

AC – 11th May, 2017

Item No. 4.298

AC item no

UNIVERSITY OF MUMBAI



Program: S.Y.B. Sc.

Course: Zoology

(Choice Based Credit Semester and Grading System

With effect from the academic year 2017–2018)

Syllabus Committee Members

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Syllabus for
S.Y.B.Sc.
Course – ZOOLOGY
To be implemented from Academic year 2017-18
SEMESTER - III

COURSE CODE	UNIT	TOPIC	CREDITS	LECTURES/ WEEK
USZO301	I	Fundamentals of Genetics,	2	1
	II	Chromosomes and Heredity		1
	III	Nucleic acids		1
USZO302	I	Study of Nutrition and Excretion	2	1
	II	Study Respiration and Circulation		1
	III	Control and coordination, Locomotion and Reproduction		1
USZO303	I	Amazing animals	2	1
	II	Ethology and Conservation Biology		1
	III	Applied Zoology		1
USZOP3	Practicals based on all three courses		03	9

SEMESTER - IV

COURSE CODE	UNIT	TOPIC	CREDITS	LECTURES/ WEEK
USZO401	I	Comparative Embryology	2	1
	II	Aspects of Human Reproduction		1
	III	Scientific Attitude, Methodology, Writing and Ethics		1
USZO402	I	Cell Biology	2	1
	II	Endomembrane System		1
	III	Biomolecules		1
USZO403	I	Holistic Health	2	1
	II	Neurological and genetic diseases		1
	III	Pollution		1
USZOP4	Practicals based on all three courses		03	9

Syllabus for
S.Y.B.Sc.
Course – ZOOLOGY

1. Syllabus Semester III & IV (Theory and Practical)
2. References and Additional Reading
3. Scheme of Examination and Paper Pattern (Theory and Practical)
4. Model Question bank

S.Y.B.Sc.					
Semester III			Semester IV		
Course 5	Course 6	Course 7	Course 8	Course 9	Course 10
Unit 1 Fundamentals of Genetics	Unit 1 Study of Nutrition & Excretion	Unit 1 Amazing animals	Unit 1 Comparative Embryology	Unit 1 Cell Biology	Unit 1 Holistic Health
Unit 2 Chromosome & Heredity	Unit 2 Study of Respiration & Circulation	Unit 2 Ethology and Conservation Biology	Unit 2 Aspects of Human Reproduction	Unit 2 Endomembrane System	Unit 2 Neurological and Genetic diseases
Unit 3 Nucleic Acids	Unit 3 Control and Coordination Locomotion & Reproduction	Unit 3 Applied Zoology	Unit 3 Scientific Attitude, Methodology, Writing & Ethics	Unit 3 Biomolecules	Unit 3 Pollution
Practical I	Practical II	Practical III	Practical I	Practical II	Practical III

S.Y.B.Sc SYLLABUS DRAFT

SEMESTER III

Sr. No	USZO301 COURSE-5	No of lect allotted	Learning pleasure
	Fundamentals of Genetics, Chromosomes and Heredity, Nucleic acids		
	Unit 1: Fundamentals of Genetics	15L	25hrs
	Objectives : ➤ To Introduce basic terms of genetics ➤ To study Mendelian principles of inheritance and other patterns of inheritance		
	Desired outcomes : ➤ Understand and apply the principles of inheritance. ➤ Understand the concept of multiple alleles, linkage and crossing over.		
1.1	Introduction to genetics ➤ Definition, scope and importance of genetics. ➤ Classical and Modern concept of Gene (Cistron, muton, recon). ➤ Brief explanation of the following terms: Allele, wild type and mutant alleles, locus, dominant and recessive traits, homozygous and heterozygous, genotype and phenotype, genome.	2L	2hrs
1.2	Mendelian Genetics ➤ Mendelian Genetics: Monohybrid cross, Dihybrid cross, test cross, back cross, Mendel's laws of Inheritance, Mendelian traits in man. ➤ Exceptions to Mendelian Inheritance: Incomplete dominance, Co-dominance, Lethal alleles, Epistasis - Recessive, Double recessive, dominant and double dominant. ➤ Chromosome theory of inheritance. ➤ Pedigree analysis-Autosomal dominant and autosomal recessive, X-linked dominant, and X-linked recessive	8L	12hrs
1.3	Multiple Alleles and Multiple Genes ➤ Concept of multiple alleles, Coat colour in rabbit, ABO and Rh blood group systems ➤ Polygenic inheritance with reference to skin colour and eye colour in man. ➤ Concept of pleiotropy.	3L	06hrs
1.4	Linkage and Crossing Over ➤ Linkage and crossing over, types of crossing over, cytological basis of crossing over.	2L	05hrs

Unit: 2: Chromosomes and Heredity		15 L	26hrs
	<p>Learning objectives:</p> <ul style="list-style-type: none"> ➤ To familiarize the learners with the structure, types and classification of chromosomes. ➤ To introduce the concept of sex determination and its types, sex influenced and sex limited genes. 		
	<p>Desired Outcomes:</p> <ul style="list-style-type: none"> ➤ Learners would understand the structure and types of chromosomes. ➤ Learners would understand mechanisms of sex determination. ➤ Learners would be able to correlate the disorders linked to a particular sex chromosome. 		
2.1	<p>Chromosomes</p> <ul style="list-style-type: none"> ➤ Types of chromosomes–Autosomes and Sex chromosomes ➤ Chromosome structure - Heterochromatin, Euchromatin ➤ Classification based on the position of centromere ➤ Endomitosis, Giant chromosomes- Polytene and Lamp brush chromosomes and significance of Balbiani rings. 	4L	8hrs
2.2	<p>Sex- determination</p> <ul style="list-style-type: none"> ➤ Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZW. ➤ Sex determination in honey bees- Haplodiploidy, ➤ Sex determination in <i>Drosophila</i>-Genic balance theory, intersex, gynandromorphs. ➤ Parthenogenesis. ➤ Hormonal influence on sex determination-Freemartin and sex reversal. ➤ Role of environmental factors- Bonellia and Crocodile ➤ Barr bodies and Lyon hypothesis 	7L	10hrs
2.3	<p>Sex linked, sex influenced and sex limited inheritance.</p> <ul style="list-style-type: none"> ➤ X-Linked: Colourblindness, Haemophilia ➤ Y-linked: Hypertrichosis ➤ Sex-influenced genes ➤ Sex limited genes 	4L	8hrs
Unit: 3 Nucleic acids		15 L	30hrs
	<p>Objectives:</p> <ul style="list-style-type: none"> ➤ To introduce to the learners the classical experiments proving DNA as the genetic material. ➤ To make the learner understand the structure of nucleic acids and the concept of central dogma of molecular biology. ➤ To familiarize the learner with the concept of gene regulation. 		
	<p>Desired Outcomes:</p> <ul style="list-style-type: none"> ➤ Learner would understand the importance of nucleic acids as genetic material. ➤ The learners would understand and appreciate the regulation of gene expressions. 		

3.1	Genetic material <ul style="list-style-type: none"> ➤ Griffith's transformation experiments, Avery-Macleod and McCarty, Hershey Chase experiment of Bacteriophage infection ➤ Chemical composition and structure of nucleic acids. ➤ Double helix nature of DNA, Solenoid model of DNA. ➤ Types of DNA – A, B, Z & H forms. ➤ DNA in Prokaryotes -chromosomal and plasmid. ➤ Extra nuclear DNA -mitochondria and chloroplast. ➤ RNA as a genetic material in viruses. ➤ Types of RNA: Structure and function. 	7L	14hrs
3.2	Flow of genetic information in a Eukaryotic cell <ul style="list-style-type: none"> ➤ DNA Replication ➤ Transcription of mRNA ➤ Translation ➤ Genetic code 	5L	08hrs
3.3	Gene Expressions and regulation <ul style="list-style-type: none"> ➤ One gene-one enzyme hypothesis /one polypeptide hypothesis ➤ Concept of operon ➤ Lac operon 	3L	08hrs

Sr. No	USZO302 COURSE-6	No of lect allotted	Learning pleasure
	Study of Nutrition and Excretion , Respiration and circulation, Control and coordination, Locomotion and Reproduction		
	Unit: 1 Study of Nutrition and Excretion	15L	23hrs
	Objective : <ul style="list-style-type: none"> ➤ <i>To introduce the concepts of physiology of nutrition, excretion and osmoregulation.</i> ➤ <i>To expose the learners to various nutritional apparatus, excretory and osmoregulatory structures in different classes of organisms.</i> 		
	Desired Outcome : <ul style="list-style-type: none"> ➤ <i>Learners would understand the increasing complexity of nutritional, excretory and osmoregulatory physiology in evolutionary hierarchy.</i> ➤ <i>Learners would be able to correlate the habit and habitat with nutritional, excretory and osmoregulatory structures.</i> 		
1.1	➤ Comparative study of Nutritional Apparatus (structure and function): Amoeba, Hydra, Earthworm, Cockroach, Bivalve, Amphioxus, Pigeon, Ruminants.	5L	06hrs
1.2	➤ Physiology of digestion in man	2L	04hrs

1.3	<ul style="list-style-type: none"> ➤ Comparative study of Excretory and Osmoregulatory structures and function a. Amoeba -contractile vacuoles b. Planaria -Flame cells c. Earthworm -Nephridia d. Cockroach-Malphigian tubules and green gland e. Bivalve -Organ of Bojanus 	5L	08hrs
1.4	<ul style="list-style-type: none"> ➤ Categorization of animals based on principle nitrogenous excretory products 	1L	01hrs
1.5	<ul style="list-style-type: none"> ➤ Structure of kidney, Uriniferous tubule and physiology of urine formation in man. 	2L	04hrs
Unit: 2 Study of Respiration and Circulation		15L	27hrs
<p>Objective :</p> <ul style="list-style-type: none"> ➤ To introduce the concepts of physiology of respiration and circulation ➤ To expose the learners to various respiratory and circulatory structures in different classes of organisms. 			
<p>Desired Outcome:</p> <ul style="list-style-type: none"> ➤ Learners would understand the increasing complexity of respiratory and circulatory physiology in evolutionary hierarchy. ➤ Learners would be able to correlate the habit and habitat with respiratory and circulatory structures. 			
2.1	<ul style="list-style-type: none"> ➤ Comparative study of Respiratory organs (structure and function) Earthworm, Spider, Rohu, Frog and Pigeon. 	3L	06hrs
2.2	<ul style="list-style-type: none"> ➤ Accessory respiratory structures: Anabas /Clarius 	1L	02hrs
2.3	<ul style="list-style-type: none"> ➤ Structure of lungs and physiology of respiration in man 	2L	04hrs
2.4	<ul style="list-style-type: none"> ➤ Comparative study of circulation: Open and closed - single and double 	1L	02hrs
2.5	<ul style="list-style-type: none"> ➤ Types of circulating fluids- Water, coelomic fluid, haemolymph, lymph and blood. 	2L	02hrs
2.6	<ul style="list-style-type: none"> ➤ Comparative study of Hearts (Structure and function) Earthworm, Cockroach, Shark, Frog, Crocodile and Pigeon 	4L	07hrs
2.7	<ul style="list-style-type: none"> ➤ Structure and mechanism of working of heart in man ➤ 	2L	04hrs
Unit: 3 Control and coordination, Locomotion and Reproduction		15L	25hrs
<p>Objective :</p> <ul style="list-style-type: none"> ➤ To introduce the concepts of physiology of control and coordination and locomotion and reproduction ➤ To expose the learners to various locomotory and reproductive structures in different classes of organisms 			

