Zoology : NO Revision

Tribhuvan University
Institute of Science and Technology
4 Years Bachelor of Science (B.Sc.) Programme
B.Sc. third year Zoology Course of Study
2071

Course Title: Physiology, Genetics and Molecular biology **Full Marks: 100**
Course No. : Zool.301 **Pass Marks: 35**
Nature of Course: Theory **Year: III**
Instruction Lectures: 150
Objectives of the Course:
At the end of course students will be able to understand:

- Physiological processes in animals.
- Details of endocrine glands and their roles.
- Various biochemical phenomena in animals.
- Embryonic development in animals.
- Structure and function of animal cell organelles
- Basic concept of genetics and molecular biology.
- Some molecular techniques necessary for carrying out molecular analysis

Group A: Physiology (75 lec.)

Nutritive substances, Enzymes and Energetics: Biological role of nutritive substances. Metabolism and metabolic pathways. Bioenergetics. General properties and mechanism of action of enzymes. Cofactors and Coenzymes. Factors influencing enzyme activity. (**15 lec.)**
Digestion: Digestion and absorption of nutrient. Gastrointestinal secretions and its regulation. **(4 lec.)**
Respiration: Respiratory mechanism. Respiratory pigments. Respiratory gases. Regulation of respiration. (**8 lec.**)
Circulation: Blood groups. Haemostasis and blood coagulation. Conduction system of the heart. Cardiac output and its control. **(8 lec.)**
Excretion: Excretion and excretory products in animals. Mechanism of urine formation. Role of kidney in the maintenance of electrolyte balance & pH**.** **(5 lec.)**
Nervous System: Nerve cells and electrical signaling. Synaptic transmission and neuronal integration. **(6 lec.)**
Endocrine System: Primary endocrine glands, respective hormones and their functions. (**12 lec.)**

Sensory System: General principles of sensory physiology:- vision, hearing and balance, taste, smell and touch. **(6 lec.)**

Reproduction and Development: Female reproductive cycle (ovarian and uterine cycles in human). Gametogenesis. Types of eggs. Mechanism of fertilization. Embryonic development. **(11 lec.)**

Group B: Cell Biology, Genetics and Molecular biology (75 lec.)

B1-Cell Biology (22 lec.)

Cell: General organization of Prokaryotic and Eukaryotic cells. **(2 lec.)**

Cell membrane: Molecular organization. Membrane transport principles. **(2 lec.)**

Cytoskeleton and Cell Motility: Microtubules, microfilaments, intermediate filament, Cilia and flagella. **(2 lec.)**

Structure and functions: Endoplasmic Reticulum, Golgi Complex, Lysosome, Peroxisome, Mitochondria and Ribosomes. **(10 lec.)**

Nucleus: Structure of nuclear envelope, nucleoplasm, chromatin fibres and nucleolus. Nucleo-cytoplasmic inter-relationship. **(2 lec.)**

Chromosomes and Chromatin: Nomenclature, karyotype and giant chromosomes. Heterochromatin and euchromatin. **(2 lec.)**

Cell cycle and Cell division: Cell cycle, mitosis and meiosis. **(2 lec.)**

B2-Genetics (19 lec.)

Mendelian and Non-Mendelian Inheritance. **(2 lec.)**

Genetic Interaction: Gene, Alleles, Dominant and Recessive. **(2 lec.)**

Multiple Alleles: Blood groups in human (ABO and Rh). **(2 lec.)**

Linkage and Crossing over: Theories, types and significance. **(2 lec.)**

Sex-Linked Inheritance: Characteristics, X, Y and X-Y linked genes inheritance, Non–disjunction as proof of chromosomal basis of heredity. **(3 lec.)**

Sex determination in animals. **(1 lec.)**

Chromosomal Variations: Chromosomal aberration. Euploidy, monoploidy, polyploidy nullisomy, trisomy, double trisomy and tetrasomy, mutations and their types. **(2 lec.)**

Human Genetics: Pedigree analysis, human traits, sex-linked diseases, disorders due to mutant genes, Eugenics, and Euphenics. **(4 lec.)**

Genetic Engineering and Gene Therapy: Introduction and their applications. **(1 lec.)**

B3-Molecular Biology (34 lec.)

