forensic Science in India - A Vision for 21st Century, B. B. Nanda and Dr. R. K. Tewari, Select Publishers.
13. Fundamentals of Forensic Science, Second Edition, Max M. Houck and Jay A Siegel, Academic Press.
14. Forensic Science, Third Edition, Stuart H James and Jon. J. Nordby.
15. Forensic Biology, Richard Li, CRC Press.
16. Forensic Science: An introduction to Scientific and Investigative Techniques by S. H James, J. J. Nordby.
17. Illustrated Guide to Home Forensic Science Experiments by Robert Bruce Thompson and Barbara Fritchman Thompson, First Edition. (Online Pdf available)
18. Fly: http://flybase.bio.indiana.edu:82/
19. Worm: http://www.expasy.ch/cgi-bin/lists?celegans.txt
20. http://www.wormbook.org/
21. Zebrafish: http://www.ncbi.nlm.nih.gov/genome/guide/D_rerio.html

Course Code: RPSZOO202

Course Title: Biochemistry and Metabolism- II

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand and analyse the classification, structures, and functions of Proteins and enzymes.
CO 2	Enumerate and understand the concept of enzyme kinetics.
CO 3	Compare and contrast between competitive, non-competitive, and uncompetitive mechanism of enzyme kinetics and correlate it with Vmax and Km.
CO 4	Compare and contrast between different metabolic pathways and understand its significance.
CO 5	Analyse and understand the different inborn errors of metabolism.

RPSZOO202	Biochemistry and Metabolism- II	Credits 4
UNIT –I	***Biomolecules- a structural and functional approach-II*** • Proteins as polymers of amino acids Amino acids: structure, classification based on structure, polarity, nutritional requirement and metabolic fate; properties of amino acids; derivatives of amino acids, non-transcribed amino acids as protein constituents, D-amino acids. • Organization of protein structure: Primary structure and peptide bond, secondary, tertiary and quaternary structure; conjugate proteins- haemoglobin, cytochromes, myoglobin; bonds involved in protein organization. • Properties of proteins: classification, denaturation and protein folding. • Biological functions of proteins. Biologically important peptides: glutathione, octa-, nona-, and deca-peptides. • Ramachandran plot.	**15 Lectures**
UNIT – II	***Enzymes and Enzyme kinetics*** • Enzyme kinetics: i. Mechanism of enzyme catalysis. ii. enzyme activation and inhibition. iii. factors affecting enzyme activity. iv. Michaelis Menton equation. v. Lineweaver-Burk plot. vi. significance of Vmax and Km (including non-competitive, Uncompetitive and competitive inhibitions); • Regulatory enzymes: covalently modulated, allosteric regulation, Isoenzymes (LDH, CK, ALP, ADH) • Non-protein enzymes- Ribozymes, Ribonucleas & Peptidyl transferase.	**15 Lectures**
UNIT – III	***Metabolic pathways and Integration of metabolism*** • Protein Metabolism: Metabolism of amino acids: Amino acid pool, transamination; oxidative and non- oxidative	**15 Lectures**

	deamination; metabolism of branched chain amino acids; fate of carbon skeleton of amino acids. • Metabolism of ammonia: Urea cycle. • Metabolism of nucleic acids: Synthesis of ribo nucleotides- a brief idea of *de novo* pathway and salvation pathway. Conversion of ribo nucleotides to deoxyribo nucleotides. Degradation of nucleotides • Integration of Metabolism, Energy demand and supply. Integration of major metabolic pathways of energy metabolism; Intermediary metabolism; Organ specialization and metabolic integration. Metabolism in starvation	
UNIT –IV	***Regulation of metabolism and inborn errors of metabolism*** • Carbohydrate metabolism: Glycogen storage disease, G-6-PD deficiency • Lipid metabolism: Metabolic disorders of cerebrosides. • Protein metabolism: PKU, Albinism, Cysteinurea • Purine metabolism: Primary Gout • Mineral metabolism and diseases: Hypocalcimia, Hypercalcimia, Osteoporosis. • Teratology i. Teratogens and their effects i. Sensitive period of teratogen i. Specificity of teratogen i. Thalidomide syndrome i. Teratocarcinoma and Teratoma i. Environmental teratogens i. Evaluation of teratogenicity of chemicals	**15 Lectures**
RPSZOOP202	**Practical Title: Biochemistry and Metabolism- II**	**Credits 2**
	1. Determination of total cholesterol and HDL cholesterol from serum. 2. Colorimetric estimation of protein by Peterson-Lowry method 3. Detection of conformation of BSA by viscosity measurement and effect of varying concentration of urea on viscosity of BSA 4. Determination of creatinine in serum. 5. Determination of urea in serum. 6. SDH specific activity	

