AC/II(21-22).2.RUS12

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

Syllabus for: UG

Program: B.Sc.

Program Code: Zoology (RUSZOO)

(Credit Based Semester and Grading System
for the academic year 2021–2022)

GRADUATES ATTRIBUTES

GA	GA Description **A student completing Bachelor's Degree in Science (B. Sc) program will be able to:**
GA 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
GA 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
GA 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
GA 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA 5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
GA 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
GA 7	Follow ethical practices at work place and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
GA 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.

PROGRAM OUTCOMES

PO	Description **A student completing Bachelor's Degree in Science program in the subject of Zoology will be able to:**
PO 1	Identify the major groups of organisms, discuss the basis of their biodiversity and draw parallels with their phylogenetic relationship, using well thought cardinal features of classification on the basis of morphology and molecular information.
PO 2	Understand and analyse the evolutionary link amongst the animals and also understand the basic classification patterns of invertebrates and vertebrates. They will be able to compare and contrast between the anatomy and physiology of different invertebrates and vertebrate phylum.
PO 3	Analyse the genes, genomes, cells, cell organelles, tissues and histological studies, understand the linkage of genes, mechanisms of sex determination, various structures of DNA and apply the knowledge of genetics to the process of evolution.
PO 4	Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
PO 5	Analyse and understand the broad concepts of ecology, food webs, food chains and the interconnectedness of biotic and abiotic factors. Comprehend the concepts of Population dynamics, communities and its dependence on the ecosystems.
PO 6	Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives.
PO 7	Solve the environmental problems involving interaction of humans and natural systems at local or global level.
PO 8	Apply their knowledge in fields of Biostatistics and research methodology.
PO 9	Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within Zoology.
PO 10	Get a flavour of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.
PO 11	Apply their knowledge in problem solving and future course of their career development in higher education and research.

PROGRAM OUTLINE

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
F. Y. B. Sc.	I	**RUSZOO101**	Levels of Organization- I and Biodiversity	2
	I	**RUSZOO102**	Animal Biotechnology and Instrumentation	2
	I	**RUSZOOP101**	Practicals based of both papers of semester I	2
	II	**RUSZOO201**	Levels of organization- II and Ecology	2
	II	**RUSZOO202**	Nutrition, Public health and Hygiene	2
	II	**RUSZOOP201**	Practicals based of both papers of semester II	2
S. Y. B. Sc.	III	**RUSZOO301**	Genetics, Heredity and Nucleic Acids	2
	III	**RUSZOO302**	Life processes	2
	III	**RUSZOO303**	Ethology and Economic Zoology	2
	III	**RUSZOOP301**	Practicals based of all papers of semester III	3
	IV	**RUSZOO401**	Evolution and Population Genetics	2
	IV	**RUSZOO402**	Cell Biology and Biomolecules	2
	IV	**RUSZOO403**	Reproductive Biology and Pollution	2
	IV	**RUSZOOP401**	Practicals based of all papers of semester IV	3
	V	**RUSZOO501**	Study of animal types – Non chordates	2.5

	V	**RUSZOO502**	Haematology and Immunology	2.5
	V	**RUSZOO503**	Molecular Biology and Biotechnology	2.5
T. Y. B. Sc.	**V**	**RUSZOO504**	Endocrinology, Osteology and Embryology.	2.5
	V	**RUSZOOP501 + RUSZOOP502**	Practical based both RUSZOO501 and RUSZOO502	3
	V	**RUSZOOP503 + RUSZOOP504**	Practical based both RUSZOO503 and RUSZOO504	3
	VI	**RUSZOO601**	Study of animal type: Chordates	2.5
	VI	**RUSZOO602**	Physiology, Histology and Pathology	2.5
	VI	**RUSZOO603**	Toxicology and Computational Biology	2.5
	VI	**RUSZOO604**	Environmental Biology and Entomology	2.5
	VI	**RUSZOOP601 + RUSZOOP602**	Practical based both RUSZOO601 and RUSZOO602	3
	VI	**RUSZOOP603 + RUSZOOP604**	Practical based both RUSZOO603 and RUSZOO604	3

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Syllabus for: F. Y. B. Sc.

Program: B.Sc.