Nucleic acids: Structure and composition of DNA, DNA Replication**:** DNA polymerase-properties and mechanism of action. Semi-discontinuous, uni-directional and bi-directional DNA replication. DNA replication mechanisms in prokaryotes and eukaryotes. Structure and composition of RNA, RNA Processing: Processing of messenger RNA (mRNA), ribosomal RNA (rRNA), and transfer RNA (tRNA). **(10 lec.)**

Genetic Code and Central Dogma: Characteristics and Wobble hypothesis. Concept of Central Dogma. **(3 lec.)**

Transcription, Translation and Protein Synthesis: Differences between replication and transcription. RNA polymerase in prokaryotes- properties and organization of promoters. Mechanism of prokaryotic and eukaryotic transcription. Mechanisms of translation (initiation, elongation and termination), Translation process in prokaryotes and eukaryotes. Post-modification of released protein. **(9 lec.)**

Gene Regulation: Gene expression, regulation and control in prokaryotes and Eukaryotes. Transcriptional, translational and posttranslational modification system. Control at hormonal level. **(7 lec.)**

Techniques of Molecular Biology: Polymerase chain reaction (PCR), DNA fingerprinting, gene cloning, DNA sequencing, Blotting and Enzyme linked immunoserbent assay (ELISA).

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Text Books

Balinsky, B.I. 1970. An Introduction to Embryology. W.B. Saunders, London.

Dhami, P.S. and Dhami, J.K. A Textbook of Zoology, vol. II & III. latest ed., Pradeep Pub., New Delhi.

Jordan, E.L. and Verma, P.S. Chordate Zoology & Animal Physiology. latest ed., S. Chand, New Delhi.

Kotpal, R.L. Modern Textbook of Zoology: Vertebrates. latest ed., Rostogi Pub., Meerut India.

Rastogi, S. C. 2001. Cell and Molecular biology. New Age International (P) Limited, Publishsers: New Delhi, Banglore, Calcutta, Chennai,Lucknow, Mumbai, India.

Rastogi, S.C. Text Book of Physiology.Willey Eastern Ltd.

Singh, B.D. 2006. Fundamentals of Genetics. Kalyani Publishers, Ludhiana, New Delhi, Noida (UP), India.

Verma, P.S. and Agarwal, V.K. 2012. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. Published by S.Chand & Company LTD,New Delhi India.

References:

Bijlani, R.L.(Ed.) Understanding Medical Physiology, Jaypee Brothers, Medical Publishers (P.) LTD. India.

Eckert, R. and Randall, D. Animal Physiology, CBS Publishers and Distributers, India.

Goel, K.A. and Sastri, K.V. 1998. A Text Book of Animal Physiology. Rastogi Pub., Meerut.

Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology, Elsevier.

Hoar, William S. General and Comparative Physiology. Prentice Hall.
Jeremy, M. Berg and John L. Lubert Stryer. Biochemistry. 5th ed. W.H. Freeman & Company, New York.
Knut Schmidt- Nielson. Animal Physiology. Cambridge Univ. Press.
Knut Schmidt-Nielsen. 1973. Animal Physiology. Foundations of Modern Biology Series. Prentice Hall.
Nelson, David L. and Cox, Michael M. 1982. Lehninger Principles of Biochemistry. 4th ed. Pub. Prentice- Hall of India Private Limited New Delhi.
Powar, C.B. and Chatwal, G.R. Biochemistry. Himalaya Pub.House, Mumbai, latest ed.
Randall, D.,Burggern, W. and French, K. Eckert Animal Physiology. WH Freeman & Co.
Satyanarayan, U. Biochemistry. Books and Allied (P) Ltd., Kolkata, India.
Stanfield, C.L. and Germann, W.J. Principles of Human physiology, Third edition, Pearson International Edition.
Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H .1998. Instant Notes in Molecuar Biology. Viva Books Pvt.Limited, New Delhi, Mumbai and Chennai, India.
Vander, Sherman and Luciano. Human Physiology. McGraw- Hill.
Winter, P.C., Hickey, G.I. and Fletcher, H.L (2000): Instant Notes in Genetics. Bios Scientific Publishers Ltd, 9 Newtec Place, Magdalen Road, Oxford 0X4 IRE, UK.
Yapp, W.B. 1970. An Introduction to Animal Physiology. Oxford at the Clarenden Press.