	7. Enzyme kinetics - pH variation & Temperature-fungal amylase. 8. SDS PAGE of milk protein or blood plasma.	

References:

1. U. Satyanarayan: Biochemistry- 2nd Ed. 2002, Books and Allied Publ.
2. S.C. Rastogi: Biochemistry- 2nd Ed., Tata McGraw Hill.
3. J.I.Jain, S. Chand and Co. Publ : Fundamentals of Biochemistry- 3rd Ed. 1988.
4. Lehninger, A. L., Nelson, D. L. and Cox, M. M., 2nd Edn.: Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
5. Conn, E. E., Stumpt, P. K., Bruencing, G. and Dol, R. G. (1995): Outlines of Biochemistry. John Wiley, Singapore.
6. Murray, RK.Garner, D.K., Mayes P.A. and Rodwell, V.W. (2003): Harper's Illustrated Biochemistry, 26th Edn. Lange Medical Books, McGraw Hill, New York.
7. www.enzymesIndia.com

Course Code: RPSZOO203

Course Title: Molecular Techniques

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand and comprehend the concepts of DNA replication, DNA repair and protein synthesis.
CO2	Comprehend the concepts of RNA synthesis and processing, Protein synthesis and processing
CO 3	Evaluate and understand broad concepts of bioinformatics.
CO 4	Demonstrate efficacy studies in the experimental techniques for any biological project.
CO 5	Apply the principle of

RPSZOO203	Molecular Techniques	Credits 4
UNIT –I	***Molecular Biology- I*** • DNA replication, repair and recombination- Meselson-Stahl experiment, Enzymes involved in prokaryotic and eukaryotic replication, Structure of DNA polymerase-III(Prokaryotes), Unit of replication (Prokaryotic and Eukaryotic replication process)- Inititiation, Elongation and termination fidelity of replication, extra chromosomal replicons (Plasmid and Mitochondria). • DNA damage and repair mechanisms (Direct repair- Photoactivation, Alkylation and Methyltransferase; Single stranded repair- Base excision repair, Nucleotide excision repair and Mis-match repair), Double stranded repair- homologous and non homologous repair, site-specific recombination.	15 Lectures
UNIT –II	***Molecular Biology- II*** • RNA synthesis and processing- Structure and function of different types of RNA, RNA transport transcription factors and machinery (Prokaryotes and Eukaryotes), formation of initiation, elongation and termination complex. RNA polymerases, capping, RNA processing, RNA editing, splicing, and polyadenylation. • Protein synthesis and processing- Ribosome, Prokaryotes and Eukaryotes- Formation of initiation complex, Initiation factors & their regulation, elongation and elongation factors, termination. • Genetic code, Aminoacylation of tRNA, t-RNA identity, Aminoacyl of tRNA synthetase, Translational proof reading. • Post translational modifications.	15 Lectures
UNIT –III	***Bioinformatics*** • Specialized databases: EST, GSS, KEGG, OMIM Conserved regions in nucleotide and protein sequences • Gene finding and motif finding. System biology and Bioinformatics, Biological pathway analysis • System biology database and tools: Reactome, Pathway commons Bioinformatics and functional genomics and proteomics • Introduction to Protein and DNA microarray	15 Lectures

	• Data analysis in Microarray using bioinformatics. • GEO database: functional genomics data repository Bioinformatics and structural proteomics- Visualization and comparison of protein structure; Prediction of Secondary and tertiary structure of protein.	
UNIT –IV	***Molecular Modeling & Molecular Dynamics simulations*** Concept of molecular modeling, chirality & stereochemistry. Theory and practice of energy minimization, Monte Carlo. Definition of the potential energy surface of a molecule, force field and generic form of a forcefield. Differences between molecular mechanics energy and the quantum mechanical energy of a system. Differences between Class I, Class II and Class III forcefields. Parametrization of a forcefield. Molecular dynamics simulation: Major steps, simulation models such as coarse grained, bead rod and bead spring models, Ensembles- microanonical, canonical, isobaric-isothermal & grand canonical ensembles.	**15 Lectures**
RPSZOOP203	**Practical Title: Molecular Techniques**	**Credits 2**
	1. Quantitative estimation of DNA in a suitable tissue-comparative study- by diphenyl amine method. **2**. Quantitative estimation of RNA in a suitable tissue-comparative study by orcinol method. **3**.Using mini-prep method isolate plasmid DNA from the given strain of bacteria & show the purity of the isolate by performing agarose gel electrophoresis. **4**. Restriction-digest the given DNA sample & demonstrate the separation of fragments by performing agarose gel electrophoresis. Interpret the results by comparing with the standard digests provided. **5**. Study of genetic diseases using OMIM database. **6**. Tools for gene and motif finding. **7**.Visualization of biological pathway- KEGG Pathway, Plant Reactome. **8**. BLAST and its variants: Phi and Psi blast **9**. Visualization of protein structure – Rasmol and PyMol **10**.Protein structure prediction: Homology modelling based structure prediction tool-SWISS model.	