	<p>Desired Outcome:</p> <ul style="list-style-type: none"> ➤ Learners would understand the process of control and coordination by nervous and endocrine regulation. ➤ Learners would be fascinated by various locomotory structures found in the animal kingdom. ➤ Learners would be acquainted with various reproductive strategies present in animals. 		
3.1	<p>Control and coordination</p> <ul style="list-style-type: none"> ➤ Irritability – <i>Paramecium</i>, Nerve net in Hydra, Nerve ring and nerve cord in earthworm ➤ Types of neurons on the basis of structure and function ➤ Conduction of nerve impulse: Resting potential, action potential and refractory period ➤ Synaptic transmission ➤ Endocrine regulation: Hormones as chemical messengers, feedback mechanisms 	5L	08hrs
3.2	<p>Movement and Locomotion</p> <ul style="list-style-type: none"> ➤ Locomotory organs - structure and functions <ul style="list-style-type: none"> a. Pseudopodia in Amoeba (sol gel theory), Cilia in Paramecium b. Wings and legs in Cockroach c. Tube feet in Starfish d. Fins of fish 	4L	08hrs
3.3	<ul style="list-style-type: none"> ➤ Structure of Striated muscle fibre in human and Sliding filament theory 	2L	02 hrs
3.4	<p>Reproduction</p> <ul style="list-style-type: none"> a. Asexual Reproduction- Fission, fragmentation, gemmule formation, budding b. Sexual reproduction <ul style="list-style-type: none"> i. Gametogenesis ii. Structure of male and female gametes in human iii. Types of fertilization iv. Oviparity, viviparity, ovo-viviparity 	4L	07hrs
USZO 303 COURSE-7			
Amazing animals, Ethology and Conservation biology, Applied Zoology			
Unit: 1 Amazing animals		15L	26hrs
	<p>Objective:</p> <ul style="list-style-type: none"> ➤ To introduce the learners to the fascinating facts of animal life. ➤ To study the natural history and marvelous world of animals 		
	<p>Desired Outcome:</p> <ul style="list-style-type: none"> ➤ Learners will become familiar with the enthralling animal world. ➤ Learners will appreciate the use of unique abilities of animals in development of technology. 		

1.1	Natural History <ul style="list-style-type: none"> ➤ Introduction and life timeline ➤ Butterflies the flying jewels- Blue Mormon, Striped tiger. ➤ Herpetofauna of India- Flying frog, Fan Throated lizard and Gharial ➤ Feathered Biped: Kingfisher, Drongo ➤ Mammals of India: Malabar giant squirrel and Lemur 	2L	03hrs
1.2	The world's most amazing animals <ul style="list-style-type: none"> ➤ Octopus ➤ Spider ➤ Mudskipper ➤ Flying fish ➤ Pebble toad ➤ Strawberry poison frog ➤ Komodo dragon ➤ Lesser flamingo ➤ Great white pelican ➤ Spatuletail hummingbird ➤ Cheetah 	5L	10hrs
1.3	Five most incredible animals discovered within the last decade <ul style="list-style-type: none"> ➤ The purple (Joker) Crab, The African dwarf Sawshark (Stabbing Shark), The Psychedelic (Crime Fighting) Gecko, The Matilda Viper and The Michael Jackson Monkey 	5L	10hrs
1.4	Marvels of Animals Animals with special abilities <ul style="list-style-type: none"> ➤ Mantis shrimp: Fastest punch ➤ Homing in Pacific Salmon ➤ Sperm whale: Mechanism of deep sea diving. 	3L	3hrs
Unit: 2 Ethology and Conservation Biology		15L	27hrs
Objective: <ul style="list-style-type: none"> ➤ <i>To equip learners with a sound knowledge of how animals interact with one another and with their environment.</i> ➤ <i>To enable the learners to understand the different patterns of animal behavior.</i> ➤ <i>To make the learners aware of the rapid loss of biodiversity and the different methods for its protection.</i> 			
Desired Outcome: <ul style="list-style-type: none"> ➤ <i>Learners would gain an insight into different types of animal behavior and their role in adaptation.</i> ➤ <i>Learners would become sensitized to protect and manage biodiversity in a sensible and sustainable manner.</i> 			

2.1	Introduction to Ethology ➤ Definition and scope. ➤ Nature v/s Nurture, Innate behavior and Learning	2L	06hrs
2.2	Types of Animal behavior ➤ Defensive behavior in octopus. ➤ Predatory behavior in Lion. ➤ Schooling in fishes ➤ Aggressive behavior in Gorilla. ➤ Courtship behavior in Great Crested Grebe. ➤ Territorial behavior in tiger ➤ Social behavior in Elephants	3L	06hrs
2.3	Animal Communication ➤ Definition, components ➤ Types of communication-Visual, Sound, Tactile, Chemical.	4L	06hrs
2.4	Conservation Biology ➤ Concept, HIPPCO, Extinction crisis ➤ In-situ and ex situ conservation strategies.	2L	06hrs
2.5	Case Study: Community Conservancies ➤ Snow Leopard Conservancy in India ➤ Community-based Nature Conservancy (CNC) in Tadoba ➤ Community Wildlife Conservancies in Namibia ➤ Lewa and Maasai Mara Wildlife Conservancies in Kenya	4L	03hrs
Unit: 3 Applied Zoology		15L	24hrs
	Objective: ➤ To introduce the learner to the science of vermicomposting and dairy. ➤ To make the learner aware about care of different pet animals.		
	Desired Outcome: ➤ Learner will understand the science of vermicomposting and dairy. ➤ Learner will appreciate and respect domestic pets through proper care.		
3.1	Vermiculture and Vermicomposting ➤ Introduction ➤ Different species of earthworms used in vermiculture. ➤ Vermicomposting: Methods, maintenance and harvesting. ➤ Advantages of vermiculture, and vermicomposting.	5L	08hrs

3.2	Dairy science	5L	08hrs
3.2.1	Role of Dairy development in rural economy		
3.2.2	Milk and milk products		
	➤ Composition of milk		
	➤ Milk products: Skimmed milk, Milk Powder, Cheese, Curd, Yogurt, Paneer, Khoya, Butter, Ghee, Ice cream		
3.3	Care of Pet animals	5L	08hrs
3.3.1	Ornamental fish: Care and Breeding behaviour of ornamental fishes: Gold fish, Siamese fighting fish, Freshwater Angelfish, Oscar.		
3.3.2	Management of common diseases of ornamental fishes- Fin and Tail rot disease, Dropsy, White spot disease.		
3.3.3	Dog Breeds: Labrador, German Shepherd, Chihuahua, Mudhol hound and Combai.		
3.3.4	Cat breeds: Siamese cat, Persian cat.		
3.3.5	Nutrition, vaccination and care of pet dogs and cats.		

SEMESTER III	
Practical USZOP3 (Course V)	
1	Extraction and detection of DNA
2	Extraction and detection of RNA.
3	Mounting of Barr bodies.
4	Study of Polytene chromosome.
5	Study of mitosis- temporary squash preparation of Onion root tip
6	Detection of blood groups and Rh factor.
7	Problems in genetics a. Monohybrid/ Dihybrid cross b. X- linked inheritance c. Multiple alleles
8	Chromosome morphology: Metaphase spreadsheet (photograph to be provided)
9	Pedigree analysis
10	Problems on molecular biology
Practical USZOP3 (Course VI)	
1	Urine analysis—Normal and abnormal constituents
2	Detection of ammonia in water excreted by fish
3	Detection of uric acid from excreta of Birds
4	Study of striated and nonstriated muscle fibre
5	Study of nutritional Apparatus (Amoeba, Hydra, Earthworm, Pigeon, Ruminant stomach)
6	Study of respiratory structures: a. Gills of Bony fish and Cartilaginous fish. b. Lungs of Frog c. Lungs of Mammal.

	d. Accessory respiratory structure in Anabas (Labyrinthine organ) e. Air sacs of Pigeon.
7	Study of locomotory organs (<i>Amoeba</i> , <i>Unio</i> , Cockroach, Starfish, Fish, and Birds)
8	Study of hearts (Cockroach, Shark, Frog, <i>Calotes</i> , Crocodile, Mammal)
9	Study of permanent slides on topic of Reproduction a. Sponge gemmules b. Hydra budding c. T.S. of mammalian testis d. T.S. of mammalian ovary
Practical USZOP3 (Course VII)	
1	Preparation of paneer from given milk sample.
2	Measurement of density of milk using different samples by Lactometer.
3	Various breeds of Cows: Indigenous: Red Sindhi and Sahiwal. Exotic: Jersey, Holstein Friesian (Identification using photographs)
4	Various breeds of Buffalo: Murrah, Nagpuri and Jaffrabadi (Identification using photographs)
5	Setting up of Freshwater aquarium in the Laboratory.
6	Animal behavior: <ul style="list-style-type: none"> • Communication in animals: <ol style="list-style-type: none"> a) Chemical signals <ol style="list-style-type: none"> i) Alarm pheromones in honey bee ii) Trailing pheromones in ants. b) Visual signal in Peacock and Spider c) Sound signal in Vervet Monkey and Bull frog. d) Tactile communication in mother tiger. • Nesting behavior and parental care in birds (Horn bill and Emperor penguin)
7	Study of Marine National park and Sanctuaries <ul style="list-style-type: none"> • Mahatma Gandhi Marine National Park (Andaman) • Gahirmatha Marine National Park (Orissa) • Malvan Marine Sanctuary
8	Identifications of amazing animals with the help of photographs: Pistol Shrimp Suicidal Ant, Self-healing Axolotl, Pebble toad, Flying Snake, Hippopotamus' Blood-Sweat Sunscreen
9	Study of amazing animal hybrids with the help of photographs: Liger, Zebroid, Grizzly polar bear, Savannah Cat, Wholphin.
10	Study of animals that have inspired technology: Bat and Radar, Nautilus and submarine, Birds and Aeroplane
11	Field visit- Visit to vermicomposting unit or Visit to Aquarium or wild life sanctuaries and submission of report. (Report may be submitted in a group not exceeding five students).

Note -The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.

#There shall be at least one excursion/field trip.