Course Title: Physiology, Genetics and Molecular Biology **Full Marks: 50**
Course No. : Zool. 302 **Pass Marks: 20**
Nature of Course: Practical **Year: III**
Objective of the Course: For better understanding of the topics of Zool.301.

Physiology Practical

1. Detection of carbohydrates, proteins and lipids.
2. Effect of temperature and pH on enzymatic action of amylase on starch.
3. Estimation of Haemoglobin.
4. Blood grouping.
5. RBC and WBC counting.
6. Detection of sugar, urea and protein in urine.
7. Study of the models and embryological slides of different stages of Chick.

Molecular Biology Practical

1. Study of the cytological slides: Cell division (Mitosis and Meiosis).
2. Study of Lampbrush chromosome of any animal.
3. Study of the human genetic traits (ear lobe, colour of eye, etc.).
4. Extraction and quantification of DNA.
5. Separation of DNA by Agarose gel electrophoresis.

6. Preparation of short community/family based survey report on human genetic traits.

Practical note book preparation as regular study.

Books (Latest Eds.)

Arora, M.P. Genetic Engineering. Himalaya Publishing House, India.

Sambrook, J. and Russel, D.W. Molecular Cloning , A labortory manual. Cold Spring Harbor Laboratory Press, New-York

Swarup, H., Pathak, C.S. and Arora, S. Laboratory Techniques in Modern Biology. Himalayan Publishers.

Verma, P.S. and Agrawal, V.K. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co., New Delhi.

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Course Title: Natural Resource Management **Full Marks: 50**
Course No. : Zool.303 **Pass Marks: 17.5**
Nature of Course: Theory (Elective) **Year: III**
Lecture Hrs: 75

Objectives of the Course:

At the end of course students will be able to:

- Understand an overview of the various natural resources
- Know the resource degradation problem
- Be familiar with issues and conservation of natural resources.

Introduction to Natural Resources and Management: Concept, values and types. Consumption trends and factors affecting resource use. Depletion and management of natural resource. Sustainable development. Policy and governance. (**10 lec.)**

Water Resource: Introduction. Hydrological cycles. Major sources of water. Use and depletion of water resources. State of water resources of Nepal. Water resource management.

(10lec.)

Land resource: Concept of land resource. Land use. Land resource degradation. Land resource management (Policy, planning and practice). **(9 lec.)**

Mineral resource: Introduction, types and importance of mineral resource. Consequence of mineral extraction, Status of major minerals in Nepal. Conservation of mineral resources. **(7 lec.)**

Mountain Resource: Mountain natural resource and their conservation. **(4 lec.)**

Biodiversity Resource: Introduction, types and importance of biological resources. Concept of biodiversity. State and threats of biodiversity of Nepal. Management of biodiversity (ex-situ and in-situ). **(11 lec.)**

Forest resources: Importance. Forest types of Nepal. Forest products and their uses in Nepal. Forest degradation. Forest Management and Community forestry program of Nepal.**(8 lec.)**

Energy resources: Introduction. Consumption trends of energy. Sources of energy: renewable and non renewable sources. Consequence of rapid consumption of non renewable energy. Status of energy resources in Nepal. Energy policy. **(10 lec.)**

Natural Resource Management in the Context of Climate Change: Climate change. Climate change impacts and vulnerability. Climate change mitigation and Adaptation. **(6 lec.)**

Suggested Readings

Agarwal, K.M., Sikdar, P.K., Deb., S.C. 2005. A Text Book of Environment. Macmillan India Limited

Asthana, D. R. and Asthana, M. 2012. Environment: Problems and Solutions. S Chand and Company PVT LTD.

Khadka, N. B. 2008. Natural Resource and Conservation.

Klee, G.A. 1991. Conservation of Natural Resources. New Jersey: Prentice Hall Publ. Co.

Miller, G. T. (Jr.) and Spoolman, S. T. 2010. Living in the Environment. Brooks/Cole. Belmont, California, USA: Wardsworth Publishing Company.

Nalini, K.S. 1993. Environmental Resources and Management. Anmol Publishers.

NPC, 2011: Climate-Resilient Planning. [Working Document], Government of Nepal, National Planning Commission, Kathmandu, Nepal.

Owen. O.S, Chiras. D.D, Reganold. J.P, 1998. Natural Resource Conservation Management for a Sustainable Future (7th Edition). Prentice Hall.

