Tribhuvan University
Institute of Science and Technology
4 Years Bachelor of Science (B.Sc.) Programme
B.Sc. 3rd Year Zoology

Course Title : Bioinformatics **Full Marks: 50**
Course No. : Elective Zool. 304 **Pass Marks: 17.5**
Nature of Course: Theory **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 so many problems related to computational science*

Teaching materials required to fulfill the objectives are boards, charts, flex prints, overhead projector (OHP), power-point projector and other basic teaching materials prepared by teachers and as provided by the campuses.

Unit	Sub-units	Description of content of the sub-unit (depth)	Lectures	Text/Ref. for the topics (for detail see the list of text & references)
Introduction to Bioinformatics (15 Lectures)	**Introduction, application, dawn of sequencing, human genome, homology and analogy.**	What is bioinformatics. Historical Review. Applications. The dawn of sequencing. The biological sequence/structure deficit. Basic concept of genomics, genes, proteins, and proteomes. Status of the human genome project. Sequence analysis. Homology and analogy.	15	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.

Information Networks (7 Lectures)	**Introduction, www, web Browsers, EMBnet and NCBI**	What is internet? How do computer find each others? Facilities used on the Internet. What is World Wide Web? Web Browsers: HTTP, HTML and URLs, The European Molecular Biology network (EMBnet), The National Center for Biotechnology Information (NCBI).	7	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Protein Information Resources (5 Lectures)	**Introduction, Biological databases, Structure Classification databases**	Introduction, Biological databases, Primary sequence data bases, Composite protein sequence databases, Secondary databases, Composite protein pattern databases, Structure classification databases.	5	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Genome Information Resources (3 Lectures)	**Introduction, Human genome, DNA sequence databases**	Introduction. Human genome and other genomes. DNA sequence databases. Specialized genomic resources.	3	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
DNA Sequence Analysis (10 Lectures)	**Introduction, Features of DNA sequence analysis, EST, cDNA library, EST analysis**	Introduction, Features of DNA sequence analysis, Interpretation of Expressed Sequence Tags (EST) searches, Two approaches to gene hunting, cDNA library and ESTs, Different approaches to EST analysis, Effects of EST data on DNA databases, A Practical examples of EST analysis.	10	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Pair-wise Alignment Techniques (10 Lectures)	**Introduction, Database searching, Algorithms and programs, Identity and similarity, Global and local alignment**	Introduction, Database searching, Algorithms and programs, Comparing two sequences-a simple case, Identity and similarity, Global alignment: the Needleman and Wunsch algorithm, Local alignment: the Smith-	10	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.

		Waterman algorithm, Pair-wise database searching.		
Multiple Alignment Techniques (10 Lectures)	**Introduction, manual, simultaneous and progressive methods, databases of multiple alignment**	Introduction**,** Manual methods**,** Simultaneous methods**,** Progressive methods**,** Databases of multiple alignments**,** Searching databases with multiple alignment.	10	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Phylogenetic Trees (4 Lectures)	**Introduction and methods**	Introduction. Clustering and Cladistic methods.	4	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Secondary Database Searching (1 Lectures)	**Introduction**	Introduction.	1	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Building a Sequence Search Protocol (3 Lectures)	**Introduction, a practical approach, structural and functional interpretation**	Introduction. A practical approach. When to believe a result. Structural and functional interpretation.	3	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Analysis Packages (5 Lectures)	**Introduction, Commercial database and software, comprehensive packages.**	Introduction. Commercial databases and software. Comprehensive packages: specializing in DNA analysis, intranet and internet packages.	5	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.
Ethics and Workflow Management System (2 Lectures)	**Ethics, and workflow management system in Bioinformatics**	Introduction. Ethics in Bioinformatics. Workflow management systems in Bioinformatics.	2	Attwood, T.K. & Parry-Smith, D.J.; Lesk, A.M.; Pangeni, R.P.

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, University 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.

References

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

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

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

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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