Semester –III

REFERENCE BOOKS AND ADDITIONAL READING

COURSE-V (USZO301)

1. Principles of Genetics. Gardner, E.J., Simmons, M.J and Snustad, D.P. John Wiley and Sons
2. Concepts of Genetics. Klug, W.S., Cummings M.R., Spencer, C.A. Benjamin Cummings.
3. Genetics- A Molecular Approach. Russell, P. J Benjamin Cummings.
4. Genetics: Analysis of Genes and Genomes. Daniel L., Hartl, Elizabeth W. Jones Jones & Bartlett Publishers
5. Introduction to Genetic Analysis. Griffiths, A.J.F., Wessler. S.R., Lewontin, R.C. and Carroll, S.B. W. H. Freeman and Co.
6. Cell Biology, Genetics, Molecular Biology Evolution and Ecology. Verma P.S. and Agrawal P.K., 9th edition, S. Chand Publication, New Delhi.
7. Principles of Genetics – Eight edition- Eldon John Gardner, Michael J. Simmons, D. Peter Snustad
8. Genetics- Weaver, Hedrick, third edition, Mc Graw Hill Education
9. Genetics A Mendelian approach Peter J.Russel, Pearson Benjamin Cummings
10. Genetics A conceptual approach, Benjamin A. Pierce, Southwestern University, W.H. Freeman and company, New York
11. Genetics, Third Edition, Monroe W. Strickberger
12. Genetics from gene to genome, third edition, Leeland H. Hartwell, Leroy Hood, Michael 7. L. Goldberg, Ann E. Reynolds, Lee M. Silver, McGraw Hill Education

COURSE-VI (USZO302)

1. Vertebrate Zoology Volume I- Jordan and Verma , S. Chand and Co.
2. Invertebrate Zoology Volume II- Jordan and Verma , S. Chand and Co.
3. Invertebrate Zoology- Majupuria T. C., Nagin S.and Co.
4. Chordate Zoology- Dhami P. S. and Dhami J. K. , R. Chand and Co.
5. Invertebrate Zoology- Dhami P. S. and Dhami J. K., R. Chand and Co.
6. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition.
7. Zoology- Miller S. A. and Harley J. B., Tata McGraw Hill.
8. Modern Textbook of Zoology, Invertebrates, Kotpal R. L.

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9. Biological Science, Taylor D.J., Stout G.W., Green N.P.O, Soper R.,Cambridge University Press.

COURSE-VII (USZO303)

- 1 Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
- 2 Animal Behavior: Mechanisms, Ecology and Evolution Stephen Vessey, Elizabeth Jacob, S. H. Vessey and L. C. Drickamer, McGraw-Hill.
- 3 Animal Behaviour- David McFarland
- 4 Animal Behaviour- Mohan Arora
- 5 Animal Behaviour- Reena Mathur
- 6 An introduction to Animal Behaviour- Manning and Dawkins
- 7 Animal Behaviour-Agarwal
- 8 Principles of Animal Communication. Bradbury, J.W. and S.L. Vehrencamp. Sinauer Assoc. Sunderland, Massachsets, USA.
- 9 The biology of Behaviour. Eibl-Eibesfeldt, I. Ethlogy. Holt,Rineheart & Winston, New York.
- 10 Living in the Environment-Concepts, Connections and Solutions. G. Tyler Miller and Scott E. Spoolman, Brooks/Cole, Cengage learning.
- 11 An introduction to conservation biology. Richard B. Primack and Anna A. Sher, Sinauer Associates
- 12 FishLore.Com – Fresh water Aquarium Book- Free EBook
- 13 Ecology of The Planted Aquarium- A Practical Manual and Scientific Treatise for Home Aquarist By Diana L. Walstad (Echinodorous Publishing, North Carolina, U. S. A.)
- 14 A practical Guide to Your Aquarium-WWW.worldofwater.com In Association with practical fish keeping magazine www.practicalfishkeeping.co.uk
- 15 Handbook on Aquafarming-Ornamental Fishes. Published by MPEDA
- 16 Diseases of ornamental fishes and their control- By A. P. Lipton (2006) eprints.cmfri.org.in
- 17 The Book of Indian Dogs- S. Theodore Baskaran (2017) Aleph Book Company
- 18 Newsletters- Animal Welfare Board of India- awbi.org
- 19 Vermiculture Technology - Clive A. Edwards, Norman Q. Arancon and Rhonda Sherman
- 20 Economic Zoology- Shukla G.S. & Upadhyay V.B., Rastogi Publications.
- 21 A handbook on Economic Zoology, S. Chand & Co.
- 22 Candler, W., & Kumar, N. (1998). India: The dairy revolution: The impact of dairy development in India and the World Bank's contribution. World Bank Publications.
- 23 Park, Y. W., & Haenlein, G. F. (Eds.). (2013). Milk and dairy products in human nutrition: production, composition and health. John Wiley & Sons.

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- 24 Venkatasubramanian, V., Singh, A. K., & Rao, S. V. N. (2003). Dairy development in India: An appraisal of challenges and achievements. Concept Publishing Company.
- 25 Shrivastava, J. S. M. (2008). Dairy Development In The New Millennium (The Second White Revolution). Deep and Deep Publications.
- 26 <http://listverse.com/2012/12/03/10-amazing-animal-abilities/>
- 27 www.toptenz.net/top-10-amazing-animals-discovered-within-the-last-decade.php
- 28 dailynewsdig.com/top-10-amazing-animal-hybrids.
- 29 <https://www.pinterest.com/pin/16044142395584735/>
- 30 www.naturalhistorymag.com/
- 31 <https://naturalhistory.si.edu/>.

SCHEME OF EXAMINATION

- (a) One Theory examination of hundred (100) marks per course per semester should be conducted as per the following skeleton question paper pattern.
- (b) One practical examination of fifty (50) marks per course each should be conducted at the end of every semester.

SKELETON PAPER PATTERN FOR THEORY EXAMINATION

NOTE: All Questions are compulsory.

Figures to the right indicate full marks.

Draw neat labeled diagrams wherever necessary.

Time: 3 hours

Total marks: 100

Q.1. Objective type from Unit I, II and III with No internal options*	20
Q.2. Unit I may have questions carrying 12 and 8 marks OR of 10 marks each with 100% internal options	20
Q.3. Unit II may have questions carrying 12 and 8 marks OR of 10 marks each with 100% internal options	20
Q.4. Unit III may have questions carrying 12 and 8 marks OR of 10 marks each with 100% internal options	20
Q.5. Unit I, II and III (Any 4 out of 6)	20

*For Question 1 it is recommended to have objective questions such as –

- (i) Match the column
- (ii) MCQ
- (iii) Give one word for
- (iv) True or False
- (v) Define the term
- (vi) Answer in one sentence

For Q 2, 3 and 4 there shall be 100% internal option.

MODEL QUESTION BANK SEMESTER III

USZO301(COURSE V)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit : 1 (10 Marks)

1. Define genetics and explain its scope and importance.
2. Explain Mendel's laws of inheritance.
3. Describe in detail the monohybrid cross and state the Mendelian principle of inheritance derived from it. Add a note on Co-dominance.
4. Describe in detail dihybrid cross and state the Mendelian principles of inheritance derived from it.
5. Discuss in brief inheritance of Mendelian phenotypic traits in humans.
6. Describe incomplete dominance with a suitable example.
7. Describe Co-dominance with a suitable example.
8. What is epistasis? Give a detailed account of double dominant epistasis.
9. What is epistasis? Give a detailed account of recessive epistasis.
10. What is epistasis? Give a detailed account of dominant epistasis
11. What is epistasis? Give a detailed account of double recessive epistasis.
12. Explain the pattern of inheritance of recessive and dominant lethal alleles.
13. Explain the inheritance of multiple alleles with the help of a suitable example.
14. Describe polygenic inheritance with reference to skin colour and eye colour in man.
15. Compare and contrast pleiotropy and polygenic inheritance.
16. Explain the phenomenon of linkage with respect to Morgan's Experiment. Add a note on the differences between complete and incomplete linkage.
17. Describe the pattern of inheritance of blood group and Rh factor in man.
18. Explain the cytological basis and molecular mechanisms of crossing over.
19. Explain pedigree analysis of X-linked recessive traits.

Unit : 1 (5 Marks)

1. Describe the classical concept of gene.

2. Explain the modern concept of gene.
3. Differentiate between (Any two):
 - (a) Genotype and phenotype of an organism
 - (b) Dominant and recessive traits
 - (c) Gene and genome.
 - (d) Homozygous and heterozygous
 - (e) Monohybrid and dihybrid cross
 - (f) Incomplete Dominance and co-dominance
 - (g) Multiple alleles and polygenes
 - (h) Test cross and backcross
4. Explain how probability is used to predict the results of genetic crosses.
5. Write a note on the chromosome theory of inheritance.
6. Describe co-dominance with a suitable example.
7. Give an account of the symbols used in human Pedigree analysis
8. Characteristics of autosomal dominant traits
9. Characteristics of X-linked recessive traits
10. Characteristics of autosomal recessive traits
11. Characteristics of X-linked dominant traits
12. Intermediate lethal alleles
13. Phenylketoneuria
14. Albinism
15. Explain the inheritance of skin colour in humans.
16. Write a note on pleiotropy.

Unit: 2 (10 Marks).

1. Explain the structure of eukaryotic Chromosome.
2. Classify chromosomes on the basis of position of centromere.
3. Give a detailed account of Polytene chromosomes.
4. Explain **any two** mechanisms of chromosomal basis of sex determination.
5. Explain the inheritance of colour blindness in man.
6. Explain sex determination in man/ Honey bee/ Birds/ *Drosophila*.

Unit: 2 (05 Marks)

1. Describe the terms euchromatin and heterochromatin.
2. Write a note on polytene chromosomes.
3. Write a note on Lampbrush chromosomes.
4. Write a note on salivary gland chromosome of *Drosophila*.
5. Write a note on Balbiani rings.
6. Explain endomitosis.

7. Write a note on Gynandromorphs.
8. Explain the role of environment on sex determination.
9. Explain the role of hormones in sex determination.
10. Explain hypertrichosis.
11. Differentiate between sex linked and sex influenced genes.
12. Differentiate between human X and Y chromosome.
13. Differentiate between autosomes and sex chromosomes.
14. Write a note on Lyons hypothesis.
15. What are Barr bodies? Give a scientific reason that Barr bodies are present only in women and not in men.
16. Give a scientific reason that Y chromosome is a sex determining chromosome in man.
17. Explain parthenogenesis.
18. Give scientific reason that the X linked genes affect males more than females in human beings.
19. What is centromere? Explain its role during cell division.

Unit: 3 (10 marks)

1. Describe Griffith transformation experiment.
2. Explain Avery, Macleod, McCarty's experiment
3. Give an account of Hershey Chase experiment of bacteriophage infection.
4. Write a note on types of DNA.
5. Explain RNA as a genetic material.
6. Describe the process of DNA replication
7. Write in detail the process of transcription
8. Discuss the process of translation
9. What is gene expression? Describe the regulation of genes with Lac operon.

