MAHATMA GANDHI UNIVERSITY, KERALA

Abstract

Bachelor of Science (Honours) Bioinformatics - Eighth Semester - Recommendations for modifications to the Course Content and Mode of Assessment - Academic Council Resolution - Orders issued.

ACA 16

No. 7530/ACA 16/2025/MGU Priyadarsini Hills,Dated: 12.08.2025

Read:-1. U.O. No. 5797/AC A16/2024/MGU, dated. 27.06.2024

2. Item No: 97/52814/ACA 16 -3/2025, of the minutes of the meeting of the Academic Council held on 04.07.2025,

ORDER

The syllabi of various Under Graduate Programmes coming under the MGU-UGP (Honours) Regulations, 2024, have been approved vide paper read as (1) above and published on the website of the University.

The Expert Committee on Bioinformatics (UG), deliberated on modifying the Course Content and Mode of Assessment of the DCE type courses in the Eighth Semester syllabus of Bachelor of Science (Honours) Bioinformatics programme, and has submitted recommendations. (Recommendations are attached as Annexure)

The said recommendations were placed before the Academic Council for consideration as per the orders of the Vice Chancellor on 12.06.2025.

The Academic Council meeting, vide paper read as (2) above, has resolved to approve the recommendations of the Expert Committee on Bioinformatics (UG).

Hence, the Course Content and Mode of Assessment of the said courses in the Eighth Semester syllabus of Bachelor of Science (Honours) Bioinformatics programme stands modified to this extent.

Orders are issued accordingly.

SUDHA MENON J

ASSISTANT REGISTRAR III

(ACADEMIC)

For REGISTRAR

Copy To

1. PS to VC
2. PA to Registrar/CE
3. JR 2 (Admin)/DR 2, AR 3 (Academic)
4. JR/DR/AR (Exam)
5. Convenor, Expert Committee, Bioinformatics (UG)
6. Tabulation /Academic Sections Concerned
7. AC C1/ AC C2 Sections
8. IT Cell 3/OQPM1 Sections
9. PRO/IQAC/Records Sections
10. Action Taken Report
11. Stock File/ File Copy

File No: 52814/AC A16 -3/2025/ACA 16

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Section Officer

Annexure

Semester VIII

Course Name: AI IN BIOINFORMATICS
Course Code: MG8DCEBIF402

COURSE CONTENT
Content for Classroom Transaction (Units)

Module	Units (Modified)	Course Description (Modified)	Hrs. (Modified)	CO No. (Modified)	Page No.
1	1	**Artificial intelligence, Data presentation and Deep learning**			187
	1.1	What is AI and the role of AI in advancing bioinformatics research. Machine learning fundamentals: supervised and unsupervised learning.	15	No Change	
	1.2	Algorithms in machine learning. Classification of algorithms: Regression and Clustering algorithms.		2	
	1.3	What are high dimensional biological datasets. Noise reduction in high dimensional data.		3	
	1.4	Techniques for selecting relevant features from high dimensional datasets including Principal Component Analysis and high dimensionality reduction of high dimensional data.		4	
	1.5	Introduction to deep learning approaches. Basic understanding of Convolution Neural Network (CNN) and Recurrent Neural Network (RNN). Applications of deep learning in Bioinformatics		5,6	
2	2	**Application of AI in Sequence and Gene expression Analysis**			
	2.1	AI in DNA sequence alignment.	15	7	
	2.2	AI in motif discovery and protein structure prediction.		7	
	2.3	Techniques for analyzing gene expression data using AI methods.		7	
	2.4	Differential gene expression analysis.		7	
	2.5	Gene co-expression network analysis.		7	
	2.6	**Removed**			
	2.7				
3	3	**AI in drug discovery and Network Analysis and its ethical consideration**			
	3.1	AI in virtual screening, molecular docking and de novo drug design.		8	

