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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન પ્રાણીશાસ્ત્ર વિષયની તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર F.Y. B.Sc. થી M.Sc. સુધીનાં અભ્યાસક્રમોનું સમીક્ષન કાર્ય અંગે ચર્ચા કરતા ઝૂઓલોજી વિષયની અભ્યાસ સમિતિની તા.૧૪/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨ અન્વયે નીચે મુજબ કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં ડીનશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલ તા.૧૨/૦૪/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨૮ થી સ્વીકારી મંજૂર કરેલ છે. જેની આથી જાણ કરવામાં આવે છે.

ઝૂઓલોજી વિષયની અભ્યાસ સમિતિની તા.૧૪/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર F.Y. B.Sc., S.Y. B.Sc., T.Y. B.Sc. તથા M.Sc. નાં પ્રાણીશાસ્ત્ર વિષયના રિવાઈઝડ અભ્યાસક્રમો મંજૂર કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૧૨/૦૪/૨૦૨૨ની ઠરાવ ક્રમાંકઃ ૨૮

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર F.Y. B.Sc. થી M.Sc. સુધીનાં અભ્યાસક્રમો ઝૂઓલોજી વિષયની અભ્યાસ સમિતિની તા.૧૪/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં ડીનશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણનો સ્વીકાર કરી F.Y. B.Sc. થી M.Sc. નાં પ્રાણીશાસ્ત્ર વિષયના રિવાઈઝડ અભ્યાસક્રમો મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./પ્રાણીશાસ્ત્ર/પરિપત્ર/૭૭૭૬/૨૦૨૨
તા.૨૦–૦૪–૨૦૨૨

ઈ.ચા. કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન પ્રાણીશાસ્ત્ર વિષયની તમામ કોલેજોનાં આચાર્યશ્રીઓ. તથા ડિપાર્ટમેન્ટનાં વડાશ્રી.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Course: M.Sc. Zoology

Syllabus for Semester I and Semester II

(Credit Based Semester and Grading System with effect From the academic year 2022-23)

M.Sc. Zoology Syllabus Semester I and Semester II

Credit Based and Grading System

To be implemented from the Academic year 2022-2023

ZOO 1001: BIOLOGY OF NON-CHORDATES 60 hrs

Unit 1: **15 hrs**

a) Non-chordata - classification with diagnostic features up to class level.

b) Origin of metazoa

c) Origin and Organization of Coelom: Acoelomates, pseudo coelomates and coelomates

Unit 2: **15 hrs**

a) Locomotion: Amoeboid, Flageller and Ciliary movement in protozoa. Hydrostatic movements in Coelenterata. Mollusca and Echinodermata

b) Nutrition and Digestion: Patterns of Feeding and digestion in lower Metazoa, Mollusca, Echinodermata, Filter feeding in polychaeta, Mollusca and Echinodermata

Unit 3: **15 hrs**

a) Respiration and Excretion: Organs of respiration: Gills, lungs and trachea. Respiratory pigments. Mechanism of respiration. Excretion in lower invertebrates. Excretion in higher invertebrates. Mechanism of Osmoregulation.

b) Nervous System: Primitive Nervous systems:-Coelentrata and Echinodermata. Advanced nervous system - Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda). Sense organs and their importance

Unit 4: **15 hrs**

a) Invertebrate larvae: Invertebrate larval forms and their evolutionary significance. Trematoda and Cestoda. Larval forms of Crustacea, Mollusca and Echinodermata.

b) Minor Phyla: Structure affinities and life history of the following minor Phyla-Rotifera, Entoprocta, Phoronida and Ectoprocta

Bibliography

1. Hyman, L.H. The invertebrates, Nol. Protozoa through Ctenophora, McGraw Hill Co., New York
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson & Sons Ltd., London.
3. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.
4. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.
5. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
6. Russel-Hunter, W.D. A biology of higher invertbrates, the Macmillan Co. Ltd., London.
7. Read, C.P. Animal Parasitism. Parasitism prentice Hall Inc., New Jersey.
8. Sedgwick, A.A. Student text book of Zoology. Vol. I,II & III. Central Book Depot, Allahabad.
9. Parker, T.J., Haswell W.A. Text book of Zoology, Macmillan Co., London.

PRACTICALS: **60 hrs**

1. **Protozoa:** *Trypanosoma, Plasmodium, Radiolaria, Balantidium, Monocystis, Noctiluca, Paramecium*

2. **Porifera:** *Leucosolenia, Euplectella* (Venus flower basket), *Hyalonema*

3. **Cnidaria:** *Hydra, Carrybdea* (Cubozoan medusa), *Tubipora*, Alcyonarian coral, *Physalia* (Portuguese man of war), *Pennaria, Velella, Porpita, Aurelia, Obelia*, Sea Anemone

4. **Platyhelminthes & Nemathelminthes:** *Microstomum, Gyrodactylus*, *Schistosoma haematobium* (Blood worm), *Echinococcus granulosus* (Dog tapeworm), *Ancylostoma duodenale* (Hook worm), *Trichinella spiralis* (Pin worm)

5. **Annelida:** *Nereis, Aphrodite, Tubifex, Placobdella, Hirudinaria* (Leech), *Arenicola, Sabella,*Earthworm, *Chaetopterus*

6. **Arthropoda:** Black widow spider, *Cyclops*, *Calanus*, *Lepas*, *Balanus* (Acorn barnacle), Centipede, Millipede, *Xiphosura limulus* (King crab)

7. **Mollusca:** *Neopalina*, *Cardium*, *Sepia, Loligo, Patella, Chiton, Dentalium, Murex xanchus*

8. **Echinodermata:** *Ophiothrix*, Sea urchin, Heart urchin, Starfish, Sea cucumber, Echinoderm larvae

9. **Dissections:** C**ockroach :**1) Digestive system

2) Reproductive system of male & female

3) Nervous system.