Peter, M. Dixit, A. and Athukorala, K. (edited). 2007. Integrated Water Resources Management: Global Theory, Emerging Practice and Local need. Sage Publication

Primack, R.B., Poudel, P.K. & Bhattarai, B.P. 2013. Conservation Biology: A Primer for Nepal. Dreamland Publication, Kathmandu

Ramade, F. 1984. Ecology of Natural Resources. John Wiley & Sons Ltd.

Ristinin, R.A. and Kraushaar, J.J. 2006. Energy and Environment. New York: John Wiley and Sons, Inc.

Sharma, V.K. 1985. Water Resources Planning and Management. Himalaya Pub. House

Stainton, JDA. 1972. Forests of Nepal. John Murray, London.

WECS. 1995. Alternative Energy Technology – Overview and Assessment. Kathmandu: WECS, GoN.

WECS. 2011. Water Resources of Nepal in the Context of Climate Change. Water and Energy Commission Secretariat. GoN

William M. B., Shrestha, A., Subedi, B. Dulal, HB. and Baumback, R.. 2013. Nepal Forest Sector Survey: Policy priorities and recommendations. Washington, DC: Program on Forests (PROFOR).

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Course Title: Bioinformatics **Full Marks: 50**
Course No. : Zool.304 **Pass Marks: 17.5**
Nature of Course: Theory (Elective) **Year: III**
Instruction Lectures: 75

Objectives of the Course:

At the end of the course the students will be able to:

- Understand what is bioinformatics
- Understand bioinformatics as the meeting point of computational science and biology
- Understand algorithms & statistics for biological data analysis with the use of biological software
- Align single and multiple biological data
- Develop creativity of using biological data to solve problems related to computational science.

Introduction to Bioinformatics: Introduction, application, dawn of sequencing, human genome, homology and analogy. **(15 lec.)**

Information networks: Introduction, www, web Browsers, EMBnet and NCBI. (**7 lec.)**

Protein Information Resources: Introduction. Biological databases. Structure Classification databases. **(5lec.)**

Genome Information Resources: Introduction. Human genome. DNA sequence databases. **(3lec.)**

DNA sequence analysis : Introduction. Features of DNA sequence analysis. EST, cDNA library and EST analysis. **(10lec.)**

Pairwise alignment techniques: Introduction. Database searching. Algorithms and programs. Identity and similarity. Global and local alignment. **(10 lec.)**

Multiple alignment techniques: Introduction. Manual, simultaneous and progressive methods. Databases of multiple alignment **(10 lec.)**

Phylogenetic trees: Introduction and methods. **(4 lec.)**

Secondary database searching: Introduction. **(1 lec.)**

Building a sequence search protocol: Introduction, a practical approach, structural and functional interpretation. **(3 lec.)**

Analysis packages: Introduction. Commercial database and software. comprehensive packages. **(5 lec.)**

Ethics, and workflow management system in Bioinformatics **(2 lec.)**

Text Books:

Pangeni, R.P. 2007. Concept on Bioinformatics. Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal.

Attwood, T.K. & Parry-Smith, D.J. 1999 and 2014. Introduction to Bioinformatics (Cell and Molecular Biology in Action Series) Published by Prentice Hall, edited by DR. Ed Wood, Department of Biochemistry and Molecular Biology, Univ. of Leeds, UK.

Lesk, A.M. 2003. Introduction to Bioinformatics. Oxford University Press, UK, printed in India by Gopsons, Noida 201301, Published by Manzar Khan, Oxford University Press, YMCA Library Building, Jai Singh Road, New Delhi 110001.

References

Andrew, J., Cammon, Mc, Harvey S. 1988. Dynamics of Proteins and Nucleic acids.

Cambridge University Press.

Campbell, A. M. and Heyer, L. J. 2004. Discovering Genomics, Proteomics & …….

Leach, A. R. 2001. Molecular Modeling. Prentice Hall.

Pevsner, J. 2003. Bioinformatics & Functional Genomics. John Wiley and Sons.

Pevzner, P. A. 2004. Computational Molecular Biology. An Algorithmic Approach PHI.

Rastogi, S.C., Mendiratta, N., Rastogi, P. 2004. Bioinformatics, Methods and Applications. PHI Publication.

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