Unit 3: (5 Marks)

Write short notes on:

1. Chemical composition of nucleic acid
2. A and B DNA
3. Plasmid
4. Function of mRNA
5. Function of tRNA
6. Genetic code
7. One gene one enzyme hypothesis
8. Concept of operon
9. Z DNA
10. H DNA

11. Chromosomal DNA in prokaryotes
12. Mitochondrial DNA
13. DNA in chloroplast

MODEL QUESTION BANK SEMESTER III

USZO302 (COURSE VI)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (10 Marks)

1. Explain in detail the digestive system of earthworm.
2. Explain in detail the digestive system of cockroach.
3. Describe the digestive system in bivalve.
4. Describe the digestive system of pigeon.
5. With the help of a labeled diagram describe the structure and functions of ruminant stomach.
6. Explain the physiology of digestion in cockroach.
7. Give an account of the enzymes involved in the process of digestion in cockroach.
8. With the help of a labeled diagram describe the structure of mammalian kidney.
9. Give a detailed account of process of urine formation in man.
10. With the help of a labeled diagram describe the structure of septal nephridium of earthworm.

Unit 1: (05 Marks)

1. Write a note on nutrition apparatus in amoeba.
2. Describe briefly gastro-vascular cavity in hydra.
3. Write a note on Wheel organ of Amphioxus.
4. Write a note on ruminant stomach.
5. Write short note on digestion of proteins with respect to man.
6. Write short note on digestion of carbohydrates with respect to man
7. Write short note on digestion lipids with respect to man
8. Write short note contractile vacuoles as excretory and osmoregulatory structures in protozoa.
9. Write a note on flame cells.
10. Write a note on nephridia as excretory organs in earthworm.

11. Describe briefly excretory and osmoregulatory structures in arthropods.
12. Write a note on Organ of Bojanus.
13. Write a note on structure of kidney in fish.
14. Write a note on structure of amphibian kidney.
15. Write a note on structure of kidney in bird.
16. Write a note on structure of mammalian kidney.
17. Write a note on Ammonotelic organisms.
18. Write a note on Ureotelic organisms.
19. Write a note on Uricotelic organisms.
20. Write a note on ultrafiltration.

Unit 2: (10 Marks)

1. Describe briefly air sacs in pigeon.
2. Describe briefly the process of internal respiration with respect to man
3. Describe briefly the process of external respiration with respect to man
4. Give a brief account of types of circulating fluids present in animals.
5. Describe briefly mechanism of working of heart.
6. Describe briefly two chambered heart in shark.
7. Describe briefly structure of heart of frog.
8. Describe briefly heart of crocodile.
9. Give a brief account of heart of man.

Unit 2: (5 Marks)

1. Write short note on cutaneous respiration.
2. Write a note on Spiracle in cockroach.
3. Write a note on book lungs in spider.
4. Explain the structure of gills of bony fish
5. Explain the structure of gills of cartilaginous fish.
6. Describe briefly lungs as respiratory organs in frog.
7. Describe briefly lungs as respiratory organs in man.
8. Explain briefly accessory respiratory structure in *Anabas*.
9. Write short note on open circulation.
10. Write short note on closed circulation.
11. Write a note on heart of cockroach
12. Write a note on heart of earthworm.

Unit 3:(10 Marks)

1. Describe different types of neurons on the basis of structure and function.
2. Explain conduction of nerve impulse.

3. Briefly describe synaptic transmission.
4. Describe briefly hormones as chemical messenger.
5. Explain briefly feedback mechanism of hormone regulation.
6. Explain sol-gel theory of amoeboid movement.
7. Describe ciliary movement in *Paramecium*.
8. Give an account on types of wings in insects.
9. Explain types of fins in Pisces.
10. Describe sliding filament theory.
11. Describe briefly asexual reproduction in animals.
12. Describe the structure and function of tube feet.
13. Describe spermatogenesis.
14. Describe oogenesis.
15. Describe briefly the structure of mammalian gametes.
16. Give an account on types of fertilization.

Unit 3: (5 Marks)

1. Write a note on irritability in *Paramecium*.
2. Write a note on resting potential of nerve membrane.
3. Write a note on action potential of nerve membrane.
4. Describe different types of neurons on the basis of structure.
5. Describe briefly different types of neurons on the basis of functions.
6. Describe the structure of synapse.
7. Write a note on striated muscle fibre.
8. Describe the structure of cilia.
9. Give an account on types of legs in insects.
10. Write a note on ovo-viviparity.
11. Write a note on viviparity.
12. Write a note on oviparity.
13. Describe the structure of mammalian egg.
14. Describe the structure of mammalian sperm.
15. Describe the formation of gemmule in sponges.
16. Write a note on budding as asexual reproduction in mammals

MODEL QUESTION BANK SEMESTER III

USZO303 (COURSE VII)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception.

Unit 1: (10 Marks)

1. Give a brief account of Blue mormon butterfly and Striped Tiger butterfly.
2. Describe special characters of Sperm whale that help them feed on squids.
3. Give a brief account on homing in Pacific Salmon.
4. Describe the behavior of Octopus and spider as most dedicated mothers in the world.
5. Describe the remarkable characters of fan throated lizard and flying frog.
6. Describe the marvelous characters of Mantis shrimp.
7. Give a brief account of Malabar giant squirrel and Lemur
8. Describe the marvelous characters of the Purple (Joker) crab and lesser flamingo.
9. Describe the marvelous characters of the Cheetah and the Matilda viper.
10. Describe marvelous characters of the Stabbing Shark and Crime Fighting Gecko.
11. Describe marvelous characters of the Gharial and the Matilda Viper
12. Describe marvelous characters of the Michael Jackson Monkey and micro chameleon.

Unit 1: (5 Marks)

Write a short note on the remarkable characters in the following amazing animals:

1. Blue mormon butterfly
2. Striped Tiger butterfly
3. Mudskipper
4. Weedy sea dragon
5. Flying fish
6. Komodo dragon
7. Pebble toad
8. Lesser flamingo
9. Great white pelican
10. Spatuletail hummingbird
11. Strawberry poison frog
12. Kingfisher
13. Drongo
14. Malabar giant squirrel
15. Cheetah
16. Octopus

Unit 2: (10 Marks)

1. What is ethology? Comment on the nature versus nurture controversy.
2. Describe in brief the different modes of animal communication.
3. List the different types of animal communication and explain **any two** in detail.
4. Explain in detail the use of chemical signals in animal communication.
5. Explain in detail the use of sound signals in animal communication.
6. Explain in detail the use of visual signals in animal communication.

7. Distinguish between home range and territory and describe the costs and benefits of territoriality.
8. What are pheromones? Give an account of the different types of insect pheromones.
9. What is conservation biology? Discuss the in situ conservation strategies.
10. Describe in brief the ex situ conservation strategies.
11. Elaborate on HIPPCO.
12. Describe the current wild life extinction crisis.
13. Give a detailed account of **any two** Community based Wild life Conservancies in India.
14. Explain how the Community Wildlife Conservancies have helped transform wild life conservation in Namibia and Kenya.

Unit 2: (5 Marks)

1. Write notes on:

- i. Defensive behavior in Octopus
- ii. Predatory behavior in Lion
- iii. Schooling behavior in fish
- iv. Territorial behavior in tiger
- v. Aggressive behavior in Gorilla
- vi. Courtship behavior in Great Crested Grebe.
- vii. Social behavior in Elephants
- viii. Components of animal communication
- ix. Tactile communication
- x. Communication using sound signals

2. Differentiate between innate behavior and learning.

3. Are landscape biology and restoration ecology examples of in situ or ex situ conservation measures? Why?

4. Write short notes on:

- i. Biodiversity Hotspots
- ii. Ecosystem Conservation/Landscape ecology
- iii. Restoration ecology (Ecosystem Management),
- iv. Captivity breeding

5. Describe in brief:

- i. Snow Leopard Conservancy in India
- ii. Community-based Nature Conservancy (CNC) in Tadoba
- iii. Community Wildlife Conservancies in Namibia
- iv. Lewa Wildlife Conservancies in Kenya

Unit 3: (10 Marks)

1. Describe the different species of earthworms used in vermiculture.
2. Describe the methods used for vermicomposting.
3. Describe the maintenance and harvesting of vermicomposting.
4. Describe role of dairy development in rural economy.
5. Describe the composition of milk
6. Describe care and breeding behavior of Gold fish and Siamese fighting fish
7. Describe care and breeding behavior of Freshwater Angelfish and Oscar fish.
8. Discuss the management of fin and tail rot disease and dropsy in ornamental fishes.
9. Elaborate on the management of dropsy and white spot disease in ornamental fishes.
10. Describe nutrition, vaccination and care of pet dogs.
11. Describe nutrition, vaccination and care of pet cats.

Unit 3: (5 Marks)

Write notes on:

1. Advantages of vermiculture
2. Advantages of vermicomposting
3. Maintenance and harvesting of vermiculture
4. Skimmed milk and Milk powder
5. Cheese and Curd
6. Yogurt and Paneer
7. Khoya and Butter
8. Ghee and Ice cream
9. Dropsy and its control in ornamental fish
10. Fin and tail rot disease and its control in ornamental fish
11. White spot disease and its control in ornamental fish
12. Labrador/ German Shepherd/ Chihuahua / Mudhol hound / Combai dog breed.
13. Persian cat/ Siamese cat breed.

PRACTICAL
USZOP3 (Course V)
Skeleton-Practical Examination Question Paper Pattern

Time: 3 hrs

Marks: 50

Major Question

15 marks

Q1. Extraction and detection of DNA

OR

Q1. Extraction and detection of RNA

Minor Question

07 marks

Q2. Mounting of Barr bodies

OR

Q2. Study of mitosis-Temporary squash preparation of Onion root tip

OR

Q2. Detection of blood groups and Rh factor

Q3. Problems on Genetics and Molecular biology (Transcription /Genetic code)
(01 problem each)

10 marks

Q4. Identification

08 marks

a. Chromosome morphology

b. Pedigree analysis

Q5. Viva and Journal

10 marks

PRACTICAL
USZOP3 (Course VI)
Skeleton-Practical Examination Question Paper Pattern

Time: 3 hrs

Marks: 50

Major Question

15 marks

Q1. Urine analysis—Normal and abnormal constituents

Minor Question

10 marks

Q2. Detection of ammonia in water excreted by fish

OR

Q2. Detection of uric acid from excreta of Birds

Q3. Identification

15 marks

- c. Nutritional apparatus
- d. Respiratory structures
- e. Locomotory organs
- f. Study of hearts
- g. Permanent slides on reproduction

Q4. Viva

05 marks

Q5. Journal

05 marks

PRACTICAL
USZOP3 (Course VII)
Skeleton -Practical Examination Question Paper Pattern

Time: 3 hrs

Marks: 50

Major Question

10 marks

Q1. Preparation of paneer from the given milk sample.