Program Code: Zoology (RUSZOO)

(Credit Based Semester and Grading System
for the academic year 2020–2021)

Course Code: RUSZOO101

Course Title: Levels of organisation I and Biodiversity

Academic year 2021-22

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After successfully completing the course, the students will be able to:
CO 1	Learn and understand about Taxonomy, Systematics and classification of animals, its objectives and importance.
CO 2	Understand the significance of use of scientific terminologies, concept of ICZ and binomial nomenclature.
CO 3	Acquire deep insight of different aspects of Type Studies of various groups of Non-chordates, their classification upto level of order, general and salient features, habit and habitat, geographical distribution and economic importance.
CO 4	Apply knowledge of classification and should be able to classify a non-chordate animal.
CO 5	Understand the concept of Hotspot, biodiversity values, threats to biodiversity, conservation and management of biodiversity.
CO 6	Apply the knowledge of conservation and conserve locally found flora and fauna
CO 7	Appreciate and identify the biodiversity hotspots and interrelate conservation with climate change.

Detailed Syllabus

RUSZOO101	Title: LEVELS OF ORGANIZATION-I AND BIODIVERSITY	Credits-2
Unit I	**Introduction to systematic and Levels of Organization: Non-chordates**	**15 lectures**
	Importance and application of systematics in biology: • Basic concept of animal taxonomy: Classical taxonomy to systematics-taxonomic terms; taxonomy; classification and nomenclature; phenon, taxon and category • Modern concepts and recent trends: chemotaxonomy, cytotaxonomy, serotaxonomy and molecular taxonomy • Taxonomic procedures – collection, preservation and process of identification of Biological species. • Taxonomic keys – different kinds of taxonomic keys, their merits and demerits, Process of typification of different zoological types • International Code of Zoological Nomenclature (ICZN), its operative principles; history of rules of Zoological nomenclature, Bionomial nomenclature	
	Levels of organization in animal kingdom: • Uni-cellularity versus multi-cellularity, colonization and organization of germ layers (Diploblastic and triploblastic condition) - Division of labour and organization of tissues (brief fate of ectoderm, mesoderm and endoderm) • Coelom - Types a) Acoelomate - e.g. Platyhelminthes - *Planaria* b) Pseudocoelomate - e.g. Nematoda - *Ascaris* (Round worm) c) Coelomate - e.g. Annelida - *Pheretima* (Earthworm)	
	• Symmetry – Types a) Asymmetry - e.g. *Amoeba* b) Radial – e.g. Bi-radial –*Aurelia* (Jelly –fish); Penta–radial- *Asterais* (Starfish) c) Bi-lateral- e.g. Simple- *Planaria*; Complex – *Mus* (Rat)	
	Segmentation and metamerism – Types a) Homonymous– e.g. Annelida- *Pheretima* (Earthworm) b) Heteronomous– e.g. Crustacean- *Panulirus* (Lobster) c) Cephalization–e.g. Insecta- *Periplanata* (cockroach) d) Tagmatization–e.g. *Panulirus* (Lobster) e) Cephalothorax - e.g- *Penaeus* (Prawn)	
Unit II	**Non chordates: Unicellular and multicellular organization**	**15 lectures**
	Salient features with examples for phyla, sub-phyla and classes mentioned below; **Unicellular organization**: phylum Protozoa: Bioluminescence in	

	Noctiluca (Active bioluminescence)	
	Multicellular organization: Colonization level –Phylum Porifera	
	Multicellular organization: Division of labour (cell –differentiation) PhylumCoelenterate Mechanism & theories of coral formation, types of coral reefs	
	Triploblastic Acoelomate and Pseudocoelomate organization: • Acoelomate organization –Phylum Platyhelminthes • Pseudocoelomate Organization: Phylum Nemathelminthes	
	Triploblastic coelomate organization: • Animals with metameric segmentation: Phylum Annelida, Regeneration in annelids • Animals with jointed appendages: Arthropdaincluding complete and incomplete metamorphosis, Active Bioluminescence in Glowworm and firefly. Mimicry in butterflies & its significance	
	Animals with Mantle: Phylum Mollusca, Mechanism of pearl formation	
	Animals with enterocoel: Phylum Echinodermata	
Unit III	**Biodiversity and Conservation**	**15 lectures**
	Introduction to Biodiversity: Definition**,** Concepts and Scope and Significance	
	Levels of Biodiversity: Introduction to Genetic, Species and Ecosystem Biodiversity	
	Introduction of Biodiversity Hotspots: Western Ghats (Kerala, Tamil Nadu, Karnataka, Goa Maharashtra, Gujarat) and Indo-Burma Border **(**Arunachal Pradesh, Nagaland, Mizoram, Manipur)	
	Values of biodiversity: Direct and Indirect use value	
	Threats to Biodiversity: Habitat loss and Man-Wildlife conflict • Case study: Elephant man conflict and Introduction to alien species. • Case study of introduction of wolf in yellow stone national park.	
	Biodiversity conservation and management: • Conservation strategies: in situ, ex-situ, National parks, Sanctuaries and Biosphere reserves. • Introduction to International efforts: Convention on Biological Diversity (CBD) • International Union for Conservation of Nature and Natural Resources (IUCN), • United Nations Environment Program - World Conservation Monitoring Centre (UNEP-WCMC), wetland conservation (Ramsar sites)	

