Semester VI						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CE 301	Environmental studies	3	0	0	6
2	BB 415	Bioinformatics lab	0	0	3	3
3		Program Elective	2	1	0	6
4		Institute Elective – III				6
5	BB 413	Biology Lab III	0	0	6	6
		Total Credits				27

1	**Title of the course** (L-T-P-C)	**Environmental studies** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	**Module A:** Natural Resources, Ecosystems, Biodiversity and its conservation: Natural resources and ecosystems, Forest, grassland, desert and aquatic ecosystems, biodiversity at global, national and local levels, conservation of biodiversity **Module B:** Air Pollution Introduction to understanding air quality management, fundamental processes of meteorology, Air Pollutants – Gaseous and particulate, Criteria for pollutants, ambient and source standards, Aerosols: Characterisation of aerosols, size distributions, measurement methods; Transport behaviour: diffusion, sedimentation, inertia; Visibility; principles of particulate control systems. **Module C:** Water Treatment Discussion of water quality constituents and introduction to the design and operation of water and wastewater treatment processes. **Module D:** Solid Waste Management and Climate Change Different aspects of solid and hazardous waste management. Climate change and greenhouse gas emissions, technologies would reduce the greenhouse gas emissions. Climate change and its possible causes. **Module E**: Sociology/Environmentalism Description: Environmentalism in sociological tradition, Sustainability, North-South divide, Political economy approaches in environmental studies, Debates over environmental issues **Module F**: Economics Energy economics and financial markets, Market dynamics, Energy derivatives, Energy Efficiency; Sustainable Development: Concept, Measurement & Strategies, Interaction between Economic Development and the Environment **Module G:** Philosophy Environmental ethics, Deep ecology, Practical ecology, Religion and attitude towards environmental ethics, Ecofeminism and its evolution. **Module H**: Field work and project: visit to a local area to document environmental assets, case studies of a simple ecosystem and group discussions on current environmental issues.
4	**Texts/References**	**1.** Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. **2.** Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, Oxford University Press, New Delhi. **3.** Jackson, A.R.W. and Jackson, J.M. (1996), Environmental Sciences: The Environment and Human Impact, Longman Publishers. **4.** Nathanson, J.A., (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. **5.** Redcliff, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology. **6.** Srivastava, K.P. (2002), An Introduction to Environmental Study, Kalyani Publishers, Ludhiana. **7.** Review articles from literature

1	**Title of the course** (L-T-P-C)	**Bioinformatics lab** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	None
3	**Course content**	1. Biological data & sources - origin and types of biological data, public databases, storing biological data and data security. 2. Data mining - concept of data mining, methods of data mining: text-based, mining tasks, applications. 3. DNA sequence analysis - dot plot, basic concepts of sequence similarity, identity and homology, homologs, orthologs, paralogs, concepts behind scoring matrices, dynamic programming pairwise alignment - Smith-Waterman and Needleman-Wunsch algorithm, FASTA. 4. BLAST & Remote homology search - the BLAST algorithm, parsing BLAST results, advanced BLAST algorithms. 5. Multiple Sequence Alignment - methods of MSA: progressive alignments, consistency-based and structure-based alignment, programs for MSA. 6. Motif finding algorithms - sequence motif concepts, algorithms to detect DNA sequence motifs, Gibbs sampler, MEME. 7. Protein bioinformatics - Protein secondary structure calculation – DSSP, membrane topology prediction, ligand- receptor interactions, composition of active sites in functional proteins, conformational change and activity, allostery, effects of point mutations on proteins structure and function. 8. RNA structure analysis - RNA structure, RNA sequence databases, RNA structure prediction: Nussinov algorithm, EM algorithm. 9. Next generation sequencing and principles of NGS data analysis - introductory concepts, types of NGS data, various platforms of NGS, alignment algorithm - BWA, RNA-Seq, ChIP-Seq, single cell genomics. 10. R for bioinformatics - introduction, basic elements of R, plotting high-dimensional data, statistical analysis, programming.
4	**Texts/References**	1. Bioinformatics, David Mount, CSHL, 2003 2. Bioinformatics & Functional Genomics, Jonathan Pevsner, Wiley 2015 M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Elsevier, 2010.

1	**Title of the course** (L-T-P-C)	**Biology Lab III** **(0-0-6-6)**
2	**Pre-requisite courses(s)**	None
3	**Course content**	Genetic engineering lab will a micro-project-based lab. The micro-project will cover following techniques- 1. DNA isolation 2. Primer Design, 3. PCR, 4. Cloning 2. Transgene expression and validation using PCR and Western Blot, 6. Site-directed Mutagenesis, 7. qRT-PCR
4	**Texts/References**	NA