OR

Q1. Measurement of density of milk using different samples by lactometer

Q2. Identify and describe as per instructions (3 marks each)

18 marks

a. Any one Amazing Animal

b. Any one Animal hybrid

c. Any one Animal inspired technology

d. Any one from Animal behavior

e. Any one from Marine National park and Sanctuaries highlighted on a map

f. Any one breed of cow or buffalo

Q3. Submission of report on aquarium setting in lab

05 marks

Q4. Field report.

07 marks

Q5. Viva and Journal

10 marks

SEMESTER IV			
USZO401 COURSE-8			
Comparative Embryology, Aspects of Human Reproduction and Scientific Attitude, Methodology, Writing and Ethics			
UNIT 1: Comparative Embryology		15L	25hrs
Objective:			
➤ <i>To acquaint the learner with key concepts of embryology.</i>			
Desired Outcomes:			
➤ <i>Learner will be able to understand and compare the different pre- embryonic stages</i>			
➤ <i>Learner will be able to appreciate the functional aspects of extra embryonic membranes and classify the different types of placentae.</i>			
1.1	➤ Types of Eggs- Based on amount and distribution of yolk	2L	4hrs
1.2	➤ Structure and Types of Sperms	1L	1hr
1.3	➤ Types of Cleavages.- Holoblastic and Meroblastic	1L	3hrs
1.4	➤ Types of Blastulae	1L	3hrs
1.5	➤ Gastrulation	2L	4hrs
1.6	➤ Coelom -Formation and types	2L	3hrs
1.7	➤ Extra embryonic membranes ➤ Types of Placentae -Based on histology, morphology and implantation	6L	10hrs
UNIT 2: Aspects of Human Reproduction		15L	32hrs
Objectives:			
➤ <i>To acquaint the learners with different aspects of human reproduction.</i>			
➤ <i>To make them aware of the causes of infertility, techniques to overcome infertility and the concept of birth control</i>			
Desired Outcome:			

	<ul style="list-style-type: none"> ➤ Learners will be able to understand human reproductive physiology ➤ Learners will become familiar with advances in ART and related ethical issues. 		
2.1	<p>Human Reproductive system and Hormonal regulation</p> <ul style="list-style-type: none"> ➤ Anatomy of human male and female reproductive system ➤ Hormonal regulation of Reproduction ➤ Impact of age on reproduction-Menopause and Andropause 	2L	4hrs
2.2	<p>Contraception & birth control</p> <ul style="list-style-type: none"> ➤ Difference between contraception and birth control ➤ Methods of Contraception Natural Methods: Abstinence , Rhythm method, Temperature method, cervical mucus or Billings method, Coitus interruptus, Lactation amenorrhea Artificial methods : Barrier methods, Hormonal methods, Intrauterine contraceptives, Sterilization, Termination, Abortion 	2L	4hrs
2.3	<p>Infertility</p> <ul style="list-style-type: none"> ➤ Female infertility Causes - Failure to ovulate; Production of infertile eggs; Damage to the oviducts (oviduct scarring and PID or Pelvic inflammatory disease, TB of oviduct), Damage to the Uterus (Fibroids, polyps, T. B. of uterus) Damage to the cervix; Antibodies to sperm; Genetic causes; Recurrent abortions ➤ Male infertility Causes - Testicular failure, infections of epididymis, seminal vesicles or prostate; Hypogonadism, Cryptorchidism, Congenital abnormalities, Varicocele, Blockage, Azoospermia, Oligospermia, Abnormal sperms (Teratozoospermia), Reduced sperm motility (Asthenozoospermia); autoimmunity, ejaculatory disorders and ➤ Idiopathic infertility ➤ Role of endocrine disruptors in infertility 	3L	6hrs
2.4	<p>Infertility associated disorders</p> <ul style="list-style-type: none"> ➤ Endometriosis ➤ Polycystic Ovarian syndrome (PCOS) ➤ POF (Primary ovarian failure) ➤ STDs Gonorrhoea, Chlamydia, Syphilis and Genital Herpes 	3L	6hrs

2.5	Treatment of Infertility <ul style="list-style-type: none"> ➤ Removal /reduction of causative environmental factors ➤ Surgical treatment ➤ Hormonal treatment- Fertility drugs ➤ Assisted Reproductive Technology ➤ Sperm banks, cryopreservation of gametes and embryos ➤ Surrogacy 	2L	6hrs
2.6	Techniques and Ethical considerations of ART <ul style="list-style-type: none"> ➤ Techniques of ART - <i>In vitro</i> fertilization (IVF), Embryo transfer (ET), <i>In vitro</i> maturation (IVM), Gamete intra-fallopian transfer (GIFT), intra-zygote transfer (ZIFT), Intracytoplasmic sperm injection (ICSI) with ejaculated sperm and with sperm retrieved from testicular biopsies- Testicular sperm extraction (TESE), Pronuclear stage transfer (PROST). ➤ Ethical Considerations of ART 	3L	6hrs
Unit 3: Scientific Attitude, Methodology, Writing and Ethics		15L	32hrs
Objective: <ul style="list-style-type: none"> ➤ <i>To inculcate scientific temperament in the learner.</i> 			
Desired outcome: <ul style="list-style-type: none"> ➤ <i>The learner will develop qualities such as critical thinking and analysis.</i> ➤ <i>The learner will develop the skills of scientific communication.</i> ➤ <i>Learner will understand the ethical aspects of research</i> 			
3.1	Process of science-A dynamic approach to investigation	4L	10hrs
The Scientific method <ul style="list-style-type: none"> ➤ Deductive reasoning and inductive reasoning, Critical thinking, Role of chance in scientific discovery 			
Scientific Research <ul style="list-style-type: none"> ➤ Definition, difference between method and methodology, characteristics, types 			
Steps in the Scientific Method <ul style="list-style-type: none"> ➤ Identification of research problem, Formulation of research hypothesis, Testing the hypothesis using experiments or surveys, Preparing research/study design including methodology and execution (Appropriate controls, sample size, technically sound, free from bias, repeat experiments for consistency), Documentation of data, Data analysis and interpretation, Results and Conclusions 			

	Dissemination of data ➤ Reporting results to scientific community (Publication in peer-reviewed journals, thesis, dissertation, reports, oral presentation, poster presentation)		
	Application of knowledge ➤ Basic research, Applied research, Translational research, Patent		
3.2	Scientific writing	7L	15hrs
	Structure and components of a research paper ➤ Preparation of manuscript for publication of research paper- Title, Authors and their affiliations, Abstract, Keywords and Abbreviations, Introduction, Material and Methods, Results, Discussion, Conclusions, Acknowledgement, Bibliography; Figures, Tables and their legends		
	➤ Writing a review paper		
	Structure and components of research report: ➤ Report writing, Types of report		
	Computer application ➤ Plotting of graphs, Statistical analysis of data. Internet and its application in research-Literature survey, Online submission of manuscript for publication		
3.3	Ethics	3L	5hrs
	Ethics in animal research ➤ The ethical and sensitive care and use of animals in research, teaching and testing, ➤ Approval from Institutional animal ethics Committee.		
	Ethics in clinical research ➤ Approval from Clinical Research Ethics Committee ➤ Informed consent		
	Approval from concerned/ appropriate authorities : ➤ National Biodiversity Authority ➤ State Biodiversity Board ➤ Forest Department		
	Conflict of interest		
3.4	Plagiarism	1L	2hrs
	USZO402 COURSE-9		

Cell Biology, Endo membrane System and Biomolecules			
Unit 1 : Cell Biology		15L	26hrs
Objectives: ➤ <i>To study the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton.</i>			
Desired outcome : ➤ <i>Learner would acquire insight of transport mechanisms for the maintenance and composition of cell</i>			
1.1	Introduction to cell biology ➤ Definition and scope ➤ Cell theory ➤ Generalized prokaryotic , eukaryotic cell: size, shape and structure	2L	4hrs
1.2	Nucleus ➤ Size, shape, number and position ➤ Structure and functions of interphase nucleus ➤ Ultrastructure of nuclear membrane and pore complex ➤ Nucleolus: general organization, chemical composition and functions ➤ Nuclear sap/ nuclear matrix ➤ Nucleocytoplasmic interactions	5L	6hrs
1.3	Plasma membrane a. Fluid Mosaic Model b. Junctional complexes c. Membrane receptors d. Modifications: Microvilli, Desmosomes and Plasmodesmata.	4L	8hrs
1.4	Transport across membrane a. Diffusion and Osmosis b. Transport: Passive and Active c. Endocytosis and Exocytosis	2L	4hrs
1.5	Cytoskeletal structures ➤ Microtubules: Composition and functions ➤ Microfilaments: Composition and functions	2L	4hrs
Unit 2 Endomembrane System		15L	25hrs
Objective : ➤ <i>To acquaint the learner with ultrastructure of cell organelles</i>			

	<i>and their functions.</i>		
	<p>Desired outcome:</p> <ul style="list-style-type: none"> ➤ Learner would appreciate the intricacy of endomembrane system. ➤ Learner would understand the interlinking of endomembrane system for functioning of cell. 		
2.1	<p>Endoplasmic reticulum</p> <ul style="list-style-type: none"> ➤ General morphology of endomembrane system ➤ Morphology and Types of ER ➤ Biogenesis of ER ➤ Functions of RER and SER 	3L	5hrs
2.2	<p>Golgi complex</p> <ul style="list-style-type: none"> ➤ Morphology of Golgi complex ➤ Cytochemistry (chemical composition) of golgi complex. ➤ Functions of Golgi complex <ul style="list-style-type: none"> • Protein Glycosylation, • Lipid and Polysaccharide Metabolism, • Protein Sorting and Secretion. • Golgi anti-apoptotic protein (GAAP) 	3L	4hrs
2.3	<p>Lysosomes</p> <ul style="list-style-type: none"> ➤ Origin, occurrence and polymorphism ➤ Functions of lysosomes: <p>Peroxisomes</p> <ul style="list-style-type: none"> ➤ Origin, morphology & functions 	3L	4hr
2.4	<p>Mitochondria</p> <ul style="list-style-type: none"> ➤ Morphology and chemical composition of mitochondria ➤ Biogenesis of mitochondria ➤ Bioenergetics: <ul style="list-style-type: none"> • Chemical energy & ATP • Glycolysis • Krebs cycle • Respiratory chain and Oxidative phosphorylation 	6L	12hrs
	Unit 3: Biomolecules	15L	30hrs
	<p>Objective :</p> <ul style="list-style-type: none"> ➤ To give learner insight into the structure of biomolecules, and their role in sustenance of life. 		
	<p>Desired outcome:</p> <ul style="list-style-type: none"> ➤ The learner will realize the importance of biomolecules and their clinical significance. 		
3.1	<p>Biomolecules</p> <ul style="list-style-type: none"> ➤ Concept of Micromolecules and Macromolecules. 	2L	5hrs