	• National Biodiversity Action Plan, 2002 • Introduction to Indian Wildlife (Protection) Act, 1972 and Convention for International Trade of endangered species	
RUSZOOP101	**PRACTICALS**	**Credits- 1**
	LEVELS OF ORGANIZATION-I AND BIODIVERSITY	
1.	**Levels of organization**: a) Symmetry - *Ameoba*, Sea anemone,Liverfluke, *Planaria* b) Coelom – *Planaria, Ascaris,* Earthworm c) Segmentation – Tapeworm and Earthworm d) Cephalization - Cockroach	
2.	**Classification:** a) Protozoa - *Ameoba,Paramoecium, Euglena, Plasmodium* b) Porifera - *Leucosolenia, Euspongia* c) Coelenterata – *Hydra, Obelia* colony, *Aurelia,* Sea anemone, *Fungia* d) Platyhelminthes - *Planaria, Fasciola hepatica, Taenia solium* e) Nemathelmithes - *Ascaris* f) Annelida - *Nereis,* Earthworm, Leech g) Arthropoda - Crab, Lobster, *Lepisma,* Beetle, Dragonfly, Butterfly, Moth, Spider, Millipede and Centipede h) Mollusca – *Chiton, Dentalium, Pila,* Bivalves, *Sepia, Nautilus* i) Echinodermata – Starfish, Brittle star, Sea urchin, Sea cucumber and Feather star	
3.	**Introduction to safe handling of animal in laboratories.**	
4.	**Mounting of Foraminiferan shells**	
5.	**Study of types of corals**: Brain Coral, Organ pipe Coral, Staghorn Coral, Mushroom Coral	
6.	**Study of:** Symbiosis, Camouflage, Cannibalistic mate-eating animals, Animal architects (Termite, Harvester ant, Baya weaver bird) Active Bioluminescent organisms (Noctiluca, Firefly, Glow worm)	
7.	**Culture of *Paramoecium***	
8.	**Study of water vascular system of star fish**	
9.	**Metamorphosis in cockroach, dragon fly, honey bee and butterfly, Lepisma**	
10.	**Estimation of population density of animals by line transect method** (frequency distribution& through Pie diagram only).	
11.	**Estimation of population density of animals by quadrant method** (frequency distribution& through Pie diagram only).	
12.	**Study of Crustacean larvae** (permanent slide).	
	Field visit to any biodiversity related sites/ institute visit report.	

References:

- V.V. Dalvie, G.B. Raje, P. Sardesai, N.S. Prabhu. Wonders of the Animal World-University Text Book of Zoology, F. Y. B.Sc. Semester I Course 1, Univ Press.
- Jordan and Verma. Vertebrate Zoology Volume I, S. Chand and Co.
- Jordan and Verma. Invertebrate Zoology Volume II, S. Chand and Co.
- T. C. Majupuria , S. Nagin and Co. Invertebrate Zoology.
- P. S. Dhami and J. K. Dhami. Chordate Zoolog, R. Chand and Co.
- P. S. Dhami and J. K. Dhami. Invertebrate Zoology R. Chand and Co.
- Introduction to Vertebrates, Moore Cambridge University,Low Priced Edition.
- S. A. Miller and J. B. Harley. Zoology, Tata McGraw Hill.
- R. L. Kotpal. Invertebrates, Modern Textbook of Zoology.
- E. P. Odum. Fundamentals of Ecology, Sunders Publication.
- M. C. Dash, Fundamentals of Ecology, 2nd edition, Tata McGraw Hill.
- S.V.S Rana. Essentials of Ecology and Environmental Science.
- S.V.S Rana, Biodiversity, Prentice Hall Publications.
- V. B. Rastogi. Modern Biology.
- D. R. Khanna. Biology of Mollusca.
- Jeffery Parker and William. A. A Textbook of Zoology, Vol. II- T, Haswell-Low Price Publications.
- P. D. Sharma. Ecology and Environment, R. K. Rastogi Publications
- R. Dajoz. Introduction to Ecology.
- Wildlife Laws and its Impact on Tribes, Deep and Deep Publications
- K. C. Agarwal. Biodiversity, Agro Botanica Publications
- Butterflies of India – Isaac Kehimkar- BNHS Publication.