	3.2	Introduction to biological networks: Methods for constructing biological networks.	15	8	188
	3.3	Basic understanding of network analysis techniques. Relevance of network analysis in Bioinformatics.		8	
	3.4	Ethical implications of using AI in Bioinformatics. Privacy concerns, Responsible data sharing practices, Bias in AI algorithms.		8	
	3.5	Limitations and challenges of using Artificial Intelligence in biological data analysis		8	
4	4	**Practicals**			
	4.1	Gene Expression Analysis using Machine Learning: Python (scikit-learn/ pandas) or R (caret/ ggplot2).	30	2,3	
	4.2	Protein Structure Prediction using Deep Learning: Python (TensorFlow/ PyTorch/ Biopython)		5,7	
	4.3	Drug Discovery using Virtual Screening: Python (RDKit/ scikit-learn) or AutoDock		2,3	
	4.4	Genome-Wide Association Studies (GWAS) using AI: Python (scikit-learn/ TensorFlow) or PLINK		2,3	
	4.5	Microbiome Analysis using Machine Learning: Python (QIIME/ scikit-learn) or R (phyloseq)		2,3	
	4.6	**Removed**			
	4.7				
5	Teacher Specific Content				

MODE OF ASSESSMENT **(Modified)**

A. Continuous Comprehensive Assessment (CCA)		**Page No.**
1. Theory		188
Assessment Criteria	**Marks**	
Test papers/Assignments/Seminars	25	
2. Practical		
Assessment Criteria	**Marks**	
Lab involvement	15	

B. End Semester Evaluation				
1. Theory **Total Marks: 50**				**Page No.**
Type of Questions		**No. of Questions to be Answered**	**Total Marks**	
Part A	Short Answer	5 out of 7	5 x 2 = 10	188
Part B	Short Essay	4 out of 6	4 x 5 = 20	
Part C	Long Essay	2 out of 4	2 x 10 = 20	

2. Practical Exam **Total Marks: 35**			**Page No.**
Assessment Criteria		**Marks**	
Part A	Lab Examination	25	188
Part B	Viva Voce	5	
Part C	Record	5	

Course Name: ENVIRONMENTAL INFORMATICS
Course Code: MG8DCEBIF403

COURSE CONTENT
Content for Classroom Transaction (Units)

Module	Units (Modified)	Course Description (Modified)	Hrs. (Modified)	CO No. (Modified)	Page No.
1	1	**Foundations of Environmental Bioinformatics, Environmental genomics and Metagenomics**			
	1.1	Overview, Historical development, terminologies and Key concepts of environmental bioinformatics.	15	No Change	

	1.2	Exploration of biological databases relevant to environmental data. Introduction to computational tools and software used in environmental bioinformatics.		2	
	1.3	Environmental genomics: Importance in studying biodiversity, evolution and ecosystem dynamics.		3	
	1.4	Applying comparative genomics to address environmental challenges.		4	
	1.5	Functional genomics approaches for studying gene function in environmental micro organisms.		4	
	1.6	Applications of Environmental Genomics in: Conservation and Restoration, Human Microbiome and Metagenomic Analysis.		5	
	1.7	Environmental Metagenomics for Ecosystem Analysis: Antimicrobial Resistance Genes in Metagenomes, Functional Metagenomics and Bioprospecting, Bioinformatics Tools for Metagenomic Data Analysis.		6	
2	2	**Environmental Microbiome Analysis**			191
	2.1	Introduction to Environmental Microbiome Analysis.	15	5	
	2.2	Microbial communities in the environment and Applications in soil microbiome concept.		4	
	2.3	Applications in water microbiome concept.		No Change	
	2.4	Applications in air microbiome concept.		6	
	2.5	Bioinformatics approaches for microbial community analysis.		6	
	2.6	**Removed**			
	2.7				
	2.8				
	2.9				
	2.10				
3	3	**Environmental DNA (eDNA) Metabarcoding**			
	3.1	Introduction to eDNA Metabarcoding.	No Change	6	
	3.2	Applications in environmental monitoring and Biodiversity Assessment.		6	
	3.3	eDNA Metabarcoding for Invasive Species Detection.		6	192
	3.4	Bioinformatics tools for processing eDNA metabarcoding data.		No Change	
	3.5	Case studies of eDNA applications in biodiversity assessment and ecosystem monitoring.			
4	4	**Practicals**			
	4.1	Genomic and Metagenomic Analysis using: QIIME (Quantitative Insights Into Microbial Ecology)/ Mothur/ MEGAN (MEtaGenome Analyzer)/ MetaPhlAn (Metagenomic Phylogenetic Analysis)/ Kraken.	30	2	

	4.2	Phylogenetics and Evolution using: MEGA (Molecular Evolutionary Genetics Analysis)/ RAxML (Randomized Axelerated Maximum Likelihood).		2	
	4.3	Data Processing and Bioinformatics Analysis for eDNA Metabarcoding.		No Change	
	4.4	**Removed**			
	4.5				
5	Teacher Specific Content				

