

**BHARATHIAR UNIVERSITY: COIMBATORE – 641 046****SCHOOL OF DISTANCE EDUCATION****M. Sc. ZOOLOGY (ANNUAL PATTERN)****(For the students admitted during the academic year 2009-2010 batch and onwards)****Duration of the course: 2 years****Eligibility Condition:**

B.Sc. Zoology  
 B.Sc. Advanced Zoology  
 B.Sc. Applied Zoology  
 B.Sc. Animal Science and Biotechnology  
 B.Sc. Advanced Zoology and Biotechnology  
 B.Sc. Life Sciences

**SCHEME OF THE COURSE**

<b>Sub. Code</b>	<b>Subject</b>		<b>Marks</b>
13A	<b>Paper – I</b>	Invertebrate and Vertebrate Biology	100
13B	<b>Paper – II</b>	Cell Biology and Genetics	100
13C	<b>Paper – III</b>	Economic Zoology	100
13D	<b>Paper – IV</b>	Biochemistry and Biophysics	100
13E	<b>Paper – V</b>	Environmental Science and Biodiversity Conservation	100
13P	<b>Practical</b>	Invertebrate and Vertebrate Biology, Cell Biology and Genetics, Biochemistry and Biophysics and Environmental Science and Biodiversity	100
23A	<b>Paper – VI</b>	Animal Physiology and Endocrinology	100
23B	<b>Paper - VII</b>	Microbiology and Immunology	100
23C	<b>Paper - VIII</b>	Evolution and Phylogeny	100
23D	<b>Paper - IX</b>	Developmental Biology and Human Welfare	100
23E	<b>Paper - X</b>	Biotechnology and Bioinformatics	100
23P	<b>Practical</b>	Animal Physiology and Endocrinology, Microbiology and Immunology, Evolution and Phylogeny, Developmental Biology and Human Welfare and Biotechnology and Bioinformatics	100
<b>Total Marks</b>			<b>1200</b>

## **PAPER – I – 13A INVERTEBRATE AND VERTEBRATE BIOLOGY**

### **Unit - I**

Introduction to Animal Classification upto order level with examples. Salient features and type study for Protozoa (Amoeba), Porifera (Sponges) and Annelida (earthworm), Arthropoda (Insects and mites).

### **Unit - II**

Type study for Mollusca (Bivalves) - Oyster Culture and its importance, Echinodermata (Star fish and Sea anemone)- Larval forms and their significance.

### **Unit - III**

Connecting Link between: annelids and arthropods (*Peripatus*), Annelida and Mollusca (*Neopilina*) amphibians and reptiles (*Seymouria*), reptiles and Birds (*Archaeopteryx*), bony fishes and amphibians (*Protopterus*), reptilia and mammalian (*Ornithorhynchus*).

### **Unit - IV**

Salient features and type study for Protocordata, Hemichordata, Urochordata and Cephalochordata. Biological significance of Migratory animals (Fishes, Birds and Mammals).

### **Unit - V**

Adaptive radiations in chordates: Aquatic-terrestrial and arboreal.

### **References**

Ayyar, E.K. and T.N. Ananthakrishnan, 2000. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras.

Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7<sup>th</sup> Edition, Times Merror/Mosby College Publication. St. Louis.

Jordan, E.K. and P.S. Verma, 20055. Chordate Zoology and Elements of Animal Physiology, 10<sup>th</sup> edition, S. Chand & Co Ltd., Ram Nagar, New Delhi.

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## **PAPER – II – 13B**

## **CELL BIOLOGY AND GENETICS**

### **Unit – I**

Prokaryotic and eukaryotic cells. Plasma membrane: Fluid mosaic model. Transport across cell membrane: passive and active transport. Nucleus: ultra structure and Function. Cell division: mitosis and meiosis.

### **Unit - II**

Ultra structure, types and special functions of RER, SER **Golgi complex, Mitochondria and Lysosome.**

### **Unit - III**

**DNA** - Watson and Crick model of double helix, different forms of double helix – A, B & Z forms. **DNA replication**: types, enzymology and mechanism of semi-conservative mode of replication. **RNA** structure and functions of rRNA, tRNA, and mRNA.

### **Unit - IV**

**Transcription of prokaryotic and eukaryotic genes**, post transcriptional modifications of mRNA. **Protein synthesis**: the **genetic code**. Steps in protein synthesis: initiation, elongation, termination and polysomes formation. Post translational modifications.