Mountings:

1) Gizzard
2) Compound Eye
3) Mouth parts

ZOO 1002: BIOCHEMISTRY AND IMMUNOLOGY 60 hrs

Unit 1: pH and Buffers: **15 hrs**

a) Properties of water, law of mass of action, pH, dissociation of water and its ion product

b) Buffers- formulation and significance of buffers, biological buffers.

Unit 2: Biomolecules and Metabolism: **15 hrs**

a) Carbohydrates: Classification, properties and significance. Derived sugars Metabolism of carbohydrates: Glycolysis, TCA cycle, HMP shunt and their energetic pathways. Glyoxylate cycle, uronic acid pathway. mitochondrial ATP synthesis.

Glycogen metabolism - Gluconeogenesis, Glycogenesis, Glycogenolysis, and regulation of glycogen metabolism.

b) Lipids: Classification, properties and significance, phospholipids, sphingolipids, glycolipids, steroids & Oxidation of fatty acids & energetic, ketogenesis & its implications

c) Proteins: Amino acids - Classification, properties and significance, Proteins- Classification, structure, properties and significance Transamination, deamination and decarboxylation.

Unit 3: Immunbiology: **15 hrs**

a) Introduction to immune system- organs, tissue and cells of immune system
b) Types of Immunity (Innate and Acquired)
c) Antigens, haptens physical chemical characteristics.

Unit 4: Immunoglobulin: **15 hrs**

a) Non-specific Host resistance and Chemical mediators
b) Antigen-antibody structure, isotypes and biological function interaction and
c) Immunodiagnostics, hypersensitivity- types of hypersensitivity and Autoimmune diseases- mechanism of auto immunity.

Bibliography

1. Harper HA. Review of Physiological Chemistry (Lange Publications) 1993
2. Lehninger Al, Nelson DL and Cox MM. Principles of Biochemistry (CBC Publishers) 1993
3. Rastogi SC. Biochemistry (Tata Mc GrawHill Publishing Co. Ltd.) 2003
4. Satyanarayana U. Biochemistry (Book Syndicate Pvt. Ltd) 2006
5. Stryer. Biochemistry (WH Freeman and Co. Pub.) 2008
6. Plummer DT. Practical Biochemistry (Tata Mc GrawHill Publishing Co. Ltd.) 1993
7. Varley H. Practical Clinical Biochemistry (CBS Publications) 1980
8. Roitt,I.M.1994. Essential Immunology. Blackwell Scientific, Oxford.
9. Richard A.Goldsby, Thomas T.Kindt and Barbara A. Osborne. 2000. Kuby Immunology.Freeman and Co., New York.

10. Stites,D.P.,Terr,A.I. and Parsloio,T.G. 1997.Medical Immunology. Prentice Hall, New Jersey.

11. Janeway,C.A and Travers,P. 1997.Immunobiology.Current Biology Ltd., London.

12. Paul,W.E.M.1989. Fundamentals of Immunobiology. Raven Press, New York.

13. Srivastava,R.,Ram,B.P. and Tyle,P.1991. Molecular Mechanism of Immune Regulation. VCH Publishers, New York.

14. Champion,M.D. and Cooke,A.1987.Advanced Immunology. J.B.Lippincott Ltd., Philadelphia.

15. Kannan,I.2007. Immunology. MJP Publishers, Chennai.

PRACTICALS: 60 hrs

1. Determination of isoelectric point of casein.
2. Quantitative method for estimation of total amino acids
3. Determination of urine creatinine content
4. Quantitative method for estimation of total proteins
5. To study various cell types from human body (Immune Cell).
6. Study of various slides: T.S. of Spleen, Thymus, Lymphnodes and bone.

ZOO 1003: CELL AND MOLECULAR BIOLOGY 60 hrs

Unit I: **15 hrs**

Molecular Architecture of Eukaryotic cell and their environment:

a) Biomemebranes – Composition, Structure, Fluid mosaic model b) Basic functions – Permiability, Osmotic principles, Carrier protein, Channel proteins, Passive transport, Active transport, Na+/K+ Pump, Pinocytosis, Phagocytosis.

Cells and their environment :

a) Cell- matrix adhesion – Collagen, Proteoglycan, Fibronectin, Laminins, Integrins, Extra cellular matrix b) Cell-cell adhesion - Cadherins, Desmosomes, Gap junction.

Unit II:

Molecular mechanisms of cell division and Special chromosomes: **15 hrs**

a) Ultrastructure and organization of – Centrosome, centromere and Kinetochore b)Microtubule and their dynamic instability c) Microtubule associated proteins, d)Metaphase and Anaphase movements e) Cytokinesis.