	11. Demonstration- Gromacs and Discovery studio.	

References:

1. Epstein, R. J. (2003): Human Molecular Biology. Cambridge Univ. Press, Cambridge
2. Watson, J. D., T. A. Baker S. P. Bell, A Cann, M. Levine and R. Losick, (2004). Molecular Biology of Gene V Edition, Pearson Education RH Ltd. India.
3. Alberts, B, Johnson, J Lewis, M. Raff, K Roberts and P. Watter. (2014): Molecular Biology of the cell. 6th edition. Garland Science, New York.
4. Lodish, H., A. Berk, C.A Kaiser, M.P. Scott, A Bretscher, H. Ploegh, P. Matsudaira. (2016): 8th Edition, Molecular Cell Biology. W. H. Freeman and Co., N. Y.
5. Brachet, J. (1985) Molecular Cytology, Academic Press, N. Y.
6. Pollard, T. D. and W. C. Earnshaw. (2002): Cell Biology. Saunders.
7. Bioinformatics: concepts skills and applications (2004). S.C. Rastogi, N. Mendiratta and P. Rastogi.
8. Bioinformatics: A modern approach. (2005) V.R. Srinivas.
9. Essential Bioinformatics (2006). J. Xiong.
10. Statistical methods in Bioinformatics: An introduction. (2005). W. Even and G. Grant
11. Bioinformatics: A Practical Approach 2007 Shui Qing (Chapman & Hall/CRC Mathematical and Computational Biology)
12. P. Clote and R. Backofen. 2000. Computational Molecular Biology: an Introduction. Wiley and Sons.
13. J. M. Keith. 2008. Bioinformatics; Vol 2: Structure, function and applications. Humana Press.
14. A. Leach. 2001. Molecular modeling- principles and applications. Pearson Education Ltd.
15. F. J. Burkowski. 2008. Structural bioinformatics: An algorithmic approach. CRC Press.
16. A. K. Konopka and M. J. Crabb. 2004. Compact handbook of computational biology. Marcel Dekker, New York.

Course Code: RPSZOO204

Course Title: Wildlife Biology

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Understand the carrier opportunities in GIS.
CO 2	Summarize the concepts of GIS related technologies like Global Positioning System, Arial Photography, Remote Sensing, LiDAR.
CO 3	Explore and visualize geo-database.
CO 4	Evaluate and understand broad concepts in wildlife photography.
CO 5	Understand the ethical aspects in the field of tourism.

RPSZOO204	Wildlife Biology	Credits 2
UNIT –I	***Wildlife Management-I*** ● On field computation and usage of portal computing devices.Still Cameras for wild life tracking and path mapping. ● Radio telemetry and Mobile Satellite systems, Multifrequency echo sounders and acoustic tags for fishery. ● Sonogram and its analytics. e.g. (Bird songs, Insect calls, Habitat usage by Bats)	**15 Lectures**
UNIT –II	***GIS and its interpretation-I*** ● Geographical Information Systems: Brief introduction, working of GIS, Geo referenced GIS data and its significance, GIS related domain. ● Use of in decision support system and real world applications. ● Basic concepts of geography related to the use GIS technology. ● Study of data display and cartographical methods. ● Explore and visualize geo-database.	**15 Lectures**

UNIT –III	***GIS and its interpretation-II*** ● Definitions: Datum and geographic, projected coordinate system and their types. ● Introduction to various source for data and data acquisition terminologies in GIS. ● Study of the topological relationship of spatial data. ● Concepts of GIS related technologies like Global Positioning System, Arial Photography, Remote Sensing, LiDAR etc. ● Scope and carrier opportunities of GIS in India..	
UNIT –IV	***Wild life Photography and Ecoturism*** ● Introduction to wildlife photography: Scope, opportunity, Best equipment for photography, Basics of DSLR camera. Macro and Micro Photography. Rules of Wildlife Photography. ● Tourism and visitors management: Nature and scope, Definition and concept. Types of Tourism: Responsible Tourism, Eco Tourism and Humane tourism (Brief Introduction) ● Wildlife Tourism. ● Scope of Wildlife Tourism. ● Stakeholders in Sustainable Tourism: Role of Government, Non-government bodies, Local communities and International organisation (Global Sustainable Tourism Council) ● Sustainable Development Goals (SDG): SDG 8, SDG 12 and SDG 14	
RPSZOOP205	**Practical Title: Wildlife Biology**	**Credits 2**
	1. Perform the GIS operations like geo-database creation, visualization, digitization, map clean up, topology, geo-referencing, data linking, symbology, geo-processing, overlay analysis and map composition in most popular GIS packages like QGIS . **2.** Using a handheld GPS instrument locate coordinates of a demarcated field site (Eg. College campus).	