### **Unit - V**

**Mutations** – spontaneous and induced mutation, **Mutagenesis** by nitrous acid, hydroxylamine and intercalators. **DNA damage** and **DNA repair mechanisms**.

### **Reference Books**

1. De Robertis, E.D.P. and De Robertis, E.M.F., 2001, Cell and Molecular Biology, Lippincott Williams and Wilkins, USA.
2. Gupta, P.K., 1999, Cell and Molecular Biology, Rastogi Publications, Meerut.
3. Pavlella. P., 1998, Introduction to Molecular Biology, McGraw-Hill Companies Inc., New York.
4. Roy, S.C and De, K.K, 2001, Cell Biology, New Central Book Agency, Calcutta

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## **PAPER – III – 13C**

## **ECONOMIC ZOOLOGY**

### **Unit – I**

Beneficial and harmful insects, including insect vectors of human diseases. Pests of sugar cane (*Pyrilla perpusilla*), oil seed (*Achaea janata*) and rice (*Sitophilus oryzae*).

### **Unit – II**

Industrial fish, prawn and molluscs of India. Apiculture, sericulture, lac culture, carp culture, pearl culture, prawn culture.

### **Unit – III**

Non-poisonous and poisonous snakes of India. Venomous animals—centipede, wasp, honey bee.

### **Unit – IV**

Diseases caused by aberrant chromosomes/genes in man; genetic counselling; DNA as a tool for forensic investigation.

### Unit – V

Major infectious and communicable diseases (small pox, plague, malaria, tuberculosis, cholera and AIDS) their vectors, pathogens and prevention. Cattle and livestock diseases, their pathogens (helminths) and vectors (ticks, mites, Tabanus, Stomoxys).

### Reference Books

1. Ayyar, E.K. and T.N. Ananthakrishnan, 2000. Manual of Zoology Vol. I & II (Non – Chordata and Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras.
2. Economic Zoology by Upadhyay and Shukla, Rastogi Publication (2008 ed.).
3. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications (2000), Meerut.

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## PAPER – IV – 13D

## BIOCHEMISTRY AND BIOPHYSICS

### Unit - I

**Amino Acids:** Structure, Classification of amino acids and properties. **Proteins:** Classification of Proteins based on the chemical structure, properties

### Unit - II

**Carbohydrates:** Structure, classification and properties of functional groups. **Lipids:** Classification, properties – Saturated and unsaturated fatty acids – Cholesterol.

### Unit - III

**Enzymes:** Classification, properties of enzymes, Mode of enzyme action, enzyme substrate compounds. **Nucleic acids:** DNA structure and properties, DNA synthesis- Mechanism of replication- nucleotides – Different types of RNA – mRNA and rRNA, tRNA.

### Unit -IV

Principle and application of Chromatography (Paper, thin-layer, column and GLC), Centrifugation (RPM and G, Ultra centrifugation), Spectroscopic techniques (UV, visible spectroscopy, X-ray crystallography, NMR, IR, fluorescence & atomic absorption),

### Unit -V

**Biomedical Instrumentation:** Electrophoresis – Principle, Instrumentation, Applications ; PCR Technique; Applications. Isotopes and their importance (GM counters & Scintillation counting).

### REFERENCES:

1. Biochemistry, by D.Voet and J.G. Voet. John Wiley & Sons., USA.
2. Biochemistry, by R.H. Garrett and C.M. Grisham, Saunders College Publishers. 1998
3. Principles of Biochemistry by A.L. Lehninger (1984). CBS Publishers and Distributors, New Delhi.
4. Physical Biochemistry (1993) by D. Friefelder, W.H. Freeman & Company.
5. The Physical Basis of Biochemistry, by Peter R. Bergethon, Springer-Verlag, 1998.
6. Biophysics-An Introduction, by C. Sybesma, 1989, Kluwer Academic Publisher.