Special Chromosomes :

(a) Polytene chromosome- Structural organization and significance b) Lampbrush chromosomes- Structural organization and significance c) Supernumerary chromosomes

Sex determination: a) Sex chromosomes b) Chromosomal basis of sex determination.

Heterochromatin:a)Types and Function.

Unit III: **15 hrs**

Recombinant DNA Technology: a) Tools of Recombinant DNA Technology- Restriction enzymes, cloning vectors, Plasmids, Phages, Viruses b) Methods of Introduction - Tranformation, Transduction, Transfection, Electroporation, Biolistics, microinjection, liposome fusion b) Applications of Recombinant DNA Technology and Transgenic animals.

Unit IV: **15 hrs**

Molecular cytogenetic techniques: a) Banding – C, G, R and Fluorescence b)Autoradiography c) *Insitu* hybridization – FISH, Chromosome painting.

Bibliography

1. Alberts B., Bray D, Lewis J, Raff M, Roberts K and Watson JD.2001. Molecular Biology of the Cell. Garland publishing Inc. New York

2. Cooper GM.1997. The Cell: A Molecular Approach. Sinauer Associates. Inc

3. Daniel J, Lodisch H & BaltimoreD 2000. Molecular Cell Biology. Scientic American Books, Inc: USA

4. Glick BR and Paternak JJ. 1994. Molecular Biotechnology-Principles and applications of Recombinant DNA. ASM-Press: Washington DC

5. Lodish H, Berk A, Zipursky SL, Matsudaira P, Baltimore D and Darnell J. 2000. Molecular Cell Biology Freeman WH and Co. New York

PRACTICALS: 60 hrs

1. Vital staining of mitochondrial using buccal cell.
2. Preparation of salivary gland chromosomes of *Drosophila melanogaster*.
3. Study of Meiotic chromosomes- *Cockroach.*
4. Study of Barr body in human using buccal smear
5. Isolation of cellular DNA by using liver.
6. Demonstration of Agarose gel electrophoresis.

ZOO 1004: HISTOLOGY AND DEVELOPMENTALBIOLOGY 60 hrs

Unit 1: Tissue organization in Human **15 hrs**

a) Overview of Basic Tissue organization.

b) Digestive system.

c) Respiratory system.

Unit 2: System organization in Human **15 hrs**

a) Circulatory system.

b) Excretory system.

c) Reproductive system

d)Nervous system.

Unit 3: Early Development: **15 hrs**

a) Historical perspective of the science of embryology.

b) Spermatogenesis, Oogenesis, Fertilization.

c)Basic concepts of growth and differentiation.

d) Dynamic of gastrulation (Amphioxus, Amphibian, Birds, Mammals)

Unit 4: Organogenesis: **15 hrs**

a) Formation of organ rudiments.

b) Differentiation and development of heart and kidney in different mammals.

Bibliography

1. Balinsky, B.I.1981 An Introduction to Embryology. W.B Saunders Co., Philadelphia.

2. Karp,G. and Berrill,N.J.1981. Development. McGraw Hill, New York.

3. Saunders, J.W.1982. Developmental Biology. MacMillan Co., London.

4. Nagabhushanam,R. and Sarojini,R.2002 Invertebrate Embryology. Oxford and IBA Publishing Co. 56. Browder, W.1984.Developmental Physiology. Saunders College Publishing, Rinchert and Winston.

6. Gilbert, S.F.2003.Developmental Biology. Sinamer Associates Inc. Saunderland, Massachusets, U.S.A.

7. Oppenheimer, S.B.1980.Introduction to Embryonic Development. Allyn and Bacon,Inc. U.S.A.

PRACTICALS: **60 hrs**

1. Study of permanent slide of Human digestive system (T.S. of Oesophagus, Stomach cardiac, Stomach fundic, Stomach pyloric, Duodenum, Ileum, Jejunum, Colon, Rectum, Gall bladder, Pancreas, Liver).
2. Study of permanent slide Respiratory system and Circulatory system (T.S. of Trachea, Lung, Artery, Vein).
3. Study of permanent slide of Excretory system and Nervous system (T.S. of Kidney, Ureter, Urinary bladder, Urethra, Nerve and Brain stem).
4. Study of permanent slide of Reproductive system (T.S. of Ovary, Oviduct, Placenta, Uterus, Vagina, Penis, Testis).
5. Different stages in development - frog (gametes, cleavage, Blastula, Gastrula. Yolk plug stage, primary gem layer, neuration).
6. Development of chick stage - slide showing C.S. of heart, kidney lens and limb.