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Course Code: RUSZOO102

Course Title: Animal Biotechnology and Instrumentation

Academic year 2021-22

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After successfully completing the course, the students will be able to:
CO 1	Calculate the concentration of solutions.
CO 2	Recall good laboratory practices and work safely in the Department Laboratory.
CO 3	Calculate central tendencies of group and ungroup data.
CO 4	Comprehend the data and also prepare correct graphical presentation for it.
CO 5	Describe types of transgenesis methods, gene therapy, principle of DNA finger printing and its applications and application of biotechnology in animal husbandry and Medicine.
CO 6	Understand the principle and working of various basic laboratory instruments like microscope, pH meter, centrifuge etc.
CO 7	Compare and contrast between different types of centrifuges and calculate the Rf values in different chromatography (adsorption and thin layer)

Detailed Syllabus

RUSZOO102	Title: ANIMAL BIOTECHNOLOGY and INSTRUMENTATION	Credits- 2
Unit I	**Laboratory safety, Units and Measurement**	**15 lectures**
	Introduction to good laboratory practices	
	Use of safety symbols: • Concept • Types of hazards • Precautions	
	Units of measurement: • Calculations and related conversions of each: a) Metric system- length (meter to micrometer) b) Weight (gram to microgram) c) Volumetric (Cubic measures) • Temperature: Celsius, Fahrenheit, Kelvin • Concentrations: Percent solutions, ppt, ppm, ppb dilutions, Normality, Molarity and Molality • Biostatistics: a) Introduction and scope b) Sampling and its types c) Central Tendencies (mean, median, mode) d) Tabulation and Graphical representations(Histograms, bar diagrams, piediagrams)	
Unit II	**Animal Biotechnology**	**15 lectures**
	Biotechnology: Scope and achievements of Biotechnology (Fishery, Animal Husbandry, Medical, Industrial)	
	Transgenesis: • Retro viral method • Nuclear transplantation method • DNA microinjection method • Embryonic stem cell method	
	Cloning (Natural and Artificial) • Natural cloning **-** *Planaria,* Identical twins (monozygotic) and Non-identical twins (dizygotic) • Artificial cloning **-**Dolly and Macaque monkey	
	Ethical issues of transgenic and cloned animals	
	Applications of Biotechnology: • Blotting techniques- **Southern, Northern and Eastern** • DNA fingerprinting - Technique in brief and its application in forensic science (Crime Investigation) • Recombinant DNA in medicines (recombinant insulin) • Gene therapy: Ex-vivo and *In vivo,* Severe Combined Immunodeficiency (SCID), and Cystic Fibrosis • Green genes: Green Fluorescent Protein (GFP) from Jelly fish-valuable as reporter genes used to detect food poisoning	
Unit III	**Instrumentation**	**15 Lectures**

	Microscopy: Construction**,** Principle and applications of dissecting and compound microscope	
	Colorimetry and Spectroscopy: Principle and applications	
	pH: • Sorenson's pH scale • pH meter - Principle and applications	
	Centrifuge: Principle and applications (clinical and ultra-centrifuges)	
	Chromatography: Principle and applications (Partition and Adsorption)	
	Electrophoresis: Principle and applications (AGE and PAGE)	
	Assignment: Genetically modified Organisms (GMOs): Production and applications (Submission of typed or written report)	
RUSZOOP102	**PRACTICALS**	**Credit-1**
ANIMAL BIOTECHNOLOGY AND INSTRUMENTATION		
1.	a) Interpretation of safety symbols (toxic, corrosive, explosive, flammable, skin irritant, oxidizing, compressed gases, aspiration hazards and Biohazardous infectious material, Radioactivity, Environmental toxicity) b) Study of Central tendencies and plotting of Bar diagram, histogram and pie diagram	
2.	To demonstrate immobilization of Enzyme and its activity.	
3.	Calculation of pH of three different samples (one each acidic, alkaline and neutral) using Red Cabbage Indicator and confirming the result with pH meter	
4.	a) Study of parts of microscope and their functions. b) Technique of focusing a permanent slide under 10X and 45X.	
5.	a) Dilution of given sample and estimation of OD using colorimeter b) Calculation of concentration from the given OD using formula.	
6.	a) Separation of amino acids from the mixture by paper chromatography. b) Calculation of Rf value of a separated pigments/amino acids from the given chromatogram and their identification from standard chart.	
7.	a) Separation of pigments by adsorption chromatography using chalk b) Separation of Lipids by TLC	
8.	Visit to Forensic laboratory / Biotechnology Laboratory and submission of report.	