7. Cellular Biophysics I and II, by Thomas F. Weiss, 1995, MIT press.
8. Basic Biophysics for Biology, by E. K. Yeagers, 1992, CRC press.
9. Principles of Biochemistry (1996) by Albert L. Lehninger CBS Publishers & Distributors.
10. Biochemistry by Lubert stryer Freeman International Edition (1989).
11. Biochemistry (1997) by Keshav Trehan Wiley Eastern Publications.
12. Fundamentals of Biochemistry (2001) by J.L.Jain S.Chand and Company.
13. The Biochemistry of Nucleic acid – Tenth Edition-Roger L.P.Adams, John T. Knowler and David P.Leader, Chapman and Hall Publications (1998).
14. Tools of Biochemistry – T.G. Cooper (1996).
15. Practical Physiological Chemistry – Hawk (2003).
16. Biomolecules (2002) – S. Banerjee. Dominant Publishers and distributors, N. Delhi.
17. Textbook of Biochemistry, 1995 - Amita Saxena. Discovery Publishing House, N. Delhi.
18. Biochemistry. S. C. Rastogi, 2<sup>nd</sup> edition (2007). Tata McGraw Hill Publishing Company Ltd., N. Delhi.
19. Clinical Biochemistry (1999). S. Nagini, SciTech Publishing, Chennai-87.
20. Biochemistry. Fifth Edition (1997) – Jermy M. Berg, John L. Tymoczko, Lubert Stryer, Intl. Edition. W.H. Freeman and Co., New York.

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## **PAPER – V – 13E**

## **ENVIRONMENTAL SCIENCE AND BIODIVERSITY CONSERVATION**

### **Unit - I**

Understanding our Environment- Brief History of Conservation and Environmentalism- Human Dimensions of Environmental Science.

### **Unit - II**

Environmental Systems: Connections, Cycles, Flows and Feedback loops- Elements of life-Energy- Energy for life- From Species to Ecosystems- Biogeochemical cycles and life processes.

### **Unit - III**

Species populations, Interactions and Communities- How species diversity arises-Species interactions shape communities of species – The growth of Species populations-Properties of communities depend on species diversity – Human populations- past and present populations growth –factors determine populations growth.

### **Unit - IV**

Biomes and Biodiversity – Terrestrial Biomes- Marine ecosystems- Freshwater ecosystems- Biodiversity- Benefits of biodiversity- Threats to Biodiversity- Preserve Biodiversity- Endangered species management and biodiversity protection.

### **Unit - V**

Environmental conservation- World forests and Grasslands - Grasslands - Ecosystem preservation- World parks and preserves – Wilderness areas- Wildlife refuges.

Reference:

1. Agarwal. K. C. Biodiversity (1996). Agro Botanical Publishers (India).N. Delhi
2. Ranga M.M. (2005). Wildlife: Management and Conservation. Agrobios ( India), Jodhpur - 342 002.
3. Saha, T. K. (2008). Ecology and Environmental Biology. Books and Allied (P) Ltd.,
4. William P. Cunningham and Mary Ann Cunningham (2007). Principles of Environmental Science – Inquiry and Applications. 4<sup>th</sup> Edition, Tata McGraw-Hill Publishing Company Ltd., N. Delhi.\*

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**PRACTICAL – 13P INVERTEBRATE AND VERTEBRATE BIOLOGY,  
CELL BIOLOGY AND GENETICS,  
BIOCHEMISTRY AND BIOPHYSICS  
ENVIRONMENTAL SCIENCE AND BIODIVERSITY**

**INVERTEBRATE AND VERTEBRATE BIOLOGY:**

**Spotters:**

1. **Classify giving reasons:** Paramecium, any coral, obelia Leech, Ascaris, chiton, Sea cucumber, Balanoglossus, Teleost fish, Non-Poisonous snake / Poisonous snake, king fisher, bat.
2. **Draw labeled sketches:** T.S. of Ascaris, T.S. of Nereis T.S. of Planaria and T.S Thro Pharynx of amphioxus skull of frog.
3. **Biological significance:** Gemmules in sponges, Physalia, Limulus, Hippo campus, Chameleon, Axolotyl larva, Nautilus.
4. **Relate structure and function:** Spicules of sponges, Scolex of tapeworm, Nereis Parapodium, carapace and plastron, Placoid scales, Quill feather, Electric organ – Narcine.
5. **Write descriptive notes.**  
Larval forms of Echinodermata (Bipinnaria and Auricularia), Lepas/Balanus, Larvae of crustacean – Nauplius & Zoea – Draco, Cobra / Krait, Limb Skeleton of Bird, Bat.

**CELL BIOLOGY AND GENETICS:**

1. Blood Grouping in Man
2. Study of Phenotypic characters of Drosophila
3. Onion root tip squash preparation – Study of Mitosis

**BIOCHEMISTRY:**

1. Detection of carbohydrates, proteins, lipids.
2. Determination of Glucose content of a given sample. (Calorimeter method).