ZOO 2001: BIOLOGY OF CHORDATES 60 hrs

Unit 1: **15 hrs**

a) Principles of taxonomy

b) Nomenclature - Binomial, Trinomial nomenclature.

c) Zoological Nomenclature –ICZN

d) New trends in taxonomy

e) Prochordate phylogeny - systematic position of Prochordates

f) Origin of chordates

Unit 2: **15 hrs**

a) **Ostracoderms:** Silurian and Devonian Ostracoderms. Evolutionary position of the Ostracoderms.

b) **Placoderms:** Origin of Jaws- Placoderms as ancient "experiment" in the evolution of the jawed vertebrates. Structural peculiarities of Cyclostomata.

c) **Chondrichthyes:** Fossil history of chondrichthyes, tendencies in Elasmobranch evolution.

d) **Actinopterygii:** Origin and evolution, Adaptive radiation of bony fishes.

e) **Amphibia:** Origin and evolution of Amphibia

Unit 3: **15 hrs**

a) **Reptilia:** Evolution of Reptilia. Saurischian and Ornithischian Dinosaurs - Rhyncocephalia - Adaptive radiation of Reptiles.

b) **Aves:** Birds as glorified reptiles. Fossil history of birds. Palate in Birds. Adaptive radiation in birds.

c) **Mammal:** Evolution of Mammals, Structural peculiarities of Prototheria, Metatheria and Eutheria.

Unit 4: Comparative anatomy: **15 hrs**

a) Origin and evolution of the vertebrate integumentary system.

b) Paired fins and limbs

c) Heart and aortic arches

d) Respiratory organs

e) Urinogenital system

f) Brain and Nervous system

Bibliography

1. Waterman. A.J. 1971. Chordate Structure and Function. McMillan Co. London.

2. Jolie, M. 1968. Chordate Morphology. East West Press. Pvt, Ltd,

3. Romer, A.S. and Parson, T.S. 1978 Vertebrate Body. W.B. Saunders Co. Philaelphia.

4. Young, J.2.1969. Life of Vertebrates. Clarendon Press, Oxford.

5. Colbert, E.H. 1969. Evolution of Vertebrates. John Wiley and Sons Inc, New York.

6. Holstead. 1969 The Pattern of Vertebrate Evolution. Freeman and Co. San Francisco. U.S.A.

7. Hobart M. Smith,1960Evolution of Chordate Structure,Holt,Rinehart&Winston Inc. NewYork

8. Hyman L.H.1966 Comparative Vertebrate Anatomy. The University of ChicagoPress,Chicago

PRACTICALS: **60 hrs**

1. **Protochordata:** *Balanoglossus, Ascidia, Doliolum, Salpa, Oikopleura, Amphioxus.*

2. **Pisces:** *Carcharius (shark), Trygon, Clarias, Arius, Ostracion, Oreochromis, Channa, Hippocampus, Tetradon.*

3. Amphibia: ***Triton, Gegenophis, Amblystoma, Xenopus, Siren, Hyla, Ichthyophis*.**

4. **Reptilia:** *Chamaeleon, Phrynosoma, Varanus,* King cobra, Krait, Turtle, Crocodile, Skulls of turtle and crocodile.

5. Aves: **Skull and modifications in palate region – Desmognathous and Schizognathous type. eg. duck and pigeon.**

6. Mammalia: ***Loris*, bat, squirrel, *Platypus*, porcupine, *Pangolin*.**

7. Dissections: **Major Carp : 1) Digestive system 2) Urineogenital system**

ZOO 2002: ANIMAL PHYSIOLOGY 60 hrs

Unit 1: System Physiology: 15 hrs

a) Blood and body Fluids: Blood and its components, Heart cycle, Electrical Properties of the heart, ECG, Control of cardiac output. Vascular system, Regulation of arterial blood pressure.

b) Respiration: Gas exchange and mechanism of respiration in invertebrates and vertebrates oxygen curves and control of respiration.

c) Gastrointestinal system: Motility, secretion and absorption of nutrients, carbohydrate, protein and fat digestion. Role of dietary fiber in digestion. Nutritional disorders. Ruminant and non-ruminant digestive patterns, Endoparasitism.

Unit 2: Exercise Physiology: 15 hrs

a) Physiology of Exercise, Circulatory changes in muscular exercise, Blood pressure during exercise, Respiratory responses to exercise.

b) Types of exercise, Response of muscle to exercise Endocrine response to exercise. Fatigue- induced biochemical and physiological changes.

c) Role of Meditation, Yoga and their effects.

Unit 3:Hormones 15 hrs

a) Autocrine, paracrine and endocrine secretions - an overview of mammalian endocrine system. Hypothalamus- structure and functions, hypothalamo hyposhysial portal system, regulation of hypophysial secretions, Hypophysis

b) Morphology, synthesis and action of hormones of endocrine glands- thyroid, parathyroid, adrenal gland, pancreas and pineal glands, Pathophysiology- cretinism, cussing syndrome and Addison's disease.

Unit 4: Mechanism of hormone action: 15 hrs

Types of hormone receptors (membrane bound cytoplasmic and nuclear receptors) regulation of receptor number, signal transduction- secondary messengers, cyclic AMP, prostaglandin, Cadmodulin mediated pathways, genomic mechanism of hormone action- thyroid and steroid hormones, termination of hormone action.