3.2	Carbohydrates <ul style="list-style-type: none"> ➤ Definition Classification, Properties and Isomerism, Glycosidic bond ➤ Structure of <ol style="list-style-type: none"> a. Monosaccharides- Glucose and Fructose b. Disaccharides - Lactose and Sucrose c. Polysaccharides - Cellulose, Starch, Glycogen and Chitin ➤ Biological role and their Clinical significance 	4L	8hrs
3.3	Amino Acids and Proteins <ul style="list-style-type: none"> ➤ Basic structure of amino acid, classification of amino acids , Essential and Non-essential amino acids, Peptide bond ➤ Protein conformation: Primary, Secondary, Tertiary, Quaternary ➤ Types of proteins – Structural (Keratin, Collagen) and functional proteins (Hemoglobin) ➤ Biological role and their Clinical significance 	5L	8hrs
3.4	Lipids <ul style="list-style-type: none"> ➤ Definition, classification of lipids with examples, Ester linkage ➤ Physical and Chemical properties of lipids ➤ Saturated and Unsaturated fatty acids , Essential fatty acids ➤ Triacylglycerols, Phospholipids (Lecithin and Cephalin) and Steroids (Cholesterol). ➤ Biological role and their Clinical significance 	4L	5hrs
3.5	Vitamins <ul style="list-style-type: none"> ➤ Water soluble vitamins(e.g. Vit C, Vit B12) ➤ Lipid soluble vitamins (e.g. Vit A, Vit D) ➤ Biological role and their Clinical significance 	2L	4hrs
USZO403 COURSE-10			
Holistic Health, Neurological and genetic diseases and Pollution			
Unit 1: Holistic Health			15L
Objective:			
<ul style="list-style-type: none"> ➤ To make learners understand the importance of diet and life style in holistic health management. 			
Desired outcome:			
<ul style="list-style-type: none"> ➤ Learners will apply the knowledge to adopt a healthy life style. 			
1.1	Life style & Health <ul style="list-style-type: none"> ➤ Introduction to Active and Sedentary life style ➤ Requisites of a Healthy Lifestyle: Balanced diet, Avoidance of junk food & trans fats, Inclusion 	6L	10hrs

	of foods containing omega 3 fatty acids, Exercise, Sleep, Recreation & Meditation.		
1.2	Role of diet to prevent Chronic Diseases: Cancer, Osteoporosis, Tuberculosis, Dental Disorders	3L	5hrs
1.3	Stress & Health ➤ Difference between Mental and Physical stress ➤ Effects of Mental stress: Cardiovascular problems, reproductive health	3L	6hrs
1.4	Addiction & Health: ➤ Alcoholism, Smoking, Drug addiction & abuse	3L	4hrs
	UNIT 2: Neurological and Genetic diseases	15L	26hrs
	Objective: ➤ <i>The goal is to introduce learners the basic concept of genetic disorders, neurological disorders, genetic counseling, its necessity and applications.</i>		
	Desired Outcome : ➤ <i>The learner will become cognizant about genetic and neurological disorders as well as genetic counseling, its requisites and significance.</i>		
2.1	Common Neurological Disorders ➤ Introduction ➤ Causes, symptoms, detection and treatment of neurological diseases: Alzheimer's disease, Parkinson's disease, Dyslexia and Autism	6L	12hrs
2.2	Genetic Disorders ➤ Introduction ➤ Causes, symptoms and treatments/therapy of: Super-female, Klinefelter's syndrome, Down's syndrome	6L	6hrs
2.3	Genetic Counseling ➤ Introduction , need of genetic counseling ➤ Genetic tests: Maternal blood screening tests, Amniocentesis for prenatal diagnosis, Ultrasonography, New born screening	3L	8hrs
	Unit 3 : Pollution	15L	24hrs
	Objective: ➤ <i>To equip the learner with the knowledge of causes and effects of pollution and actions required to combat the detrimental effects of pollution.</i>		

	➤ <i>To create awareness in learner regarding various critical environmental issues using thought provoking case studies.</i>		
	<p>Desired Outcome :</p> <p>➤ <i>Learner will be able to relate various anthropogenic activities with environmental degradation and its harmful effects on human health.</i></p> <p>➤ <i>Learner will become more sensitive towards the environmental issues.</i></p>		
3.1	Pollution Introduction	3L	8hrs
3.2	<p>Causes, effects and control measures of pollution</p> <p>➤ Air Pollution</p> <p>➤ Water Pollution</p> <p>➤ Soil Pollution</p> <p>➤ Solid waste pollution</p>	6L	8hrs
3.3	<p>Case studies on pollution:</p> <p>➤ Bhopal Gas Tragedy, The Minamata disaster, Effect of air pollution on Taj Mahal, Acidification of Great Barrier Reef, Diclofenac as a threat to Indian vultures.</p>	6L	8hr

	SEMESTER IV
	Practical USZOP4 (Course VIII)
1	Study of the following permanent slides, museum specimens and materials. a. Mammalian sperm and ovum. b. Egg types –Fish eggs, Frog eggs , Hen's egg. c. Cleavage , blastula and gastrula (<i>Amphioxus</i> , Frog and Bird).
2	Study of Prokaryotic cells (bacteria) by Crystal violet staining technique.
3	Study of Eukaryotic cells (WBCs) from blood smear by Leishman's stain.
4	Study of bleeding time and clotting time.
5	Determination of blood sugar by GOD and POD method
6	Detection of Creatinine in urine.
7	Abstract writing /Bibliography/ References

8	Preparation of Power point presentation
9	Review writing based on programmes telecast by Doordarshan, Discovery channel, Gyandarshan, UGC programmes, Animal planet.
10	Visit to Fertility clinic/ ART Centre and report of the visit.
	Practical USZOP4 (Course IX)
1	Study of permeability of cell through plasma membrane (Osmosis in blood cells).
2	Measurement of cell diameter by occulometer (by using permanent slide)
3	Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Barfoed's test, Anthrone test)
4	Qualitative tests for protein (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test)
5	Qualitative test for lipids (Solubility test, Sudan III test)
6	Study of rancidity of lipids by titrimetric method.
7	Ultra structure of cell organelles – (Electron micrographs) <ul style="list-style-type: none"> a. Nucleus b. Endoplasmic reticulum (Smooth and Rough) c. Mitochondria. d. Golgi apparatus e. Lysosomes
8	Study of clinical disorders due to carbohydrates, proteins and lipid imbalance (Photograph to be provided / significance to given and disorder to be identified) <ul style="list-style-type: none"> a. Hyperglycemia, Hypoglycemia. b. Thalassemia, Kwashiorkar c. Obesity, Atherosclerosis
9	Study of natural ecosystem and report of the field trip.
	Practical USZOP4 (Course X)
1	Estimation of dissolved oxygen from the given water sample.
2	Estimation of salinity by refractometer from the given water sample.
3	Detection of pH of given soil sample by using pH paper and Universal indicator.
4	Identify and describe the pollution detecting and controlling devices using photographs: Sound level meter, Cyclonic separator, Typical bag house filter, Scrubber.
5	Identification of Imaging instruments used in diagnosis: X-ray, CT scan, MRI

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6	Identify and describe syndromes using Idiogram.
7	Measurement of protein content in milk.
8	Study of balanced diet chart for infants, children, adolescent and active and sedentary adults.
9	Measurement of lung capacity.
10	Submission of report on survey of physical activity and sleep habits of your batch OR Visit to school of special children.

Note –The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.

#There shall be at least one excursion/field trip

Semester IV

REFERENCES AND ADDITIONAL READING

COURSE-VIII (USZO401)

1. Developmental Biology- 5th Edition, Scot F. Gilbert, Sinauer Associates Inc.
2. Developmental Biology- Subramoniam T., Narosa Publishers.
3. Developmental Biology- Berril N.J., Tata Mc Graw –Hill Publication.
4. Essential Reproduction-Martin H. Johnson, Wiley-Blackwell Publication.
5. Chick Embryology- Bradley M. Pattern.
6. Embryology- Mohan P. Arora.
7. Chordate Embryology- Dalela, Verma and Tyagi
8. Human Anatomy and Physiology. E. L. Marieb, Pearson Education Low Price Edition
9. Biological Science. Taylor, Green and Stout. Cambridge Publication
10. Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
11. Human Biology-Daniel D Chiras Jones and Bartlett
12. The Physiology of Reproduction Vol I & II - E.K .Nobil and JU. D.Neil, Raven Press, New York.
13. Biology -The Unity and Diversity of Life. C. Starr, R. Taggart, C. Evers, L. Starr, Brooks/Cole Cengage learning International Edition
14. Research Methodology, Methods and Techniques- by C.R. Kothari, Wiley Eastern Ltd. Mumbai
15. Practical research planning and design 2nd edition- Paul D Leedy, Macmilan Publication

COURSE-IX (USZO402)

1. Cell Biology. Singh and Tomar, Rastogi Publication.

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2. Cell and Molecular Biology E.D.P De Robertis and E.M.R Robertis ,CBS Publishers and Distributors.
3. The cell A molecular Approach Goeffrey M.Coper ASM Press Washington D.C.
4. A textbook of cytology Suruchi Tyagi Dominant Publishers and Distributors New Delhi.
5. Cell and molecular biology Gupta P.K , Rastogi Publication, India.
6. Cell Biology Pawar C.B. Himalaya publication
7. Molecular Biology of the cell (6th ed) by the Insertus
8. Campbell Biology (9th Ed.)
9. Principles of Biochemistry, 2005, 2nd and 3rd edn. Lehninger A.L. Nelson D.L. and Cox M.M ,
10. Biochemistry, Dushyant Kumar Shrma, 2010, Narosa Publishing house PVT.Ltd.
11. Fundamentals of Biochemistry, Dr AC Deb, 1983, New Central Book Agency Ltd.
12. A Textbook of Biochemistry, 9th edition, Dr. Rama Rao A.V.S.S and Dr A Suryalakshmi.
13. Biochemistry-G Zubay , Addison Wesley, 1983
14. Biochemistry, L Stryer, 3rd/4th/5th ed, 1989 , Freeman and Co. NY
15. Harper's Biochemistry, 1996, 26th edition, Murray R.K. Granner D.K. Mayes P.A. Rodwell V.M. Hall international USA
16. Outline of Biochemistry, 1976, E.E. Conn and P.K. Stumpf. John Wiley and Sons USA

COURSE-X (USZO403)

1. G.J. Tortora & B Desrickson: Principals of anatomy and physiology. John Wiley & Sons, Inc
2. A.C. Guyton & J.E. Hall: A text book of medical physiology. Elsevier Inc.
3. Alan Rozanski, et al.: Impact of Psychological Factors on the Pathogenesis of Cardiovascular Disease and Implications for Therapy. Circulation. 1999;99:2192-2217.
4. Mello NK & Mendelson JH: Alcoholism A Biobehavioral Disorder. e-Book 2015 International Psychotherapy Institute
5. Walter C. et al.: Prevention of Chronic Disease by Means of Diet and Lifestyle Changes. In Disease Control Priorities in Developing Countries
6. Diet, nutrition and the prevention of chronic diseases. World Health Organ Tech Rep Ser. 2003;916:i-viii, 1-149
7. Lagraaaw HM et al: Acute and chronic psychological stress as risk factors for cardiovascular disease: Insights gained from epidemiological, clinical and experimental studies. Brain Behav Immun. 2015 Nov;50:18-30.
8. Rakesh Sharma et al: Lifestyle factors and reproductive health: taking control of your fertility. Reproductive Biology and Endocrinology 2013, 11:66.
9. Marie Nyswander. Drug Addiction. e-Book 2016 International Psychotherapy Institute.