**ENVIRONMENTAL SCIENCE AND BIODIVERSITY CONSERVATION:**

1. Estimation of dissolved oxygen of river, pond, sewage and industrial effluent
2. Estimation of salinity & PH and its relation to temperature
3. Estimation of free Carbon-di-oxide, Carbonates and Bicarbonates of water samples
4. Field Techniques.
5. Identification and use of keys – Reference specimen.
6. IUCN Red List Exercise and PVA modeling.
7. Technical writing and reporting of field studies.
8. Public presentation.

**Record of the work done in laboratory must be submitted.**

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**PAPER – VI – 23A ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY**

This study helps in understanding how the body functions adapts with respect to its external and internal environment, related to nervous integration, sensation, metabolism and reproduction.

**Unit –I**

**Nutrition:** Nutritive requirements – General. Organization of alimentary canal – Role of salivary glands, liver, pancreas and intestinal glands in digestion.

**Unit – II**

**Digestion and Excretion:** Absorption of digested food-hormonal control of digestion - Introduction to intermediate metabolism –Structure of mammalian kidney – Urine formation – acid base regulatory mechanisms; endocrine regulation of water and mineral balance.

**Unit – III**

**Circulation, Respiration and Reproduction:** Composition of blood, blood groups in man, coagulation – Structure of mammalian heart, open and closed system of circulation, blood pressure and its regulation. Functional morphology of reproductive organs, reproductive cycles – Pheromones.

**Unit – IV**

Nature, function and classification of hormones – Feedback control of hormone secretion – Organisation and functions of neuroendocrine systems.

**Unit – V**

Role of hormones in sex accessory gland growth and functions. Thyroid gland – Structure, function and biosynthesis of thyroid hormone

**REFERENCE BOOKS**

1. **Ganong, H**, Review of Medical Physiology, 1989. 14th edition, *Appleton & Lange publisher*, New York

2. **Fleur, and Strand, (1978).** Physiology: A regulatory system approach, *Macmillan Publishing Company, New York; Collier Macmillan Publishers, London.*
3. **Shier, D., Butler, J. and Lewis, R., Hole's, 2003.** Human Anatomy and Physiology, (10<sup>th</sup> edition) *WCB/McGraw Hill, Boston.* 2003.
4. **EcKert, R and W.H. Freeman. 2002.** Animal Physiology, (5th edition).
5. **Williams S. Hoar (1991)** General and Comparative Physiology 3rd edition. *Prentice Hall of India- New Delhi.*
6. **Neilson, K.S., 1997.** Animal Physiology, *Cambridge University Press, Pergamon Press, Oxford.*
7. **Knut Schmidt – Nielsen, 2005,** Animal Physiology, 5<sup>th</sup> Edition, *Cambridge University Press.*
8. **Barrington, E.J.W. (1975):** An Introduction to General & Comparative endocrinology 2<sup>nd</sup> ed., *Clarendon press, Oxford.*
9. **Williams, R H. 1981.** Text book of Endocrinology, Ed. 6th W. B. Saunders Company, Philadelphia, London.
10. **De Groot. 1979.** Endocrinology, Vol. 1-3, Grune and Stratton, New York.
11. **Astwood, E. B. 1968.** Clinical Endocrinology, Grune and Stratton, New York.
12. **Bondy P.K. and Rosenberg L.E. 1974.** Duncan's disease of Metabolism – Genetics, Metabolism and Endocrinology. W. B. Saunders Co., Philadelphia, London.

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## PAPER – VII – 23B      MICROBIOLOGY AND IMMUNOLOGY

### Unit – I

Introduction to Microbiology – Scope of microbiology – History of microbiology – Classification of bacteria, fungi, yeast and virus. Structure and functions of bacteria and virus.

### Unit – II

**Food Microbiology:** Sources, types incidence of microorganism in vegetables, meats, poultry, seafood, milk and diary products – spoilage of food, fruits, vegetables, cereals, meat, poultry egg, seafood, caned products – principles of food preservation and prevention of food spoilage – Food poisoning organism.

### Unit – III

**Outlines of Immunology:** Basics of Immunity – Types of Immunity - Structure and Types of Immune system - Lymphoid organs.

### Unit - IV

**Immunological disorders:** Immunodeficiency diseases – Transplantation immunology – Types of graft - Mechanism of allograft rejection.

### Unit – V

**Immunotechnology:** Active immunization - Passive immunization – Principles and Methods of vaccine preparation – Immunological techniques – RIA and ELISA.