MODE OF ASSESSMENT **(Modified)**

A. Continuous Comprehensive Assessment (CCA)		**Page No.**
1. Theory		192
Assessment Criteria	**Marks**	
Test papers/Assignments/Seminars	25	
2. Practical		
Assessment Criteria	**Marks**	
Lab involvement	15	

B. End Semester Evaluation				
1. Theory **Total Marks: 50**				**Page No.**
Type of Questions		**No. of Questions to be Answered**	**Total Marks**	192
Part A	Short Answer	5 out of 7	5 x 2 = 10	
Part B	Short Essay	4 out of 6	4 x 5 = 20	
Part C	Long Essay	2 out of 4	2 x 10 = 20	

2. Practical Exam Total Marks: 35			Page No.
Assessment Criteria		**Marks**	192
Part A	Lab Examination	25	
Part B	Viva Voce	5	
Part C	Record	5	

Course Name: PHARMACOGENOMICS AND DRUG ACTION
Course Code: MG8DCEBIF404

COURSE CONTENT
Content for Classroom Transaction (Units)

Module	Units (Modified)	Course Description (Modified)	Hrs. (Modified)	CO No. (Modified)	Page No.
1	1	No Change	15	No Change	195
	1.1				
	1.2				
	1.3				
2	2	**Pharmacogenomics in the Disease Treatment**			
	2.1	Pharmacogenomics in the treatment of cancer.	No Change	5	
	2.2	Pharmacogenomic in neuro degenerative diseases, cardiovascular diseases.		5	
	2.3	Pharmacogenomics in pharmaceutical industry.		5	
	2.4	Ethical issues related to Pharmacogenomics.		5	
	2.5	Pharmacogenomics and ethanopharmacology.		5	

3	3	**Drug Metabolism, Drug Designing and action**			195
	3.1	Biotransformation (Metabolism) of drugs and related organic compounds - General pathways, sites of drug biotransformation.	No Change	2	
	3.2	Oxidative reactions, reductive reactions, hydrolytic reactions, conjugation reactions, factors affecting drug metabolism and variability in drug response.		2	
	3.3	Microsatellite in studying genetic variation. Pharmacodynamics Pharmacogenomics , Pharmacognosy.		2	
	3.4	2-D and 3-D database searching. Structure-based and Ligand based drug design for all classes of targets.		3	
	3.4	QSAR studies, 3D QSAR, CoMFA, ADME prediction.		4	
	3.6	Introduction to Antibiotics and mechanism of their action. Structure,chemistry and SAR of: Beta lactam Antibiotics, Pencillins.		5	
	3.7	Antitubercular Agents and their mechanism of action. AIDS ,Potential Targets for Anti-HIV agents. Nucleoside and Non Nucleoside Analogues.		5	
4	4	**Practicals**			
	4.1	Metabolic pathway analysis using any two tools: KEGG/ Reactome/ BioCyc/ Pathway Commons/ MetaboAnalyst/ Cytoscape/ DAVID.	30	No Change	
	4.2	2D & 3D databases for drug design: PubChem, ZINC Database, ChEMBL, DrugBank, Protein Data Bank (PDB), BindingDB, Ligand Expo, ChemSpider, HMDB (Human Metabolome Database), RCSB Ligand Data Browser, eMolecules. (use any three databases)		3,5	
	4.3	QSAR studies and ADME prediction using any free tool.		5	
	4.4	**Removed**			196
	4.5				
	4.6				
	4.7				
5	Teacher Specific Content				

MODE OF ASSESSMENT (Modified)

A. Continuous Comprehensive Assessment (CCA)		Page No.
1. Theory		196
Assessment Criteria	**Marks**	
Test papers/Assignments/Seminars	25	
2. Practical		
Assessment Criteria	**Marks**	
Lab involvement	15	

B. End Semester Evaluation				
1. Theory **Total Marks: 50**				**Page No.**
Type of Questions		**No. of Questions to be Answered**	**Total Marks**	196
Part A	Short Answer	5 out of 7	5 x 2 = 10	
Part B	Short Essay	4 out of 6	4 x 5 = 20	
Part C	Long Essay	2 out of 4	2 x 10 = 20	

2. Practical Exam Total Marks: 35			Page No.
Assessment Criteria		**Marks**	196
Part A	Lab Examination	25	
Part B	Viva Voce	5	
Part C	Record	5	