Bibliography

1. Eckert, Marsall, Animal Physiology Mechanism and Adaptations, 2002
2. Eckert & Randall, Animal Physiology (CBS), 2nd Ed, 2000.
3. Ganong. Review of Medical Physiology (21st Ed.), Lang Medical Publications, 2003
4. Gordon M. Animal Physiology Macmillan & Co.; First edition (1972)
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6. Hill R.W Comparative Physiology of Animals) Sinauer Associates) Third edition
7. Hoar W.S., General and Comparative Physiology(Prentice – Hall)1983

8. Houssay, Human Physiology, McGraw Hill Books Company, Second edition

9. Hutchinson, Hunter and Bomford, Hutchinson's Clinical Methods, (Lippincott)

10. Chandra. S. Nagi : Introduction to Endocrinology PHI (New Delhi)

11. Degroot. L.J. and Neill, J.D. 2001: Endocrinology-IV Ed, Vol. I-III. W.B. Saunders company(Ed)

12. Gorbman and Beru .1962: A text book of Comparative Endocrinology

13. Highman and Hill 1972: Comparative Endocrinology of Invertebrates

14. Pickford G.E & Atz W.J.1957: The Physiology of Pituitary gland of fishes (Zoological Survey; NewDelhi)

PRACTICALS: 60 hrs

1. Study of blood pressure during rest and exercise
2. Visit to Yoga Centre / Demonstration by expert
3. Effect of exercise on breathing rate, pulse rate and blood lactate of man
4. Electrocardiogram and its interpretation
5. Permanent slides: Pituitary gland, thyroid gland, Pineal gland, Pancreas, Adrenal gland, Gonads.

ZOO 2003: ANIMAL BIOTECHNOLOGY AND BIOSTATICS 60 hrs

Unit 1 **15 hrs**

Animal cell culture: Equipment and materials for animal tissue culture technology, various systems of tissue culture, their distinguishing features, advantages and limitations.

Culture medium: natural and synthetic media, Cell and organ culture, Characteristics of cells in cultures.

Primary cultures Behaviour of cells, properties, explants culture and suspension cultures.

Unit 2 **15 hrs**

Genomic and organelle DNA isolation, polymerase chain reaction (PCR), Restriction, digestion and ligation; genomic and cDNA libraries; Vectors- Properties, cloning and expression , expression of cloned gene in E. Coli, Hybridoma technology.

Unit 3 **15 hrs**

Definition, Concept sand application of biostatistics in zoology. Measures of central location (tendency)-Mean, Median and Mode. Methods of sampling, sampling error, non sampling error, standard error Measure of variability - Range, Mean deviation, Variance, Standard Deviation and Coefficient of Variation.

Unit 4 **15 hrs**

Test of statistical significance- Chi square and T-test. Basic Probability concepts- addition of probabilities, Multiplication of probabilities, Distributions (Binomial, Poisson and Normal).Meaning of Correlation and Regression.

Bibliography

1. Tools and techniques of biotechnology. By Mousumi Debnath
2. Biostatistics by Jasra, P.K. and Gurdeep raaj, Krishna prakashan media (P),Ltd. Meerut
3. A text book of biochemistry P K Gupta, Rastogi publication
4. Animal cell biotechnology , Methods and protocols by Nigel Jenkins.
5. Biostatistics by P. Ramakrishnan

PRACTICALS: **60 hrs**

1. Animal tissue culture (sterilization, media preparation, culturing methods and dilution techniques). (*With the help of charts/ models/ videos/ photographs/ permanent slides/ working models/ visit to lab*).
2. Cell counting and cell viability.
3. Principal of single cell suspension.
4. To isolate cell organelles fraction by density gradient centrifugation method.
5. Western blotting: (*With the help of charts/ models/ videos/ photographs/ permanent slides/ working models/ visit to lab*).
6. Calculation of mean media and mode
7. Calculation of standard deviation and standard error

ZOO 2004: ANIMAL ECOLOGY AND ENVIRONMENTAL BIOLOGY 60 hrs

Unit 1: Introduction: **15 hrs**

Concepts, principles, scope, basic elements of ecosystems.

Population ecology: Structure, growth curves, concept of carrying capacity, Oscillation. Energy flow at population level; population interaction.

Community ecology: Structure, diversity, patterns in community, biotic community concept. Ecological dominance; Community analysis, Ecotone. Community production – primary and secondary production.

Unit 2: Applied ecology: **15 hrs**

Exobiology, space travel and life support system.

Conventional and Non-conventional energy resources – Wind, solar, bio-fuel and others. Nuclear Energy – Nuclear power plants. Ecological tourism.

Ecological model: Nature of ecological models; goals of model building; basic tools in model building. Approaches to development of models. Energy flow models.

Unit 3: Environment quality, its issues and sustainable development: **15 hrs**

Sources, causes and control of air, water, soil pollution with special reference to present scenario in India. Natural hazards (Earthquakes, cyclones and volcanoes); Tsunami; Soil erosion (degradation and fertility); Forest fires, mining and quarrying. Bioremediation of xenobiotics – principles and types (Phyto-, Zoo- and microbial - remediation).