**Reference Books:**

1. **Burden, K.L. and R.P. Williams (6th Ed.) 1968.** Microbiology. The *Macmillan Co.*, London P. 818.
2. **Dawes, E.A. (Ed.) 1986.** Energy conservation in bacterial photosynthesis. *In: Microbial energetics. Blackie & Son Ltd.*, Glasgon, 133-144pp.
3. **Doelle, H.W. (Ed.) 1969.** Fermentation acetic acid bacteria and lactic acid bacteria. *In: Bacterial metabolism. Academic Press.* New York, London. 256 – 351 pp.
4. **Hay, J.M. (Ed.) 1986.** Modern Food Microbiology. *CBS publishers*, Delhi. 622 pp.
5. **Reed, G. (4th Ed.) 1983.** Prescott & Dunn's Industrial Microbiology. AVI Publishing Co.,Inc. Connecticut, 883. pp.
6. **Roberts, T.A. and F.A. Skinner (Eds.) 1983.** Food Microbiology: Advances and Prospects, *Academic Press*, Inc. London, 393 pp.
7. **Selle, A.J. (Ed.) 1967.** Fundamental Principles of Bacteriology. *Tata McGra – Hill Publishing Company Ltd.*, New Delhi, 822 pp.
8. **Immunology, S.K. Gupta (1999).** *Narosa Publishing House*, New Delhi.
9. Essential Immunology (8th Edition), **Ivan Roitt, 1994.** *Blackwell Scientific publication.* Immunology W.H. Freeman and Company.
10. **Weir, D.M. and Stewart, J., 1997,** Immunology, 8th Edn., *Churchill Livingston*, NY.
11. Immunology, **George Pinchuk (2004).** *Tata McGraw-Hill Publishing Company Limited*, New Delhi.

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**PAPER – VIII – 23C      EVOLUTION AND PHYLOGENY****Unit – I:**

Geological time scales, fossils and fossilization, fossil histories of Invertebrates and Vertebrates, origin of protozoa, metazoa, bilateria, metamerism, symmetry, skeleton and coelom.

**Unit – II:**

Neo-Lamarckism; Neo-Darwinism, micro, macro and mega evolution - isolation and isolating mechanisms – race formation; selection natural, artificial and sexual.

**Unit – III:**

Trends in Evolution channelisation of selection – mechanism of evolution. Adaptations and Co-adaptations; adaptive radiations and non-adaptive characters in biology. Ecological polymorphism, mimicry and animal colorations.

**Unit – IV:**

**Protist Animals:** Protozoa – Colonial protozoan and theories on the origin of metazoans - porifera – Canal system – Polymorphism in siphonophora – Annelida – Adaptive radiation in polychaets. Affinities of trilobites –Crustacean larvae and their significance.

**Unit – V:**

**Salient Features:** Mollusca – Modifications of foot – Echinodermata – Larval forms and their significance. **Characteristic features and affinities:** Protochordata – Hemichordata – Urochordata – Cephalochordata – Origin of amphibia – Reptiles – Mammals.