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10. Wiesner P, Watson KE. Triglycerides: A reappraisal Trends. Cardiovasc Med. 2017. doi: 10.1016/j.tcm.2017.03.004
11. Drakopoulou M et al: Managing the lipid profile of coronary heart disease patients Expert Rev. Cardiovasc Ther. 2016 Nov;14(11):1263-1271.
12. Christy K. The Role of Diet in the Prevention of Common Kidney Stones. Urologic Nursing / December 2005 / Volume 25 Number 6
13. Laura M et al: Shaffer. Epidemiology of Gallbladder Disease: Cholelithiasis and Cancer. Gut and Liver, Vol. 6, No. 2, April 2012, pp. 172-187
14. Bhatia, S.C., Text book of Air pollution and its control, Atlantic publication.
15. Sharma, P.D., Ecology and environment, Rastogi publication.
16. Sharma, B.K. and Kaur, An introduction to environmental pollution, Goel publishing.
17. Khopkar, Environmental pollution analysis, New Age International (P) Ltd.
18. Benny Joseph, Environmental studies, Tata Mc Graw Hill publication.
19. Clark, R.S., Marine pollution, Clarendon press, Oxford.
20. Day, A.K., Environmental chemistry, Willey Eastern Pvt. Ltd.
21. Bharucha Erach, Text book of environmental studies for UG Course, University Press.
22. Cunningham W.P., M.A. Cunningham & B.W.Saigo, Environment Science, McGraw Hill
23. Bhopal gas tragedy-best ppt ever – SlideShare
<https://www.slideshare.net/philominide/bhopal-gas-tragedy-33689171>
24. Case study of TAJ MAHAL aakansha26 – SlideShare
<https://www.slideshare.net/aakansha26/case-study-of-taj-mahal>
25. INTRODUCTION Tragedy of Minamata Disease and Environmental....
www.nimd.go.jp/syakai/webversion/pdfversion/e001009_intro.pdf
26. Ocean acidification is already harming the Great Barrier Reef's growth
theconversation.com/ocean-acidification-is-already-harming-the-great-barrier-reefs-gr...
27. Diclofenac - Indian Vulture Crisis | PMF IAS
<https://www.pmfias.com/diclofenac-indian-vulture-crisis/>

SCHEME OF EXAMINATION

- (a) One Theory examination of hundred (100) marks per course per semester should be conducted as per the following skeleton question paper pattern.
- (b) One practical examination of fifty (50) marks per course each should be conducted at the end of every semester.

SKELETON PAPER PATTERN FOR THEORY EXAMINATION

NOTE: All Questions are compulsory.

Figures to the right indicate full marks.

Draw neat labeled diagrams wherever necessary.

Time: 3 hours

Total marks: 100

- | | |
|---|----|
| Q.1. Objective type from Unit I, II and III with No internal options* | 20 |
| Q.2. Unit I may have questions carrying 12 and 8 marks OR of 10 marks each with 100% internal options | 20 |
| Q.3. Unit II may have questions carrying 12 and 8 marks OR of 10 marks each with 100% internal options | 20 |
| Q.4. Unit III may have questions carrying 12 and 8 marks OR of 10 marks each with 100% internal options | 20 |
| Q.5. Unit I, II and III (Any 4 out of 6) | 20 |

*For Question 1 it is recommended to have objective questions such as –

- | | |
|-------------------------|-----------------------------|
| (i) Match the column | (ii) MCQ |
| (iii) Give one word for | (iv) True or False |
| (v) Define the term | (vi) Answer in one sentence |

For Q 2, 3 and 4 there shall be 100% internal option.

MODEL QUESTION BANK SEMESTER IV

USZO401 (COURSE VIII)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (10 Marks)

- 1) Classify the different types of eggs.
- 2) Briefly explain types and structure of sperms (any two animals).
- 3) Define cleavage Explain types of cleavages.
- 4) Give brief account on various types of blastulae.
- 5) What is gastrulation? Explain gastrulation in frog.
- 6) Give an account of the process of coelom formation and its types.
- 7) Explain various types of placentae in mammals.
- 8) Give an account of extra embryonic membranes.
- 9) Describe briefly the types of eggs on the basis of amount and distribution of yolk.
- 10) Describe the early development of mammalian egg upto gastrulation.
- 11) Give a brief note on different types of sperms.
- 12) Write a note on blastula and explain its types.
- 13) Explain the comparative process of embryo formation.

Unit-1: (5-Marks)

- 1) Draw neat labeled diagram and explain any one of the following:
(Microlecithal, Alecithal, Homolecithal, Heterolecithal, Isolecithal, Telolecithal, Centrolecithal, Discoidal).
- 2) Explain the structure of sperm of frog/ reptiles/ birds/ mammals.

- 3) Short note on Holoblastic cleavage Or Meroblastic cleavage.
- 4) Short note on equal or unequal cleavage.
- 5) Short note on Discoblastula or Coeloblastula.
- 6) Short note on centroblastula or amphiblastula or stereoblastula,
- 7) Explain the process of coelom formation in process of gastrulation.
- 8) Short notes on: Amnion /Chorion/Allantois/Yolk sac.
- 9) Explain the function of Amnion /Chorion/Allantois/Yolk sac.
- 10) Short note on Yolk sac placenta or Syndesmochorial placenta/Deciduate placenta/Cotyledonary placenta/Hemo-chorial placenta/Zonary placenta/Diffuse placenta
- 11) Short note on Deciduous or non-deciduous placenta
- 12) Write the functions of placenta.
- 13) What are the roles of Embryonic membranes and extra embryonic membranes

Unit 2: (10 Marks)

1. Describe male reproductive system and its hormonal regulation.
2. Describe female reproductive system and its hormonal regulation.
3. Define reproduction. Explain the hormonal regulation of reproduction.
4. What is contraception? Explain different methods of artificial contraception.
5. What is the difference between contraception and birth control? Explain the different methods for natural contraception.
6. Define infertility and explain the causes of female infertility.
7. What are the causes of male infertility?
8. Explain the hormonal treatment for infertility using drugs.
9. Describe the methods of treatment of infertility.
10. Give a brief account of infertility related disorders.
11. What are sperm banks? Add a note on cryopreservation of sperms.
12. What are cryoprotectants? Write a note on embryo cryopreservation.
13. What is testicular biopsy? Explain Testicular sperm extraction (TESE), Pronuclear stage transfer (PROST).
14. What are the steps involved in Embryo transfer (ET) and / Intra-fallopian transfer (IFT)?
15. What is ART technique? Add a note on IVF (steps, success and ethical considerations).
16. Explain in detail the steps of IVF and add a note on its applications.

Unit 2: (5 Marks)

1. Write a note on impact of age on reproductive stage –
 - a. Menopause

b. Andropause

2. What is amenorrhea?
3. How is contraception different from birth control?
4. What are IUD's? How do they work as barriers for fertilization?
5. How does sterilization act as a method of contraception?
6. Write a note on birth control.
7. What is the difference between natural and artificial methods of contraception?
8. How is T.B. a cause of female infertility?
9. What are the genetic causes of infertility?
10. Write a note on STD's as infertility related disorders?
11. Explain briefly:
 - a. Impotency
 - b. Surrogacy
 - c. Endometriosis
 - d. Idiopathic infertility
12. Discuss the role of endocrine disruptors in infertility?
13. Explain the role of the following in infertility:
 - a. Gonorrhoea
 - b. Syphilis
 - c. Genital Herpes
 - d. Chlamydia
14. Write a note on treatment of infertility by removal of causative environmental factors.
15. Write a note on Ethical considerations of ART.
16. What is surrogacy? Add a note on the ethical issues associated with surrogacy.
17. Differentiate between GIFT and ZIFT.

Unit 3: (10 Marks)

1. Explain the steps involved in scientific method.
2. Explain the steps involved in scientific research.
3. Describe briefly, the steps towards preparing a research design.
4. Elaborate on the components of a research paper.
5. Describe the anatomy of a research paper.
6. Elaborate on report writing as a scientific form of communication.
7. Describe literature survey, collection of data and its analysis.
8. Give an account of the different techniques used for dissemination of research data.
9. Elaborate on ethics in animal research.
10. Explain ethics in animal and clinical research.
11. Explain plagiarism in detail.

Unit 3: (5 Marks)

1. Write a note on inductive approach to scientific research.
2. Write a note on deductive approach to scientific research.
3. Write a note on role of chance in scientific discovery.
4. Define research. State the difference between research method and research methodology.
5. Describe in brief the different types of research.
6. Write a note on role of computers in research.
7. Describe briefly identification of research problem and formulation of research hypothesis.
8. What is abstract writing?
9. What is plagiarism?
10. What is bibliography?
11. Write a short note on ethics in animal research.
12. Write a short note on ethics in clinical research.
13. Write a short note on applications of statistics in research.
14. Write a short note on informed consent.
15. What is a patent and how is it obtained?

MODEL QUESTION BANK SEMESTER IV

USZO402 (COURSE IX)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (10 marks)

1. Explain prokaryotic cell.
2. Explain Eukaryotic cell.
3. Give an account of cell theory.
4. Describe the ultrastructure of nuclear membrane.
5. State the chemical composition and functions of nucleolus.
6. Describe nucleocytoplasmic reactions.
7. Explain rRNA processing.
8. Describe fluid mosaic model of plasma membrane.
9. Give an account of active and passive transport
10. Describe various modifications of plasma membrane
11. Explain pinocytosis, phagocytosis and secretion
12. Give an account of cell permeability
13. Differentiate prokaryotic and eukaryotic cell

Unit 1: (5 Marks)

1. Virus
2. Nuclear matrix
3. Number and position of nucleus
4. Molecular organization of chromatin
5. Unit membrane concept
6. Nucleolus
7. Membrane receptors
8. Sandwich model
9. Cell coat
10. Cell recognition

Unit 2: (10 Marks)

1. Write a note on structural organization & importance of endomembrane system.
2. Describe ultrastructure of Endoplasmic Reticulum
3. Describe the types and functions of ER.
4. Give an account of ultrastructure and functions of Golgi complex.
5. Write an essay on functions of Golgi complex.
6. Give an account of polymorphism in lysosomes.
7. Write an essay on peroxisomes.
8. Describe the structure and chemical composition of mitochondria.
9. Write a note on mitochondria as powerhouse of the cell.
10. Describe the major functions of mitochondria.