Unit 4: Human health and hazards: **15 hrs**

Chemical and Biological hazards in developed and developing countries. Risk analysis – Scope, general aspects, communication and management. Occupational health hazards. Industrialization, urbanization and globalization

Bibliography

1. Boughey A S 1971 Fundamental Ecology (Intext Educational Pub.) Pp 222
3. Chenn P 1999 Ecology (John Murray Pub.) Pp 213
4. Collin R, Townsend, Harper J L, and Michael Begon 2000 Essentials of ecology. (Blackwell Sci. Comp.) pp 552
5. Dilip R 1998 Environment management with Indian experience (APH Pub. Cor.)
6. Krebs C J 1994 Ecology (Harper and Collins) pp 801
7. Mackenzie A, Ball A S and Virdee S R 2002 Ecology (Viva Books Pvt. Ltd.) P 339
8. Miller Jr and G T 2002 Living in the environment (Wardsworth, Brooks/Cole)
9. Mishra P C 1990 Fundamentals of Air and Water Pollution (Ashish Publishing House)
10. Odum E P 1971 Fundamentals of ecology (WB Saunders Co.) Pp 574
11. Paul W P 1948 Limnological Methods (The Blakistan Co.)
12. Raven P H, Berg L R, Johnson G B 1993 Environment (Saunders College Pub.) pp 569
13. Singh M C 2000 Environment Protection and the Law (Ashish Publishing House)

PRACTICALS: **60 hrs**

1. Estimation of chloride, sulphate in water samples.
2. Estimation of the B.O.D. and C.O.D. in water sample
3. Estimation of carbon-di-oxide (free CO_2) and oxygen(DO) in aquatic bodies.
4. Population ecology: Population growth of planktons and invertebrates.
5. Identification and observation of - a) Hospital waste (Solid waste) b) Pollution indicator species

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Course: M. Sc. Zoology

Syllabus for Semester III and Semester IV

(Credit Based Semester and Grading System with effect from the academic year 2022-23)

M.Sc. Zoology Syllabus Semester-III and Semester-IV

Credit Based and Grading System

To be implemented from the Academic year 2022-23

Z-3001: Cell Biology and Genetics(Theory) **(60 hrs.)**

Unit-1: **15hrs**

An overview ofCells,Plasma Membrane, Nucleus, Mitochondria and Peroxisomes,E.R. Lysosomes, Golgi body

Unit-2: **15hrs**

Cytoskeleton and Cell Movement, Cell Cycle, Cell Signaling, Cell Death Mechanisms, Protein Sorting and Transport

Unit-3: **15hrs**

Introduction to Genetics, Mendelian Genetics,Linkage and Crossing Over

Unit-4: **15hrs**

Chromosomal Mapping,Mutations,Sex Determination, Extrachromosomal Inheritance

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Z-3001: Cell Biology and Genetics (Practicals)

1. Study of typical animal cell and cellorganelles.

2. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.

3. Mendelian laws and gene interaction using Drosophilacrosses.

4. Study of Linkage, recombination, gene mapping using marker based datafrom Drosophila.

5. Study of Human Karyotype (normal andabnormal).

6. Pedigree analysis of some human inheritedtraits.

SUGGESTED REFERENCES:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition.John Wiley &Sons.Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006.Cell and Molecular Biology.8th edition. Lippincott Williams and Wilkins,Philadelphia.

3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition.ASM Press &Sunderland, Washington, D.C.; Sinauer Associates,MA.

4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009.The World of the Cell.7th edition.Pearson Benjamin Cummings Publishing, SanFrancisco.

5. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). VIII ed. Principles of Genetics.Wiley India.

6. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics.VEdition.John Wiley andSons Inc.

7. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics.XIEdition. BenjaminCummings.

8. Russell, P. J. (2009). iGenetics- A Molecular Approach. III Edition. BenjaminCummings.

9. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applicationsof recombinant DNA. ASM Press,Washington.

10. Pevsner, J. (2009). Bioinformatics and Functional Genomics.IIEdition.John Wiley &Sons.

11. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis. W. H. Freeman andCo.

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Z-3002: <u>Chronobiology and Animal Behaviour</u>(Theory) (60 hrs.)

Unit-1: 15hrs

Chronobiology, Biorhythms, Biological Clocks, Importance of biological clocks

Unit-2: 15 hrs

Introduction to Animal Behaviour, Patterns of Behaviour Social and Sexual Behaviour

Unit-3: 15hrs

Instinctive and learning behaviour, Fixed action pattern, Communication in honeybees (dance Language and pheromone), Elements of Sociobiology: Altruism and selfishness, Social organization in termites (including Eusociality, castes in termites)

Unit-4: 15hrs

Foraging: Optimal, foraging theory, Foraging and predation risk: defense strategies against predators, Territoriality and Group foraging

Aggression:

Aggressive behavior, Game theory models and strategies

Sensory system and Communication:

Signal content and structure, Orientation and cues

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Z-3002: Chronobiology andAnimalBehaviour (Practicals)

1. To study circadian rhythms in humans (Eating, Sleep, Temperaturepattern).
2. To study Nest and Nesting behavior in Birds and Socialinsects.
3. To study the phototaxicbehaviour in insectlarvae.
4. Visit to a National Park/ Wildlife Sanctuary/ Biodiversity Park etc. in order to study biological clocks and behaviour ofanimals.

References:

1. John Alcock, Animal Behaviour, Sinauer Associate Inc.,USA.
2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour,Cambridge, University Press.UK.
3. David McFarland, Animal Behaviour, Pitman Publishing Limited, London,UK.
4. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.)R.D. Lewis.(3rd Ed.) Barens and Nobel Inc. New York,USA.
5. The Clock that times us. 1982. Moore Ed etal.
6. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springe-Verlag,Germany.

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Z-3003:Project/Dissertation) (60 hrs.)