**Recommended Readings:**

1. Glaessner, M.F: Pre Cambrian fossils, 1965. *Biol. Rev.* 37: 467-494.
2. Stahl, V: Vertebrate History: Problems in Evolution, 1985. **McGraw - Hill**, New Delhi.
3. Stokes, W.L: Essentials of Earth History: An Introduction to Historical Geology, 1960. *Prentice Hall Ltd.*
4. Colbert, E.H: Evolution of Vertebrates, 1970. *John Willey and Sons, Inc.* New York.
5. Levtrup: Phylogeny of Vertebrate, 1984. *John Willey and Sons, Inc.* New York.
6. Smith: Evolution of Vertebrate structure, 1953. *John Willey and Sons, Inc.* New York.
7. Carter, G.S: Animal Evolution, 1951. *Sedgwick and Jackson*, London, England
8. Mayer, S: Systematic and origin of species, 1942. *University Press*, Columbia.
9. Sobrig and Sobrig: Population Biology and Evolution, 1981. *Addison Wiley*.
10. Barnes: Invertebrate Zoology. *Holt-Saunders International*, 4th edition, 1980.
11. Barnes: The Invertebrates – A synthesis, 3rd edition, *Blackwell*, 2001.
12. Hunter: Life of Invertebrates, *Collier Macmillan Pub.* 19790.
13. Marshall: Parker & Haswell Text Book of Zoology, Vol. I, 7th edition, *Macmillan*, 1972.
14. Moore: An Introduction to the Invertebrates. *Cambridge University Press*, 2001.
15. Boolootian, R.A. and Stiles, K.A., College Zoology, 10th edition, *Macmillan publishing Co.,Inc*, NY,
16. Colbert, E.H., Morales, M. and Minkoff, E.C. Colbert's Evolution of the Vertebrates: A history of the backboned animals through time, 5th edition, *John Wiley – Liss, Inc.*, New York, 2002.
17. Farner, D.S. and King, J.R., Avian Biology (in several volumes), *Academic Press*, New York, 1971.
18. Goodrich, E.S., Studies, on structure and Development of Vertebrates, *Dover Publication*, NY, 1958.
19. Hildebrand, M. Analysis of Vertebrate Structure, 4th edition, *John Wiley & Sons, Inc.*, NY, 1995.
20. Jordan, E.L. and Verma, P.S., Chordate Zoology, *S. Chand & Company Ltd.*, 1998.
21. Kotpal, R.L. The Birds, 4th edition, *Rastogi Publications*, Shivaji Road, Meerut, 1999.
22. Marshall, A.J., Biology and Comparative Physiology of Birds, Volume I & II, 1960.

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## PAPER – IX - 23D      DEVELOPMENTAL BIOLOGY AND HUMAN WELFARE

Developmental Biology and Human Welfare is an experimental science, which provides understanding of the processes of early embryonic development, to analyze the mechanisms of development by experimental manipulation of developing embryos and to review current methodologies for conducting research in the field of embryology. It also emphasizes on current experimental approaches utilized in research of normal and abnormal development of the mammalian embryo.

### Unit – I

**Introduction and scope – Gametogenesis: Spermatogenesis:** Origin of Primordial germ cells – Differentiation of spermatozoa – structure and motility of sperm – egg activation – acrosomal reaction. **Oogenesis:** Development of Oocytes – types of eggs – Biochemical changes during Oogenesis.

### Unit – II

**Fertilization process:** Activation of sperm and egg– interaction of sperm and egg – Sequence of events in sperm entry – Egg surface changes. **Post–fertilization changes:** changes in the organization of the egg cytoplasm caused by fertilization.

### Unit – III

**Cleavage:** Cell division and chemical changes during cleavage – pattern of cleavage – Distribution of cytoplasmic substances in the egg – morphogenetic gradient in the egg cytoplasm. **Gastrulation:** Principles and patterns of gastrulation – Fate map.

### Unit – IV

**Organizer:** Spemann’s primary organizer – analysis of nature and mechanism of induction; **Organogenesis:** Cellular interaction – differentiation. **Embryonic adaptation:** Extra embryonic membrane structure in Reptiles and Birds. **Post embryonic developmental events:** Metamorphosis (Insects and amphibians); Regeneration in various animals.

### Unit – V

Birth control – Infertility – Artificial insemination – Test tube babies – Human cloning – Embryo transplantation – Rh factor – Congenital anomalies - Disturbances of growth and cancer.

### Recommended Readings:

1. Berril, N.T. : Developmental Biology, 1971. *McGraw Hill Co.*, New York.
2. Berril, N.T., Karp, G. : Development, 1988. *Tata McGraw Hill Co.*, New York
3. Patten’s Foundation of Embryology, Bruce M Carlson . *Tata McGraw Hill Co.*, New York
4. Waddington, G.H. : Fundamentals of Embryology, 1949. *George Allen and Unwin.*
5. Huxley De Beer: The Elements of Experimental Embryology, 1934. *Cambridge Univ. Press, Cambridge, Hafher Publishing Co.*
6. Rover, C.P. : An Outline of Developmental Physiology (1968). *Pergamon Press.*
7. Austin, C.R. : Fertilization (1966). *Prentice Hall.*

8. Austin, C.R. : Ultrastructure of Fertilization (1967). *Holt Reinhart and Winston.*
9. Hay, E.D. : Regeneration (1970). *Holt Reinhart and Winston.*
10. Nelson, G.F. : The Comparative Embryology of Vertebrates (1979). *Blackinston and Co.*
11. Balinsky, B.I. : An Introduction to Embryology (1960). *W. B. Saunders Co., Philadelphia*
12. Bodemer, C. : Modern Embryology (1968). *Hold, Rinehart and Winstorn, Inc, New York.*
13. Trampush, HAL and Kiotsis, V. : Regeneration and Related Problems (1972). *North Holland Publishing Co.,*
14. Vorontsova, M.A. and Liosner, L.D. : Asexual Propagation and Regeneration (1960). *Pergaman Press.*
15. Monray, A. Chemistry and Physiology of Fertilization (1978). *Halt Reinhart and Winston.*