References:

- V.V. Dalvie, R. G. Deshmukh, R. D'souza and H.U. Shingadia. Basic Laboratory Techniques, Instrumentation and Biotechnology- University Text Book of Zoology,

F.Y.B.Sc. Semester I Course 2. University Press.

- Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co. Ltd.
- S.K. Sawhney and Randhir Singh. Introductory Practical Biochemistry, Narosa Publishing House.
- B. K. Mahajan. Methods in Biostatistics, Jaypee Publications.
- V. K. Sharma. Microscopy and Cell Biology, Tata McGraw Hill Publishing Co. Ltd.
- L. Veerakumari. Bioinstrumentation, M.J.P. Publishers.
- Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, Cambridge University Press.
- Thieman and Pallidino. Biotechnology, Pearson edu.
- Glick and Pasternak. Biotechnology.
- Satyanarayana. Biochemistry .
- A. Borem, D. Bowe. Understanding biotechnolog, Low price edition –Pearson Publication
- R. C. Dubey. A Textbook of Biotechnology, S. Chand Publication.
- A. H. Patel. A Manual of Medical Laboratory Technology, Navneet Prakashan Ltd.
- Dr. P. K. Bajpai. Biological instruments and methodology, S. Chand company Ltd.
- Frank H. Stephenson. Calculations in Molecular biology and Biotechnology, Academic Press.

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MODALITY OF ASSESSMENT

A] Internal assessment - 40% 40 marks

Sr. no.	Evaluation type	Marks
1.	One class test (Multiple choice questions or Objective)	20
2.	Assignment/ Case study/ Research project/ Group Discussion/ Presentation/ Viva	20
	TOTAL	**40**

B] External examination - 60%

- **Semester End Theory Assessment = 60 Marks**

  *** (Deviation from the usual modality)**

  Owing to the pandemic situation prevailing in 2020 and continuing in 2021, the external examinations (Semester End) may be conducted online as per the instructions/circulars received from the University of Mumbai and Maharashtra State notifications from time to time. The conventional mode of external examination will commence again only after the declaration of normalcy by the Government authorities.

  - Duration – These examinations shall be of **two hours** each paper.
  - Paper Pattern: All questions shall be compulsory with internal choice within the questions.

Paper pattern

Questions	Options	Marks	Questions on
Q.1) A, B, C	Any 2 out of 3	16	Unit I
Q.2) A, B, C	Any 2 out of 3	16	Unit II
Q.3) A, B, C	Any 2 out of 3	16	Unit III
Q.4)a, b, c, d, e	Any 3 out of 5	12	All Units
	TOTAL	**60**	

Practical Examination Pattern:

(A) Internal Examination

Heading	Practical
Journal	05
Lab Participation	05
Lab work/ Field report/ Presentation	10
Total	**20**

(B) External (Semester end practical examination)

Particulars	Practical
Lab work and / or *Viva voce*	30
Total	**30**

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / In charge of the department; failing which the student will not be allowed to appear for the practical examination.

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Course Code: RUSZOO201

Course Title: Levels of organization- II and Ecology

Academic year 2021-22

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After successfully completing the course, the students will be able to:
CO 1	Learn about different aspects of type's studies of various groups of Chordates. Their identification and classification up to order, general and salient features, habit and habitat, geographical distribution and economic importance.
CO 2	Apply knowledge of classification and should be able to classify a chordate animal up to class.
CO 4	Acquire knowledge and understanding of relationship, distribution, abundance of organism in an environment and understand and explain the major ecological concepts of energy flow, Bio-geochemical cycles, population and community
CO 5	Learn about interrelationship between organism in population and communities, structural adaptation and functional adjustment of organism to their physical environment.
CO 6	Calculate Natality, Mortality and fecundity of a population and identify different population graphs and survivorship curves.
CO 7	Apply scientific knowledge of ecology to analyse social and environmental issues