The learning objective of the paper will enrich the students with basic principle of research methodology which help the students to learn essential steps involved in research.

- Project work should be done individually on any topic of importance related to the subject.
- Project may be done in-house or at a recognized institution outside the campusas specified in theguidelines.
- The concerned candidates have to submit their Project/Dissertation in a standard Hard- Bound thesisformat.
- The Thesis will be evaluated by an external examiner.
- The Project/Dissertation must be presented in a Power-Point Presentation by the concerned candidates within 15 minutes during their Dissertation Viva.
- The students are supposed to attend the Industrial Workshops/Laboratory Workshops/ Training Programme/Symposia/Seminar/State or National Conference/ Field visit/Educational Excursion organized by the department/college or organized by the other University/college.
- Make a report on at least 5 papers presented by expert in Symposia/Seminar/State or National Conference related to your topic.

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Z-3004: Review Article (60 hrs.)

1. Students will be individually allotted **10** research papers forreview.
2. The selected paper should be from a reputed peer reviewed journal havingISSN.
3. Selected Research paper should have been published during the last fiveyears.
4. The research paper should not exceed 15 pages includingreferences.
5. Students have to answer the questionnaire as per the attached format andsubmit it to the department.

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Z-4001: Human AnatomyandParasitology (Theory)(60 hrs.)

Unit-1: 15hrs

Structure and functions ofdifferent organs of Digestive system,Respiratorysystemand Circulatory system

Unit-2: 15 hrs

Structure and functions of different organs of Excretory system, Nervous systemand Reproductive system

Unit-3: 15hrs

Introduction to Parasitology, Host –Parasite Interaction,

Epidemiology of Infectious Diseases: Its pathogenicity, symptoms, control and treatment (H_1N_1, HIV, Zika, Polio, Chikungunya)

Unit-4: 15hrs

Study of life cycle of Hookworm (Ancylostomaduodenale), Entamoebahistolytica, Pediculushumanus.Study of mouth parts of Culex, Anopheles, Aedesaegypti.

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Z-4001: Human Anatomy and Parasitology(Practicals)

The following Practicals to be taught/studied through permanent slides/photomicrographs/specimens / charts /models etc.

1. Study of human Digestive system and Respiratorysystem
2. Study of human Circulatory system and Excretorysystem
3. Study of human Nervous system and Reproductivesystem
4. Study of Measles, HIV, Zika, Polio, Chikungunya viruses andsymptoms
5. Study of life cycle of Hookworm (Ancylostomaduodenale), Entamoeba histolytica, Pediculushumanus
6. Study of mouth parts of Culex, Anopheles, Aedesaegypti**,**Pediculus.

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SUGGESTED REFERENCES:

1. Park, K. (2007) Preventive and social medicine. XVI Edition. B.BPublisher.

2. Arora, D.R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributers.

3. Chaudhury, S.K. (1996) Practice of fertility Control, A Comprehensive Textbook. B.I.Churchill Livingston Pvt Ltd,India.

4. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea &FabigerPublisher.

5. Hafez, E. S. E. and Evans, T. N. (1973). Human Reproduction: Contraception and Conception. Harper and Row, NewYork.

6. Atwal, A. S. (1993) Agricultural Pests of India and South East Asia. Kalyani Publishers, New Delhi.

7. Pradhan, S (1983) Insect Pests of Crops. National Book Trust,India.

8. Prost, P.J. (1962) Apiculture. Oxford and IBH, New Delhi.

9. Knobil, E. & Neill, J.D. (2006) The Physiology of Reproduction, Vol. 2, ElsevierPub.

10. Srivastava, C.B.L. (1999) Fishery Science and Indian Fisheries. KitabMahal publications, India.

11. Dunham R.A. (2004) Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications,U.K.

12.. Berry A. K. (2012) A Text Book of Animal Physiology. XI th ed. Reprinted. EmkayPublication , Delhi-110051.

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Z-4002: Applied andEconomic Zoology (Theory)(60 hrs.)

Unit-1: 15hrs

Poultry Breeding: Habitat of fowl, food and feeding of fowl, Breeds of fowl, Breeding in fowls, Eggs and hatching, Rearing of chickens,Diseases of Poultry, Poultry Products

Unit-2: 15 hrs

Aquaculture :Scope,history and present status.different systems of Aquaculture,Cultivable fish species,Planning, layout and construction of fish farm,other culture practices

Unit-3: 15 hrs

Dairy Farming:Indian and Exotic Breeds of cow sand buffaloes, Breeding, Feeding Stuffs, Feeding of Young Stock, Diseases, Milk, Milk Products,

Unit-4: 15 hrs

Apiculture: Types and cast of Honey Bee, Social Organization of Honey Bee, life history Honey Bee, structure of bee hive, flora of Apiculture, Methods of bee keeping,Products of bee keeping, bee enemies(predators),diseases of Honey Bee

Z-4002: <u>Applied and Economic Zoology</u>(Practicals)

1. Study ofPoultry Diseases: Ranikhet,Fowl pox, Tick fever, Tuberculosis, Fowl cholera, Avian leucosis, Infectious coryza, Rickets, Nutritional Roup ,Crop bound,Featherpicking,Perosis,Coccidiosis,Roundworm.StudyofBreeds of fowl
2. Study oftypes ofCultivable fishspecies.
3. Study of species of cow and buffalo in Cows and Buffaloes
4. Study ofDiseases of Honey Bee: American foulbrood disease, chlkbrood, sacbrood, nosema
5. Visit to poultry farm/ animal breeding centre/.fish farm/honey bee keeping. Submission of visit report
6. Maintenance of fresh water aquarium.