	3. Using a suitable insect model, apply the capture – recapture technique for enumeration of population size (e.g. rice weevil using - marker pen). **4.** On campus visit and learning macro photography using DSLR camera/mobile camera. **5.** Make an audio recording of a song bird. e.g., bulbul, magpie robin, sunbird. Observe and note the activity of the bird while recording the call. Make a sonogram of the recording. Analyze the call and correlate with the behavioural observations. Classify the call as advertisement call, territorial call, alarm call, courtship call etc. **6.** Activity based learning: To communicate conservation and sustainable awarness amongst the youth & general public.	

References:

1. Wildlife management. Robert, G.H. W.H. Freeman and Co., San Francisco, U.S.A.1978

2. Aerial Photography and Image Interpretation for Resource Management. Paine, D.P. John Wiley and Sons.

3. Remote Sensing: Principles and Applications Sabbins, F.E., Freeman

4. Manual of wildlife techniques,for India. Sale, J.B. and Berkmuller, K. WII, FAO, Dehra Dun, India 1988.

5. A New Approach to Linear Programming Sharma, S.D. Kedarnath, Ramnath and Co. Meerut 1975.

6. Text Book of Wildlife Management. Singh, S.K. IBDC, Lucknow. 2005.

7. Guide for Planning Wildlife Management in Protected Areas and Managed Landscapes VishwasSawarkar Natraj Publisher. Dehradun

Course Code: RPSZOO205

Course Title:Research Methodology
Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION Upon successful completion of this course, learners will be able to;
CO 1	Develop skills to write research papers and literature reviews.
CO 2	
CO 3	Evaluate and understand broad concepts
CO 4	Demonstrate efficacy studies
CO 5	Understand the ethical aspects

RPSZOO205 ASE	Research methodology	Credits 2
UNIT –I	***Research methodology*** • Research methodology: Meaning of research; objective of research; motivation in research; types of research; research approaches; significance of research; research methods versus methodology; Research and scientific methods; Importance of knowing how research is done; Research process; Criteria for good research. • Research problem and research design: Selecting research problem; necessity of defining a problem; techniques involved in defining the problem; meaning of research design; need for research design; important concepts related to research design; different research designs; basic principles of experimental design; important experimental designs.	**15 Lectures**
UNIT –II	***Library Referencing*** • Library: Structure of a scientific library, journals, books, Digital library and E books • Catalogue: Classification of books (Universal Decimal System). • Journals: Indexing journals, H-index, abstracting journals, research journals, review journals, e-journals. • Impact factor of journals, NCBI-Pub Med. • Reprints, Secondary storage devices, Internet, open access initiative, INFLIBNET, INSDOC. Google Scholar • Preparation of index cards: Author index and subject index; Open source, bibliography management system.	**15 Lectures**

References:

1. Practical Research Planning and Design; 2nd Ed. Paul D. Leedy. Macmillan Publ.
2. Research Methodology. Methods and Techniques; C.R.Kothari. Wiley Eastern Ltd. Mumbai.

Modality of Assessment

Theory Examination Pattern:

B) Internal Assessment- 40%- 40 Marks

Sr. No.	Evaluation type	Marks
1.	Two Assignments/Case study/Project/Research paper review	20
2.	One class Test (multiple choice objective question)	20

B) External Examination- 60%- 60 Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of **2hours 30 mins** duration.
2. Theory question paper pattern:

Paper Pattern:

Questions	Options	Marks	Questions on
Q.1	**Any 1 out of 2**	**12**	**Unit- I**
Q.2	**Any 1 out of 2**	**12**	**Unit- II**
Q.3	**Any 1 out of 2**	**12**	**Unit- III**
Q.4	**Any 1 out of 2**	**12**	**Unit- IV**
Q.5	**3 short notes out of 5**	**12**	**All Units**

Practical Examination Pattern:

D) External Examination: 50 Marks

Particulars	Marks
Journal	05
Experimental tasks/ Viva	45
Total	50

Overall Examination & Marks Distribution Pattern

Semester-II

Course	RPSZOO201		RPSZOO202		RPSZOO203		RPSZOO204		Grand Total
	Internal	External	Internal	External	Internal	External	Internal	External	
Theory	40	60	40	60	40	60	40	60	400
Practical	50		50		50		50		200