Detailed syllabus

RUSZOO201	Title: LEVELS OF ORGANIZATION-II AND ECOLOGY	Credits-2
Unit I	**Levels of Organization: Chordates**	**15 lectures**
	Salient features with examples for phyla, sub-phyla and classes mentioned below; **Phylum: Hemichordata**	
	Phylum: Chordata • Subphylum: Urochordata • Subphylum: Cephalochordata	
	Subphylum Vertebrata • Super-class: Agnatha – Class Cyclostomata • Super-class: Gnathostomata • Class: Pisces (Cartilagenous and bony fish), Passive bioluminescence in Angler fish, Parental care in fishes • Class: Amphibia, parental care in Amphibians • Class: Reptilia, Regeneration in Lizard • Class: Aves, Migration and brood parasitism in birds • Class: Mammalia, Parental care, Echolocation (Bat, Dolphin & Whale) & Adaptation to desert life	
Unit II	**Population Ecology and Ecosystem**	**15 lectures**
	Concept of ecosystem	
	Concept of energy flow: different types of ecological pyramids Food chain and food web (Aquatic and terrestrial), Detritus food chain, Lentic & Lotic ecosystem, concept of biomagnifications. • Edaphic: Soil formation, Components of Soil, Types of soil and Soil Profile. • Light: Relation to terrestrial and aquatic habitat, photoperiodism, diurnal migration, adaptations of animals to dark. • Temperature: range, tolerance, Bergman's Principle, Allen's Rule, effects of temperature on living organisms.	
	Concept of biogeochemical cycles with respect to current ecological issues: • Carbon cycle • Nitrogen cycle • Phosphorous cycle (Bird & bat guano) • Sulfur cycle	
	Concept of population and community: • Population - Natality, mortality, population growth, survivorship curve, density age and sex composition • Community (Forest, grassland & pond) - Ecological niche, ecological succession (different seral stages), ecological climax (significance)	
	Concept of animal interaction: Symbiosis, Mutualism, Commensalisms, Parasitism and predation, Antibiosis	
Unit 3	**National parks and Sanctuaries of India**	**15**

		Lectures
	Concept of Endangered and Critically Endangered species: Using examples of Indian Wildlife with respect to National Parks and Wildlife Sanctuaries of India – a) Sanjay Gandhi National Park b) Tadoba Tiger Reserve c) Corbett National Park d) Kaziranga National Park e) Gir National Park f) Silent Valley g) Pirotan Island Marine Park h) Keoladeo Ghana National Park i) Bandipur Sanctuary j) Namdapha National Park k) Hemis National Park l) Keibul Lamjao National Park	
	Management strategies with special reference to Tiger and Rhinoceros in India	
	Ecotourism	
	Bio-piracy	
RUSZOOP201	**PRACTICALS**	**Credit-01**
1.	**Classification:** a) Hemichordata - *Balanoglossus* b) Urochordata - *Herdmania* c) Cephalochordata - *Amphioxus* d) Cyclostomato – *Petromyzon*, *Myxine* e) Pisces – Shark, Skates, Sting ray/Electric ray, Flying fish**,**bioluminescence in angler fish f) Amphibia – Frog, Toad, Caecilian, Salamander g) Reptilia – Chameleon, *Calotes*, Turtle, Tortoise, Snake, Crocodile h) Aves – Kite, Kingfisher, Duck i) Mammalia – Shrew, Hedgehog, Guinea pig, Bat	
2.	a) **Calculation of** Natality, Mortality, Population density from given data b) Estimation of population density by capture-recapture method	
3.	**Interpretation of Growth curves** (Sigmoid and J shaped)	
4.	**Estimation of hardness from given water sample** (Tap water versus Well water)	
5.	**Estimation of free carbon dioxide (free CO2) from two different samples** (Aerated drinks (diluted) versus Tap water)	
6.	**Estimation of dissolved oxygen (O2) from two different samples** (Tap water and Bottled Mineral water)	
7.	**Estimation of sulfur from given soil sample**.	
8.	**Construction of food chain and food web using given information/data**: a) Identification and interpretation of ecological pyramids of energy, biomass and number b) Construction of different types of pyramids from given data.	

9.	Breeding and parental care in Amphibians (Rhacophorus, Midwife toad Darwin's frog, Caecilian)	
10.	Parental in fishes (Tilapia, cat fish, viviparity, oviparity, ovoviviparity, sea horse, pipe fish)	
11.	Mounting of scales of Fish,	
12.	Identification of common urban birds with respect to: a) feathers b) beaks and c) claws (Preferably slide show)	
13.	Field visit to Snake park: To study venomous and non-venomous snakes and adaptive radiation in other reptiles. (Submission of written or typed report)	
14.	**Field visit:** Guided nature tour to any National Park and submission of report.	