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## PAPER – X – 23E BIOTECHNOLOGY AND BIOINFORMATICS

### Unit – I

**Animal and Plant cell culture:** Preparation of culture media, cell lines, characterization and maintenance of cell lines. **Applications of Stem cells.** Plant Cell culture: Callus, meristem and anther culture. **Protoplast fusion methods** and applications

### Unit - II

**Transgenic animal production:** Principles and applications of Gene gun, Electroporation and microinjection. **Current trends in Gene therapy.** Ethical issues in Animal Biotechnology

### Unit - III

**Integrated Pest Management** – pest management using *Bacillus thuringiensis* and Baculovirus – **Biotechnology in aquaculture** – transgenic fishes. **Biotechnology in human welfare:** recombinant proteins and vaccines. Insulin, somatotrophin, somatostatin,  $\beta$ -endorphin, Human interferon - DNA vaccine.

### Unit - IV

**Bioinformatics:** definition, database – **Primary databases** – NCBI, EMBL and DDBJ, PIR., SWISS – PROT. **Secondary databases** – PRINTS, PROFILE, PFAM and BLOCKS, Applications of **Biological databases**

### Unit - V

**Applications of molecular phylogenetics** Analysis package–Comparative **genomics** – in study of human disease gene. Medical **proteomics** based diagnostics – proteomics of multi protein complexes human body fluids and cancer proteomics.

### References

- Dubey, R. C., 2008, A text book of Biotechnology, S. Chand Co., New Delhi  
 Gupta, P.K, 2008, Biotechnology and Genomics, Rastogi Publications, Meerut, India.  
 Lesk, A.M. 2007. Introduction to Bioinformatics, Oxford University Press, Oxford.  
 Muthy, C.S.V. 2006. Bioinformatics. Himalaya Publishing House, Mumbai.

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**PRACTICAL – 23P ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY,  
MICROBIOLOGY AND IMMUNOLOGY,  
EVOLUTION AND PHYLOGENY,  
DEVELOPMENTAL BIOLOGY AND HUMAN WELFARE  
BIOTECHNOLOGY AND BIOINFORMATICS**

**ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY:**

1. Total Count of R.B.C
2. Total Count of W.B.C
3. Differential count of W.B.C
4. Total hemoglobin determination.
5. **Spotters:** Transverse section of Pituitary, Thyroid, Pancreas, Adrenal, Thymus, Prostrate gland, Vas deferens, Seminal vesicles, Ovary and Testis.

**MICROBIOLOGY AND IMMUNOLOGY:**

1. Technique of sterilization using Autoclave / pressure cooker
2. Preparation of Nutrient Agar broth
3. Distribution of Microbes in soil, air & water (Individual practical)
5. Hanging drop technique
6. Gram's staining.
7. Study of Antigen and Antibody reaction through the study of Blood grouping.
8. Study of Rh factor through the study of Blood grouping.

**EVOLUTION AND PHYLOGENY:**

**Fossils Characteristics and identification:**

1. Coelenterate – Coral (Carboniferous)
2. Arthropoda – Trilobite (Silurian)
3. Mollusca – Lamellibranch (Recent)
4. Mollusca – Gastropod (Tertiary)
5. Mollusca – Ammonite (Jurassic)
6. Echinodermata – Crinoid (Carboniferous)
7. Echinodermata – Echinoid (Jurassic)
8. Vertebrata – Shark's tooth (Miocene)

**DEVELOPMENTAL BIOLOGY AND HUMAN WELFARE:**

1. Slides showing gametogenesis.
2. Difference types of Eggs – Slides and Specimen
3. Embryology of Frog - slides
4. Chick Embryo whole mount 18, 24, 33, 48, & 72 hours.

**BIOTECHNOLOGY AND BIOINFORMATICS:**

1. Isolation of Plasmid DNA.
2. Restriction Digestion of DNA.
3. Ligation of DNA.
4. Transformation in E.Coli.
5. SDS – PAGE Analysis
6. Online Bioinformatic tools and their application.

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