Unit 2: (5 Marks)

1. Importance of endomembrane system
2. Write a short note on biogenesis of endomembrane system
3. Functions of Rough Endoplasmic Reticulum
4. Functions of Smooth Endoplasmic Reticulum
5. Structure of Golgi complex
6. Chemical composition of Golgi complex
7. Lipid & polysaccharide metabolism in Golgi complex
8. Secretion and protein sorting by Golgi complex
9. Write a brief note on GAAP
10. Write a brief note on protein glycosylation by Golgi complex
11. Origin and functions of lysosomes
12. Write a short note on peroxisomes
13. Structure of mitochondria
14. Chemical composition of mitochondria
15. Write a short note on ATP

16. Write a short note on glycolysis
17. Write a short note on Kreb's cycle
18. Write a short note on oxidative phosphorylation

Unit 3: (10 Marks)

1. Discuss the chemical behavior of carbon and a note on variety of functional groups of biomolecules.
2. Explain the concept of micromolecules and macromolecules.
3. Describe the structure of water. Add a note on physic-chemical properties of water.
4. Define carbohydrate. Add a note on its classification.
5. What are carbohydrates? Explain the classification of carbohydrate with suitable examples.
6. Explain with suitable example monosaccharide and disaccharide.
7. Discuss the properties of carbohydrates.
8. What are disaccharides? Draw the structures of maltose and sucrose.
9. What are polysaccharides? How are they classified? Write the structures of glycogen and heparin/ chitin and heparin.
10. Discuss about chemical structure of the monosaccharides/ disaccharides.
11. What are amino acids? Discuss classification of amino acids based on R group.
12. Give an account of primary and secondary structure of proteins.
13. Write an account on tertiary and quaternary structure of proteins.
14. Describe the structure of saturated and unsaturated fatty acids.
15. Define essential fatty acids. Add a note on it.
16. Define lipids. Write a note on mono, di and triglycerides/ phospholipids.
17. What are fatty acids? Add a note on types of fatty acids.
18. Describe the structure and functions of water soluble vitamins.
19. Describe the structure and functions of lipid soluble vitamins.

Unit 3: (5 Marks)

1. Write a short note on monomers and polymers.
2. Write note on properties of carbohydrates.
3. Give an account of polysaccharides.
4. With suitable example explain glycosidic bond.
5. Explain the linkage in lactose and sucrose.
6. Give the biological importance of carbohydrates.
7. What are essential and nonessential amino acids?
8. Give an account of properties of amino acids.
9. Define and explain peptide bond with suitable example.

10. Explain the different types of proteins with suitable examples.
11. Explain the biological role of proteins.
12. Peptide bond
13. Types of fatty acids.
14. Biological role of lipids
15. Properties of fatty acid
16. Sterol and waxes
17. Describe properties of fatty acid/lipids.
18. Discuss the clinical significance of protein / carbohydrate /lipids.
19. Write short note on clinical significance of lipids.
20. Write a note on isomerism in carbohydrates and amino acids?
21. Describe the structure and functions of vitamin A/ vitamin B/ vitamin C/
vitamin D.

MODEL QUESTION BANK SEMESTER IV

USZO403 (COURSE X)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (10 Marks)

1. Explain the role of diet in prevention of chronic diseases.
2. Give an account of adverse effect of junk food on heart & liver.
3. Write a note on active and sedentary life style.
4. Explain the importance of recreation and meditation on our daily life.
5. Give an account of mental stress on reproductive physiology.
6. Give an account of adverse effects of alcoholism.
7. Give an account of adverse effects of active and passive smoking.
8. Enlist healthy life style practices and their effects.
9. Write a note on adverse effects of drug addiction and drug abuse on our health.
10. Write a note on causes, symptoms and prevention of kidney/gall bladder stones.

Unit 1: (5 Marks)

1. Define balanced diet and describe its importance to our health.
2. Explain the importance of Omega 3 fatty acids in our diet.
3. Describe the role of diet in prevention of Cancer.

4. Explain the significance of diet in prevention of Osteoporosis.
5. Explain the role of diet in prevention of Tuberculosis.
6. Write short note on Active life style.
7. Write short note on Sedentary life style.
8. Role of meditation on mental and physical health
9. Role of recreation on mental and physical health
10. Importance of exercise and sleep on mental health.
11. Differentiate between Physiological and mental stress.
12. Explain the role of mental stress in cardiovascular problems.
13. Effect of mental stress on reproductive health of office workers.
14. Effect of mental stress on reproductive health of students.
15. Effect of alcoholism on Liver.
16. Effect of alcoholism on Heart.
17. Effect of Smoking on respiratory health.
18. Differentiate between drug addiction and drug abuse.
19. Causes and prevention of kidney stone
20. Causes and prevention of gall bladder stone

Unit 2: (10 Marks)

1. Describe the following diseases with reference to causes, symptoms, detection and remedy/treatment:
a) Alzheimer's b) Parkinson's c) Learning disability d) Autism
2. Describe the following syndromes with reference to causes, symptoms, detection and treatment/therapy:
a) Super female b) Klinefelter c) Down's
3. What is genetic counseling? When one should visit the counselor?
4. Describe different types of genetic counseling?
5. Enlist various benefits of genetic counseling.
6. Describe different genetic tests.
7. Explain non disjunction along with a suitable example.

Unit 2: (5 Marks)

1. Write notes on Signs and symptoms of Alzheimer's disease.
2. Write notes on sign and symptoms of Parkinson's disease.
3. Explain the role of plaques and tangles in Alzheimer's disease.
4. Write notes on Neurological diseases.
5. What are the symptoms of learning disability?

6. Write a note on the causes of learning disability.
7. What are the causes of autism?
8. Differentiate between autism and learning disability.
9. What is non disjunction?

10. Write short notes on

- i. Causes and symptoms of Klinefelter
- ii. Causes and symptoms of Down's syndrome.
- iii. Symptoms of super female
- iv. Treatment of super female
- v. Definition of genetic counseling
- vi. Reasons to visit genetic counselor
- vii. Ultrasonography
- viii. New born screening
- ix. Maternal blood screening
- x. Amniocentesis

Unit 3: (10 Marks)

1. Describe the various sources of air pollution.
2. Give a detailed account of effects of air pollution.
3. Describe control measures of air pollution.
4. Give an account of various means of water pollution.
5. Elaborate on the effects of water pollution.
6. Give control measures of water pollution.
7. Elaborate on the various sources of soil pollution.
8. Describe effects and control measures of soil pollution.
9. Explain the various sources of solid waste pollution.
10. Discuss the effects and control measures of solid waste pollution.
11. Discuss the role of individual in preventing pollution.
12. Give an account of causes and effects of Bhopal gas tragedy. Suggest measures to avoid such a tragedy in the future.
13. Give an account of causes and effects of Minamata disaster. Suggest measures to avoid such a tragedy in the future.
14. Elaborate on the effects of air pollution on Taj Mahal. Suggest control measures.
15. Describe the effects of acidification on Great Barrier Reef. Suggest control measures.
16. Discuss how diclofenac has affected the population of Indian vultures. Suggest control measures.

Unit 3: (5 Marks)

Write Short notes on:

1. Photochemical smog
2. Acid rain
3. Global warming
4. Point and non point sources of water pollution
5. Eutrophication
6. Significance of D.O. & B.O.D. values in water pollution assessment
7. Use of water hyacinth for treatment of waste water
8. Bio accumulation & bio magnification of non degradable pollutants
9. The Principle of three R s - Reduce, Reuse & Recycle
10. Polluter Pay Principle
11. Central Pollution Control Board
12. Air (Prevention & Control) Act 1981
13. Water (Prevention & Control) Act 1974
14. Environment Protection Act 1986

PRACTICAL

USZOP4 (Course VIII)

Skeleton -Practical Examination Question Paper Pattern

Time: 3 hrs

Marks: 50

Major Question

12 marks

Q1. Detection of Creatinine in urine

OR

Q1. Determination of blood sugar by GOD and POD method

Minor Question

08 marks

Q2. Prepare a smear to show prokaryotic cell.

OR

Q2. Prepare a smear to show eukaryotic cell.

OR

Q2. Study of bleeding time and clotting time

Q3. Identify and describe as per instructions

08 marks

- a. Reproduction (Mammalian egg/ Mammalian sperm/ Types of eggs)
- b. Reproduction (Cleavage/ Blastula/ Gastrula)

- Q4. From the given article prepare the bibliography/ abstract 06 marks
- Q5. Power point presentation 06 marks
- Q6. Viva and Journal 10 marks

PRACTICAL
USZOP4 (Course IX)
Skeleton -Practical Examination Question Paper Pattern

Time: 3 hrs

Marks: 50

Major Question

12 marks

Q1. Study of permeability of cell through plasma membrane (Osmosis in blood cells)

OR

Q2. Study of rancidity of lipids by titrimetric method.

Minor Question

08 marks

Q2. Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Barfoed's test, Anthrone test)

OR

Q2. Qualitative tests for proteins (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test)

OR

Q2. Qualitative test for lipids (Solubility test, Sudan III test)

OR

Q2. Measurement of cell diameter by oculometer (by using permanent slide)

- Q3. Identify and describe as per instructions 15 marks
i. Ultra structure of cell organelles (a, b, c)
ii. Clinical disorders (d, e)
- Q4. Field Report and Viva based on it. 10 marks
- Q5. Journal 05 marks

PRACTICAL
USZOP4 (Course X)
Skeleton -Practical Examination Question Paper Pattern

Time: 3 hrs **Marks: 50**

Major Question **14 marks**

Q1. Estimation of Dissolved oxygen from the given water sample.

OR

Q1. Estimation of protein content in the given milk samples (Two samples).

OR

Q1. Determine pH of given soil samples using pH paper and Universal indicator
(Two samples)

Minor Question **12 marks**

Q2. a) Estimation of Salinity by refractometer from the given water sample 07 marks

OR

a) Measurement of lung capacity.

Q2. b) Comment on the given balanced diet chart. 05 marks

Q3. Identify and describe as per instructions: **09 marks**

- i. Any one idiogram
- ii. Any one Imaging instrument
- iii. Any one pollution control device

Q4. Report and viva on visit to school of special children **10 marks**

OR

Report and viva on survey of physical activity and sleep habits

Q5. Journal and viva **05 marks**