References:

- University Text Book of Zoology- Introduction to Ecology and Wildlife, F.Y.B.Sc. Semester II Course 3. University Press.
- Eugene P. Odum and Grey W. Barrett. Fundamentals of Ecology - Brook Cole/ Cengage learning.
- Dash M. C. Fundamentals of Ecology -Tata McGraw Hill company Ltd, New Delhi.
- Mohan P. Arora. Ecology - Himalaya Publishing House.
- Alen H. Benton and William E. Werner. Field Biology and Ecology -Tata McGraw Hill Ltd. New Delhi.
- Sharma P. D. Ecology and Environment - Rastogi Publication, Mumbai.
- Chapman J.L. Ecology: Principles and Applications - Cambridge University trust.
- Subramaniam and et el. Ecology - Narosa Publishing House.
- Mona Purohit. Wildlife laws and its impact on tribes - Deep and deep Publication.
- Eldra Solomon, Linda R. Berg and Diana W. Martin. Biology - Thomson/ Brooks/ Cole.
- Shukla, Mathur, Upadhyay, Prasad. Economic Zoology, Biostats and Animal Behaviour - Rastogi Publications.

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Course Code: RUSZOO202

Course Title: Nutrition, Public health and Hygiene

Academic year 2021-22

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After successfully completing the course, the students will be able to:
CO 1	Calculate the BMI index and analyse the different food components and their proportions for having a balanced meal.
CO 2	Identify different food sources rich in different vitamins like A, B, C
CO 3	Differentiate between Kwashiorkar and Marasmus, Diabetes type I and Diabetes type II and suggest corrective lifestyle measure to overcome it.
CO 4	Comprehend the importance of physical, psychological and social health for personal growth and recall the harmful effects of self-medication and excessive use of mobile.
CO 5	Appreciate and become aware of the programmes implemented by WHO and Government of India in eradication of Polio and Leprosy from India.
CO 6	Comprehend the importance of first aid in accident and dog bite and implement it.
CO 7	Explain causes, symptoms, preventative measures and treatment noncommunicable diseases, stress related diseases and implement the preventative measures for betterment of society

Detailed syllabus

RUSZOO202	Title: NUTRITION, PUBLIC HEALTH AND HYGIENE	Credit-02
Unit I	**Nutrition and Health**	**15 lectures**
	Concept of balanced diet: Food Pyramid, Dietary recommendations to a normal adult, Infant, Pregnant woman and Aged person	
	Malnutrition disorders: • Anemia (Iron deficiency and Vitamin B12) - (cause, symptoms, diagnosis, treatment and prevention) • Marasmus (cause, symptoms, diagnosis, treatment and prevention) • Kwashiorkar (cause, symptoms, diagnosis, treatment and prevention) • Goiter (cause, symptoms, diagnosis, treatment and prevention)	
	Vitamins – cause, symptoms, diagnosis, treatment and prevention (Scurvy, Rickets, Beriberi, Pellagra and Night blindness) and poisoning.	
	Starvation, acidity and peptic ulcers: cause, symptoms, diagnosis, treatment and prevention.	
	Obesity: Definition, consequences and treatment.	
	Importance of fibers in food.	
	Diabetes type I and II	
	Anthropometry – Definition, Measurements and applications.	
Unit II	**Public Health and Hygiene**	**15 lectures**
	Health: • Definition of Health, the need for health education and health goal • Physical, psychological and Social health issues • WHO and its programs - Polio, Small pox, Malaria and Leprosy (concept, brief accounts and outcome with respect to India) • Ill effects of self-medication	
	Water and water supply • Sources and properties of water • Purification of water, small scale, medium scale and large scale (rapid sand filters) • Water footprint (concept, brief accounts and significance)	
	Hygiene • Hygiene and health factors at home, personal hygiene, oral hygiene and sex hygiene • Radiation risk- Mobile Cell tower and electronic gadgets (data of recommended level, effects and precaution.	
	First Aid: Dog bite and its treatment	
	Blood bank – Concept and significance	
Unit III	**Common Human Diseases and Disorders**	**15 Lectures**
	Stress related disorders:	

	• Hypertension • Swine flu and Dengue • Anxiety • Insomnia • Migraine • Depression (Causes, symptoms, precaution and remedy)	
	Communicable and non-communicable diseases: (Cause/causative agents, symptoms and diagnosis, precaution, prevention and remedy Management/treatment) • Tuberculosis only pulmonary in theory others extra pulmonary in practical • Typhoid • Hepatitis (A and B) C, D and E • AIDS • Gonorrhea • Syphilis • Diseases of respiratory system- Asthma and Bronchitis • Cholera	
RUSZOOP202	**PRACTICALS**	**Credits- 1**
NUTRITION, PUBLIC HEALTH AND HYGIENE		
1.	Qualitative estimation of Vitamin C by Iodometric method.	
2.	Study of microscopic structure of starch granules of different cereals (wheat, maize and jowar)	
3.	a) Estimation of maltose from brown and white bread b) Moisture content from biscuits or other suitable food products.	
4.	Food adulteration test –Milk adulterants (starch and glucose), Methylene blue reduction test (MBRT)	
5.	a) Estimation of protein content of two egg varieties b) Study of efficacy of different antacids (any two)	
6.	**Study of Human Parasites** – a) Endoparasites – Protozoans (*Entamoeba*, *Plasmodium*), Helminthes (*Ascaris, Wuchereria*) b) Ectoparasites – Head louse and Tick c) Exoparasites – Bed bug and Mosquitoes	
7.	Screening of anemic/non-anemic persons using CuSO4 method.	
8.	BMI analysis – using formula.	
9.	Diseases - Oral cancer, TB, bronchitis (causes, symptoms and management)	
10.	Preparation and submission of BMI report.	
11.	**First Aid –** Practical training for students to be conducted by the experts and respective authorities.	