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SUGGESTED REFERENCES:

1. Park, K. (2007) Preventive and social medicine. XVI Edition. B.BPublisher.

2. Gupta S.K.,Gupta P.C.(2006) Genera and AppiedIchthyology.

3. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea &FabigerPublisher.

4. Tomar B.S. (2011) Introduction To Economic Zoology. Emkay Publications, Delhi-110051.

5. Jawaid Ahsan,(1985) A Handbook on Economic Zoology,S.Chand& Company Ltd.,New Delhi

6. Pradhan, S (1983) Insect Pests of Crops. National Book Trust,India.

7. Prost, P.J. (1962) Apiculture. Oxford and IBH, NewDelhi.

8. Srivastava, C.B.L. (1999) Fishery Science and Indian Fisheries. KitabMahal publications, India.

9. Dunham R.A. (2004) Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications,U.K.

10.Barbara R.L.,Scott,Foreman& Company:Engaland,1972.Essential human anatomy and Physiology

11. G.J.Tortara,John Wiley & sons,(2003),New York,Atlas of HumanAnatomy/Skeleton

12,G.J.Tortara Wiley India. Private Ltd.,NewDelhi.Anatomy andPhysiology

13. K.D.Chatterjee,K.D CBS Publishers & Distributors, Private Ltd.,New Delhi. Parasitology, Protozoology and Helminthology

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Z-4003:Project/Dissertation ……continue (sem-3003)(60 hrs.)

The learning objective of the paper will enrich the students with basic principle of research methodology which help the students to learn essential steps involved in research.

*Project work should be done individually on any topic of importance related to the subject.

* Project may be done in-house or at a recognized institution outside the campusas specified in theguidelines.

* The concerned candidates have to submit their Project/Dissertation in a standard Hard-Bound thesisformat.

*The Thesis will be evaluated by an external examiner.

*The Project/Dissertation must be presented in a Power-Point Presentation by the concerned candidates within 15 minutes during their Dissertation Viva

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Z-4004:Seminar Presentation)(60 hrs.)

1. Students shall attend a seminar/webinar/conference/work shop/symposium and produce a certificate. A report in this regard submitted.

2. Students have to individually deliver a seminar on the advance or novel topic other than that mentioned in the curriculum.

3. Topic should not be related to his/her dissertation.

4. Maximum number of presentation slide should not exceed **25.**

5. A topic should be explained within 12 minutes, followed by counter questions from the examiners for 3minutes.

6. Students have to submit one copy of colour printed handouts (4 slides /page) of his/her presentation to the examiner.

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QUESTIONNAIRE FOR REVIEW OF PAPER

INTRODUCTION

1. Is the information provided in the „Introduction‟ section helps to understand the problem?

2. State the reasons for performing this study.

3. Define the objectives/hypothesis of theresearch.

METHODS

4. Can you suggest other samples, if applicable, that can be taken for the prescribe study to get the similar results?

5. Find other methods, if applicable, that can be appropriately used to fulfill the aim of the study.

6. Have you understood the rationale for the selection of technique(s) /method(s) in the given study?

7. Can you suggest alternate technique(s) /method(s), if applicable, that can be use to perform same analysis with its pros and cons?

8. Has sufficient information been provided to carry out the experiment? Do you think of any further information?

9. Can you think of additional experiments for thispaper?

RESULTS AND DISCUSSION

10. Is all the essential data represented in form of figures and tables?

11. Is there any duplication/repetition of work in the form of tables or graphs?

12. What are the limitations of the study carried out?

GUIDELINES AND RULES FOR DISSERTATION

Standard Format / Style of Submission of Manuscripts

Submission of all manuscripts/thesis should be in a single MS Word file strictly adhering to the following parameters:

1.Thesisis to be printed in Times New Roman typing.

2.Font size to be kept 12.

3. Line Spacing should be 1.5 4. Thesis should contain:

a) Title page with the name(s) of the candidate, their Examination Seat Number, Name of the supervising teacher and the Name of the institute.

b) Authentication certificate of the institute.

c) Declaration

d) Acknowledgement.

e) Chapter wise Index with Sub-heads and page numbers.

f) Introduction (Maximum 05 Page).

g) Review of Literature. (Maximum 15 Page)

h) Aim & Objectives

i) Materials and Methods.

j) Results and Discussion.

k) Conclusion

l) Future line of investigation

m) Appendix

n) References. 5. All tables, charts, images should be at their appropriate places.

Figures & Tables: Each figure/table Should be numbered, titled. The position of figure or table should be placed at an appropriate place within the article only.

Project may be carried out in-house, or the student, after due sanction from the supervising teacher and institute, can opt for pursuing dissertation at following recognized institutions or industries like:

1. Any UGC recognized University PG departments.

2. Any Agriculture University.

3. All National and State level research institute.

4. ISO or FDA/USFDA industry or research center having R & D and Q.C.facilities.

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