References:

- University Text Book of Zoology. Common Diseases, Health and Hygiene - F.Y.B.Sc. Semester II Course 4. University Press.
- Mehta P. J. Common Medical Symptoms edited - National Inblisents and Distributions
- Parks K. Textbook of Preventive and Social Medicine- BanarasidasBhanotJabalpar.
- Chatterjee C. C. Human Physiology, Volume I & II, Medical Allied agency, Kolkatta.
- Chatterjee K. D. Parasitology (Protozoology and Helminthoology) - Chatterjee Medial Publishers.
- ApurbaNandy. Nand's handbook of Forensic Medicine and Toxicology – NCBA publication.
- Essentials of Public Health and Sanitation- Part I and Part II. All India Institute of Local Self Government.
- Sathe P. V., Sathe A. V. Epidemiology and Management for Health Care for all. Popular Prakashan, Mumbai.
- Jayaram Paniker C. K. Textbook of Medical Parasitology- Jaypee Brothers.
- Ghosh B. N. A Treatise on Hygiene and Public Health - Calcutta Scientific Publishing Company.
- Prevention of Food Adulteration, Act 1954. Asian Law House.
- Clinical Dietetics and Nutrition -, Oxford University Press.
- Antia F. P. and Philip. A Complete Handbook of Nature Cure - Dr. H. K. Bakru, Jaico Publishing House.
- Srilakshmi B. Dietetics - New Age International (P) Ltd. Publishers.
- Lippincott J. B. Nutrition: Principles and Application in Health Promotion – Lippincott Company. Philadelphia.
- Dr. Dastur R. H. Are You Healing Yourself Mr. Executive - IBH Publishing Company.
- Dr. Shashi Goyal, Pooja Gupta. Food Nutrition and Health- S. Chand Publications.
- Michael J. Gidney, Barrie M. Margetts, John M. Kearney and Lenore Arab. Public Health Nutrition- Willey Blackwell Publication.
- Dr. Swaminathan. Food and Nutrition – Vol. I and II, Bappco Publication.
- MahtabBamji, Prahlad Rao. Textbook of Human Nutrition –
- Paramjit Rana. Total Health.

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MODALITY OF ASSESSMENT

A] Internal assessment - 40% 40 marks

Sr. no.	Evaluation type	Marks
1.	One class test (Multiple choice questions or Objective)	20
2.	Assignment/ Case study/ Research project/ Group Discussion/ Presentation/ Viva	20
	TOTAL	**40**

B] External examination - 60%

- **Semester End Theory Assessment = 60 Marks**

  *** (Deviation from the usual modality)**

  Owing to the pandemic situation prevailing in 2020 and continuing in 2021, the external examinations (Semester End) may be conducted online as per the instructions/circulars received from the University of Mumbai and Maharashtra State notifications from time to time. The conventional mode of external examination will commence again only after the declaration of normalcy by the Government authorities.

  - Duration – These examinations shall be of **two hours** each paper.
  - Paper Pattern: All questions shall be compulsory with internal choice within the questions.

Paper pattern

Questions	Options	Marks	Questions on
Q.1) A, B, C	Any 2 out of 3	16	Unit I
Q.2) A, B, C	Any 2 out of 3	16	Unit II
Q.3) A, B, C	Any 2 out of 3	16	Unit III
Q.4)a, b, c, d, e	Any 3 out of 5	12	All Units
	TOTAL	**60**	

Practical Examination Pattern:

(C) Internal Examination

Heading	Practical
Journal	05
Lab Participation	05
Lab work/ Field report/ Presentation	10
Total	**20**

(D) External (Semester end practical examination)

Particulars	Practical
Lab work and / or *Viva voce*	30
Total	**30**

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / In charge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern

Semester- I and II

Course	101/102			201/202			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100

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